REGIONAL INTERESTS DEVELOPMENT APPROVAL (RIDA)

RPI22/028 Anglo – Moranbah South Exploration Activities

(Given under section 53 of the *Regional Planning Interests Act 2014*)

Date: 1 February 2023

Description of the land

Real property description:	Lot 5 GV148, Lot 23 GV148, Lot 2 SP260061, Lot 14 GV116, Lot 13 GV225, Lot 6 RP615467, Lot 7 RP615467, Lot 11 SP135741
Area of regional interest:	Strategic cropping area
Local Government Area:	Isaac Regional Council

Approved resource activities

The approved resource activities are set out in Table 1 below.

Definitions of the approved resource activities are provided in Table 2 below.

This development approval authorises impacts on the strategic cropping area by the approved resource activities.

Table 1: Approved resource activities: Anglo – Moranbah South Exploration Activities

Area of regional interest	Location	Resource activity	Area of disturbance (hectares)
Strategic cropping area	Lot 5 GV148, Lot 23 GV148, Lot 2 SP260061, Lot 14 GV116, Lot 13 GV225, Lot 6 RP615467, Lot 7 RP615467, Lot 11 SP135741	Eight exploration borehole drill pads	1.3
		Access tracks	0.5
		Eight exploration drill holes	
		3D seismic surveys	
Total disturbance area			**1.8 ha**

Table 2: Definitions of approved resource activities

Resource activity	Definition
Exploration borehole drill pads	Each pad approx. 40m x 40m
Exploration drill holes	Each drill hole a max 380mm diameter
Access tracks	1,774m of tracks of approx. 3m wide, to regenerate naturally from seedstock within the topsoil
3D seismic surveys	Approx. 425ha of proposed seismic surveys; seismic data obtained from units mounted on articulated vehicles; emission of ground penetrating sound waves generated by a 1m diameter vibrating pad; source lines of approx. 3m wide lines on a parallel grid between 40m and 80m apart; geophones at regular intervals along the receiver lines; approx. 3.5m wide receiver lines on a parallel grid between 50m to 100m apart and at 30 – 45^{o} to the source lines

Regional interests conditions

A person who is the holder of, or is acting under, this RIDA must not contravene a condition of this approval.

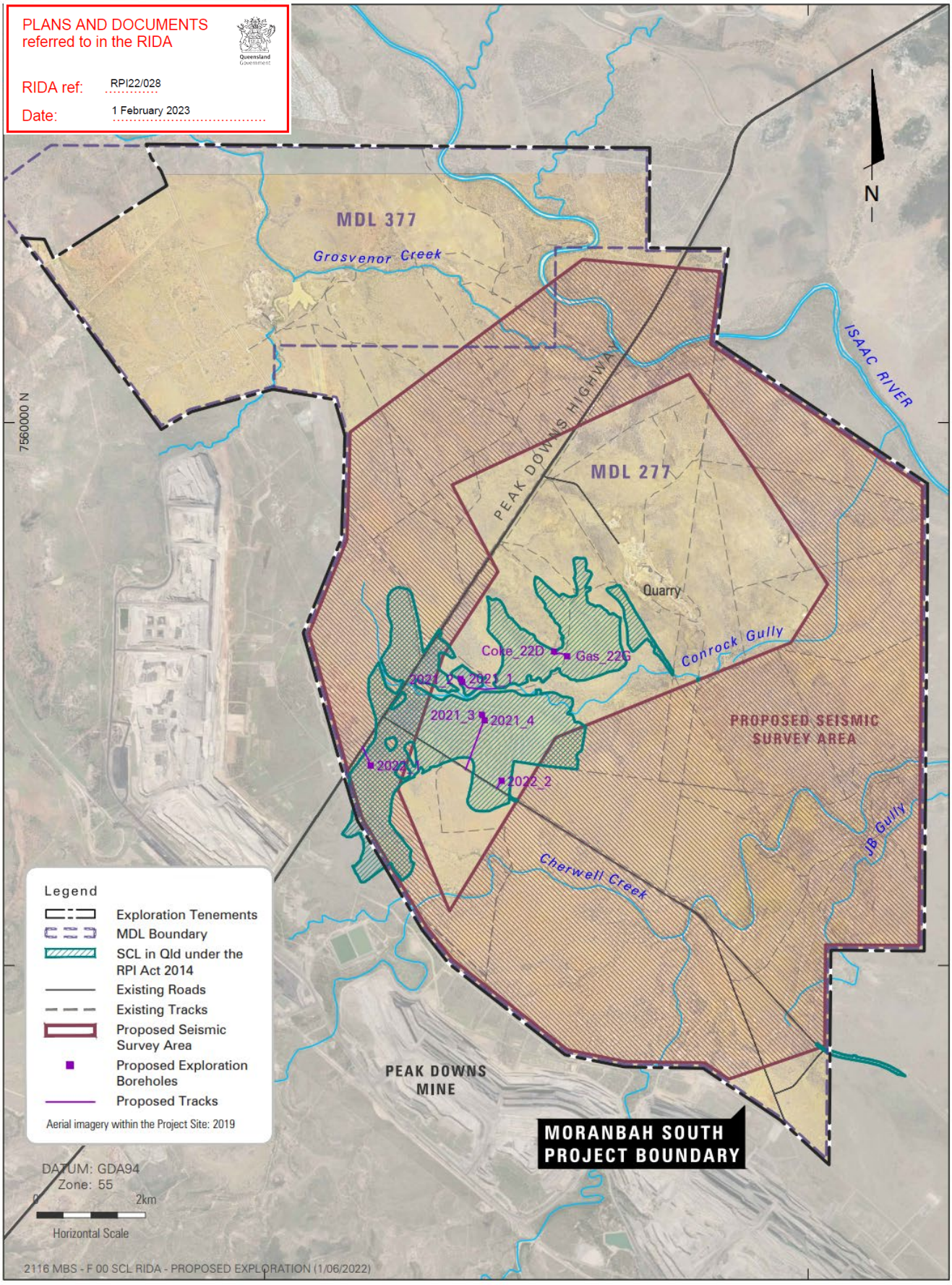
Condition number	Condition	Timing for condition
1.	Carry out the approved resource activities and disturbance of land in the Strategic cropping area generally in accordance with: (a) the resource activities identified in Table 1: Approved resource activities (b) the resource activities defined in Table 2: Definitions of resource activities (c) the locations as shown on approved plan: (i) Figure 2, Proposed Exploration Activities, prepared by Hansen Environmental Consulting (**Attachment 1**).	At all times.
2.	(a) Restore areas of disturbance of the strategic cropping area to pre-impact conditions in accordance with the methods and timeframes set out in Table 3 of Section 4 (Restoration) of the 'Strategic Cropping Land Restoration Plan' prepared by Hansen Environmental Consulting, dated 19 October 2022 (**Attachment 2).** (b) Monitoring of restoration required under parts (a) of this condition must be undertaken in accordance with the monitoring program set out in Table 4 of Section 4 (Restoration) of the 'Strategic Cropping Land Restoration Plan' prepared by Hansen Environmental Consulting, dated 19 October 2022 (**Attachment 2).**	(a) As indicated in Table 3 of the Strategic Cropping Land Restoration Plan. (b) As indicated in Table 4 of the Strategic Cropping Land Restoration Plan.
3.	The impacts of the resource activities on the strategic cropping area must be mitigated in accordance with the mitigation measures listed in section 2.2.3 of the Strategic Cropping Land Restoration Plan' prepared by Hansen Environmental Consulting, dated 19 October 2022 (**Attachment 2).**	As indicated in the Section 2.2.3 of the Strategic Cropping Land Restoration Plan.
4.	(a) All complaints received, and resulting actions taken, about the impact of the approved resource activities must be recorded. The record must include: (i) name, address and contact number of the complainant (ii) time and date of complaint (iii) reasons for the complaint (iv) investigations undertaken (v) conclusions formed (vi) actions taken to resolve the complaint (vii) any abatement measures implemented (viii) person responsible for resolving the complaint.	(a) At all times.

Condition number	Condition	Timing for condition
	(b) Provide records of any complaints received and recorded in accordance with this condition to the chief executive at RPIAct@dsdilgp.qld.gov.au *Note: The record of complaint provided to the chief executive must state the application reference number, being RPI22/028.*	(b) Within 60 business days of receipt of a complaint.
5.	A full copy of the regional interests development approval must be kept on-site and available to any person(s) contracted to undertake the approved resource activities.	At all times.

General Advice

It is the applicant's responsibility to ensure all relevant approvals and licenses are obtained from the applicable Local, State, and/or Federal Authorities prior to works commencing on site.

Attachment 1 - Approved plan



MORANBAH SOUTH EXPLORATION ACTIVITIES

HANSEN ENVIRONMENTAL CONSULTING

Proposed Exploration Activities

Attachment 2 – Strategic Cropping Land Restoration Plan

Moranbah South Exploration Activities

Strategic Cropping Land Restoration Plan

for Anglo American Metallurgical Coal Pty Ltd

19 October 2022

HANSEN ENVIRONMENTAL CONSULTING

DOCUMENT CONTROL

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1 INTRODUCTION

Hansen Environmental Consulting has prepared this Strategic Cropping Land (SCL) Restoration Plan on behalf of Anglo American Metallurgical Coal Pty Ltd. The document has been prepared in support of a Regional Interests Development Approval (RIDA) application for the Moranbah South Exploration Activities for the impact of exploration activities on SCL.

This section provides an introduction to the Restoration Plan and includes an overview of the proponent, the need for a Restoration Plan as part of the RIDA application and the structure of the Restoration Plan.

1.1 THE PROPONENT

The proponent is a Joint Venture between Anglo Coal (Grosvenor) Pty Ltd and Exxaro Australia Pty Ltd. Anglo American Metallurgical Coal Pty Ltd is the manager and operator of the exploration activities within the Moranbah South exploration tenements on behalf of the Joint Venture parties.

1.2 RESTORATION PLAN

The proponent is proposing to undertake exploration activities within the Moranbah South exploration tenements. The exploration tenements are immediately south of Moranbah township in Central Queensland (Figure 1).

The exploration activities include seismic surveys and exploration bores, and associated access tracks. The aim of the exploration activities is to investigate the coal resources within the Moranbah South exploration tenements.

Both seismic surveys and exploration bores, and associated access tracks, are proposed to be located within Strategic Cropping Areas (SCAs) shown on the SCL trigger map (Figure 2). SCAs are an area of regional interest protected under the *Regional Planning Interests Act 2014* (RPI Act). The RPI Act requires a RIDA for any resource activities, including exploration activities, carried out within SCL.

The proponent submitted a RIDA application to the Department of State Development, Infrastructure, Local Government and Planning (SDILGP) on 20 July 2022. SDILGP provided a notice on 3 August 2022 requesting additional information, including the provision of a stand-alone Restoration Plan in accordance with the *RPI Act Statutory Guideline 09/14 – How to Determine if an Activity has a Permanent Impact on SCL* (SCL Permanent Impact Guideline). This Restoration Plan has been developed in accordance with the SCL Permanent Impact Guideline. Table 1 lists the Restoration Plan requirements as detailed in the SCL Permanent Impact Guideline and provides a reference to the section of this report where each requirement is address.

TABLE 1 RESTORATION PLAN REQUIREMENTS

SCL Permanent Impact Guideline Requirements for a Restoration Plan	Restoration Plan Reference
a) Information on the nature of impact on the land and methods used to determine impact	Section 2
b) Characterisation of the pre-activity (current) condition of the land and soils	Section 3
c) Evaluation of the nature and risk of any predicted impacts on the land	Section 2
d) Evidence that scientifically proven and practical methods do exist for restoring the land	Section 4
e) Detail on the application of the restoration methods including timeframes	Section 4
f) A monitoring program including benchmarking and progress milestones	Section 4
g) A fully costed estimate of identified restoration works	Section 4
h) Restoration criteria against which successful restoration can be demonstrated	Section 4

1.3 REPORT STRUCTURE

The RIDA report is structured as follows:

- Section 1: Introduction;
- Section 2: Proposed Exploration Activities;
- Section 3: Existing Land and Soils Characterisation; and
- Section 4: Restoration.

2 PROPOSED EXPLORATION ACTIVITIES

This section provides an overview of the Moranbah South exploration tenements and the proposed exploration activities.

2.1 OVERVIEW OF THE EXPLORATION TENEMENTS

This section describes the exploration tenements.

2.1.1 LAND USE

The Moranbah South exploration tenements are Mineral Development Licence (MDL) 277 and MDL 377. Both tenements are situated directly south of the township of Moranbah (Figure 2). The exploration tenements cover an area of approximately 17,675 ha (13,548 ha for MDL 277 and 4,127 ha for MDL 377).

The land within the SCL areas in the exploration tenements is currently used for cattle grazing and is traversed by a number of State controlled and council roads. Conrock Gully and a number of existing access tracks also traverse the SCL areas within the exploration tenements (Figure 2).

The land use in the area surrounding the SCL areas include agricultural activities, coal mining and a quarry (Figure 2).

2.1.2 AREAS OF REGIONAL INTEREST

The RPI Act identifies and protects areas of regional interest throughout Queensland. The RPI Act outlines the requirements for a RIDA Application for resource activities carried out in areas of regional interest including SCAs.

Of the areas of regional interest protected by the RPI Act, only SCA is mapped within the exploration tenements. The exploration tenements and the extent of SCA are shown in Figure 2.

For the purpose of this application, the extent of the SCAs shown on the SCL trigger map within the exploration tenements has been assumed to be correct.

2.1.3 PROPERTY TITLES

The properties and associated easements within the SCL in the MBS exploration tenements are shown in Figure 3. The land ownership details are provided in Figure 3a. The detailed title searches are provided in Appendix A.

There are four road reserves through the SCL areas in the MBS exploration tenements (Figure 3), including:

1. Peak Downs Highway;
2. Peak Downs Mine Road;
3. Moranbah Access Road; and
4. An unnamed road.

However, no exploration activities will be undertaken within these road reserves and therefore the SCL mapped within the road reserves will not be impacted.

2.2 PROPOSED EXPLORATION ACTIVITIES

The exploration activities that are located within the SCA in the exploration tenements (Figure 2) include:

- Eight (8) exploration borehole drill pads, and associated access tracks; and
- 3D seismic surveys over an area of approximately 425 ha.

The following sections provide an overview of the proposed exploration activities within the SCL.

2.2.1 DRILLING AND ACCESS TRACKS

The proposed exploration drilling activities within the SCA are as follows:

- Clearing 0.5 ha of vegetation for eight access tracks (each approximately 3 m wide), with a total length of approximately 1,774 m within SCL. During the construction of the access tracks, clearing of mature vegetation will be avoided as far as practicable, and no topsoil will be removed. SCL will, therefore, not be impacted;
- Clearing for eight drill pads (each approximately 40 m x 40 m), totalling approximately 1.3 ha of disturbance within SCL. In accordance with the EA for the MBS exploration activities (EA EPPR00939813 approved 1 October 2021), topsoil must be removed and stockpiled separately from any overburden;
- Drilling of eight (8) large diameter (max 380 mm) exploration drill holes; and
- Rehabilitation following completion of drilling activities.
    - In accordance with the EA for the MBS exploration activities, drill holes must be decommissioned within 3 months following completion of drilling activities. Bore casings will be removed and the bore holes will be backfilled and sealed with grout. Drill pads will be regraded, as necessary, to match the natural terrain. The soil will be replaced in the reverse order to which it was removed (i.e. any sub-soil will be replaced first and then capped with the topsoil) and the area will be left to regenerate naturally from seedstock within the topsoil. Weed management will be applied, as necessary.
    - Access tracks will be left to regenerate naturally from seedstock within the topsoil and weed management will be applied, as necessary.

The precise location of the drill holes and associated access tracks within the SCL is still to be determined and will depend on the further interpretation of geological information by the proponent. Approximate drill hole locations are shown in Figure 2 however, these locations within the SCL are not fixed and may change. Any relocation of the drill holes within the SCL will not change the total number of drill holes or the total SCL disturbance area.

2.2.2 SEISMIC SURVEYS

This section describes how the seismic surveys will be conducted as well as the potential impacts of the seismic surveys on SCL.

OVERVIEW

3D seismic surveys are conducted ahead of underground mining activities to investigate the geology of the coal resource, provide information on the technical and economic feasibility of mining the resource, and to enable optimisation of the mine design to maximise productivity and safety.

There is approximately 425 ha of proposed seismic surveys within the SCL in the MBS exploration tenements (Figure 2). The seismic surveys will be undertaken progressively over approximately two years.

The proponent will use the Envirovibe system to obtain seismic data. Envirovibe units are mounted on articulated vehicles (Photograph 1). The units emit ground penetrating sound waves generated by a 1 m diameter vibrating pad thumping the ground at regular intervals. The Envirovibe drives down source lines creating the ground penetrating sound waves. The source lines are a series of approximately 3 m wide lines on a parallel grid between 40 m and 80 m apart. The sound waves reflect off underlying geological structures and are detected by a grid of receptors, called geophones. The geophones are placed at regular intervals along the receiver lines to collect the data. The receiver lines are a series of approximately 3.5 m wide lines on a parallel gride between 50 m to 100 m apart and at 30 – 45° to the source lines. The information gathered from seismic surveys is used to prepare 3D maps of the underlying geological structure.

PHOTOGRAPH 1: ENVIROVIBE UNIT

IMPACTS ON SCL

The impacts from seismic surveys will be limited to slashing the grass and clearing a limited number of mature trees along the survey lines. Slashing the grass will not impact the SCL as the soil will not be disturbed. The remainder of this section discusses the potential impacts on SCL from clearing trees.

Conventionally, seismic survey programs involve straight receiver and source lines that have been completely cleared of all vegetation (i.e. shrubs and trees) to allow access for the survey vehicles and equipment. However, the articulated design of the Envirovibe Unit makes the vehicle highly manoeuvrable, enabling the vehicle to weave through woodland areas to minimise tree clearing and avoid mature trees (referred to as the tree weaving method). This method results in a substantial reduction in the tree clearing impact of seismic surveys compared to the clearing of linear grid pattern seismic lines. Firstly, the tree weaving survey method results in a significant reduction in the number of trees required to be cleared. For example, in dense woodland areas within the seismic survey area a range of 0.1% to 4.2% of the total trees would be cleared using the tree weaving survey method, compared to a range of 18% to 24.9% of total trees cleared for the

unmitigated linear survey grid pattern. Secondly, the tree clearing effect due to the tree weaving survey method is a random thinning of individual trees that does not result in any broad acre clearing areas, whereas the clearing of unmitigated linear grid pattern survey lines results in regular pattern clearing. Hence overall, the tree weaving survey method has a substantially reduced impact on tree clearing within woodland vegetation.

Most of the SCL area is not mapped as containing either remnant or regrowth vegetation. Therefore, it is anticipated that, due to the tree weaving survey method and the low quantity of mature trees, only a small percentage of trees (< 1%) would be cleared within the SCL areas for the MBS seismic surveys. As described in Section 2.2.3, any tree clearing within the SCL areas will be conducted by a dozer using the blade up method to minimise the disturbance of topsoil. Any disturbed topsoil due to tree clearing within the SCL areas will be respread immediately. SCL will, therefore, not be permanently impacted by the MBS seismic surveys.

2.2.3 MITIGATION MEASURES

The proponent has committed to the following mitigation measures to help minimise the impacts of the exploration activities on SCL:

- No clearing of vegetation will be undertaken within riparian zones (i.e. within 20 m of the high bank of watercourses);
- Activities in the riparian zone will be limited to handheld geophones;
- Existing tracks and crossings will be used wherever possible;
- Any tree clearing within SCL will be conducted by a dozer using the blade up method to minimise the disturbance of topsoil. Any disturbed topsoil due to tree clearing within SCL will be respread immediately;
- Slashers will be used to mow grassland areas outside the riparian zone to no shorter than 20 cm in height, for vehicle/equipment access. This will ensure that there is no ground disturbance and ground cover will be maintained. Slashing will not take place between 1 January and 31 March when grasses are more likely to be in seed and/or flower;
- Erosion and sediment controls will be applied, where necessary during construction, operations, decommissioning and restoration;
- Weed and pest management measures will be implemented, where necessary during construction, operations, decommissioning and restoration;
- Pre-clearing surveys will be undertaken prior to any disturbance to ensure the area to be disturbed is minimised and avoids any sensitive environmental features. The pre-clearing survey will ensure compliance with the EA for the MBS exploration activities including EA condition B13 which states that the area and duration of the disturbance to the land and vegetation is minimised.
- The proposed disturbance footprint will be marked out pre-clearing to minimise the disturbance area.
- Photograph records will be taken at each of drill hole sites at the following times:
  - Pre-clearing;
  - During operations to show the separate stockpiling of the topsoil and subsoil horizons;
  - After decommissioning to show the landform matching the natural terrain; and

  - After restoration to show the successful restoration of the disturbed areas.
- As stated in Section 2.2.1, topsoil will be removed and stockpiled separately from any overburden/subsoil. Each subsoil horizon will be stockpiled separately.
- All drilling waste will be removed from site.

Given the limited areas of soil disturbance within the SCL areas and proposed application of widely used and proven successful mitigation and restoration methods, the risk of significant impacts to SCL is considered low.

3 EXISTING LAND AND SOILS CHARACTERISATION

This section provides an overview of the existing (i.e. pre-activity) land and soils characterisation of the SCL areas inside the exploration tenements. This information is taken from the 2013 Soil and Land Suitability Assessment undertaken for the Moranbah South Coal Mine Project Environmental Impact Statement (EIS) (Appendix A). The Moranbah South Coal Mine Project EIS Soils and Land Suitability Assessment includes the entire MBS tenements. The relevant soil mapping units (SMUs) for the SCL areas within the MBS tenements include:

- SMU A3;
- SMU B1; and
- SMU B2/B2(rp).

The methodology in the 2013 Soil and Land Suitability Assessment undertaken for the Moranbah South Coal Mine Project EIS is generally consistent with the *RPI Act Statutory Guideline 08/14 – How to Demonstrate that Land in the Strategic Cropping Area Does Not Meet the Criteria for SCL* and was conducted in accordance with the *Guidelines for Surveying Soils and Land Resources* (McKenzie *et al.*, 2008) with references to the:

- *Australian Soil and Survey Handbook* (Gunn *et al.*, 1988);
- *Australian Soil and Land Survey: Field Handbook* (National Committee on Soil and Terrain, 2009);
- *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);
- *Australian Soil Classification* (Isbell, 2002);
- *Land Resources Assessment of the Windeyers Hill Area, Isaac-Connors and Mackenzie River Catchments* (Burgess, 2003); and
- *Lands of the Isaac Comet Area, Queensland* (Story *et al.,* 1967).

3.1 TERRAIN, LANDFORM AND SLOPE

The local topography within the SCL areas in the MBS exploration tenements is dominated by gently undulating plains with slope gradients equal to or less than 3%. Elevations range from approximately 220 m Australia Height Datum (AHD) in the eastern SCL areas to approximately 240 m AHD in the western SCL areas.

3.2 SITE LITHOLOGY

The Moranbah South deposit lies on the north-western flank of the Permo-Triassic Bowen Basin. The sedimentary strata in this area were deposited on the Collinsville Shelf, a stable tectonic environment on the western flank of the basin. Elements of two major coal bearing formations, both of Late Permian age, subcrop in the area, these being the Moranbah Coal Measures and overlying Fort Cooper Coal Measures. The Moranbah Coal Measures are fluvial and fluvio-deltaic in origin and formed in an upper delta plain

depositional environment. A similar depositional environment is suggested for the Fort Cooper Coal Measures.

The typical stratigraphy in the exploration tenements consists of:

- A thin veneer of Quaternary soils and alluvial sediments;
- A variable thickness of Tertiary basalts and unconsolidated sediments (sandstones and claystones);
- The Late Permian Fort Cooper Coal Measures;
- The Late Permian Moranbah Coal Measures; and
- The underlying German Creek Formation.

3.3 CURRENT LAND USE

The SCL within the exploration tenements have been used for cultivation of opportunist forage crops, mainly sorghum. In addition, a significant area has been developed for leucaena fodder shrubs. Contour banks were constructed for erosion protection in most cultivated areas which includes the leucaena areas.

3.4 PREVIOUS SITE DISTURBANCE AND MODIFICATION

Existing built infrastructure within the SCL in the exploration tenements comprises (Figure 3 and Figure 4):

- Two dams;
- Moranbah Access Road, Peak Downs Mine Road, the Peak Downs Highway and an unnamed road reserve;
- One residence;
- A cattle yard; and
- Powerlines, a stock route, communications lines, the Eungella Water Pipeline and a proposed CQ gas pipeline.

3.5 SOIL CHARACTERISTICS

Table 2 summarises the SCL soil characteristics including, soil hydrology, soil surface condition, vegetation and groundcover, microrelief, soil depth, and soil profile conditions.

TABLE 2 SCL SOIL CHARACTERISTICS

Soil Characteristics	SMU A3	SMU B1	SMU B2/B2(rp)
Soil hydrology	Good water storage potential		
Soil surface condition	Generally described as cracking and sandy.	Generally described as cracking, sometimes with a weak crust.	Generally described as cracking, granular and with some erosion.

Soil Characteristics	SMU A3	SMU B1	SMU B2/B2(rp)
Vegetation and groundcover	Extensively cleared for pasture production and was originally Brigalow with areas of Mountain Coolibah and Bloodwood.	Extensively cleared for pasture production and were originally Mountain Coolibah and Bloodwood downs country.	
Microrelief	No significant microrelief (<50% of land surface being gilgai microrelief of >500 mm in depth) within the SCL areas in the exploration tenements		
Soil depth	Typically exceeding 0.9 m soil depth.	Approximately 0.9 m soil depth.	Typically exceeding 1.0 m soil depth.
Soil profile descriptions	Cracking clays on alluvium and colluvial footslopes. Further information is provided in Section 3.5.1.	Dark crusting and cracking clays on basalt. Further information is provided in Section 3.5.2.	Dark cracking clays on basalt, including SMUB2(rp), a B2 surface rock phase. Further information is provided in Section 3.5.3.

3.5.1 SMU A3

This unit consists of black and brown Vertosol soils. These soils are strongly influenced by colluvial and alluvial deposition of basaltic derived soils and have greater fine sand and silt content than in situ basalt clays as a result of these processes. Accordingly, they tend to form weak sandy surface crusts and exhibit coarser soil structure. Surface rock may be present but not to levels which would preclude cultivation.

Substrate north of the Peak Downs highway tends to be either weathered basalt or alluvial sediments while south of the highway most areas lie above sandstone.

A small percentage of sites tested had saline conditions which would affect plant rooting depth at 0.7 m. A large number of sites had high chloride levels below 1.0 m depth. The pH ranged from neutral to strongly alkaline but did not exceed 8.7. Exchangeable sodium percentage (ESP) indicated possible dispersive characteristics below 0.7 m depth at a small percentage of sites. Overall soil fertility is quite good, however, in some situations potassium, nitrogen and phosphorus were just below minimum crop requirements. These soils have a high water storage potential.

3.5.2 SMU B1

Soils are Vertosols which lie along lower landform areas and have formed from colluvial influences of basaltic derived soils. They have a more pronounced fine sand and silty texture than the B2 soils which leads to a weak sandy surface crust. Subsoil structure is somewhat coarse but not a significant limitation as they are well drained. Areas of significant surface rock occur sporadically across the unit but generally not to levels which would impede cultivation.

Elevated salinity and moderately sodic conditions were recorded in some sites however the majority of sites have an effective soil depth of at least 0.9 m depth. Main chemistry trends from this data indicates:

- Overall fertility is sound;

- Salinity, pH or general fertility are not significant limiting factors to a cropping use;
- Moderate sodic conditions may occur below 0.8 m; and
- Levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

3.5.3 SMU B2 AND B2(RP)

Soils are well structured, deep black Vertosols which have formed on basalt rock. They are quite consistent in attributes and are well suited to a cropping use. The most severe limitation for cropping is a moderate erosion risk from long sloping terrain with gradients up to 3% (mostly 1.5 – 2.5%). Contour banks had been constructed in some areas for this reason. Localised areas of significant surface rock were identified in some areas, but it is not widespread.

Main chemistry trends from this SMU indicates that;

- Saline and sodic subsoils were found in approximately 15% of sites tested. In each case it was below 0.6 m depth;
- Overall fertility is quite good;
- Soil pH is not limiting to 1.0 m depth and was generally in a range from slightly to moderately alkaline;
- Most sites had an effective soil depth which exceeded 1.4 m depth;
- Estimated water storage potential exceeds 120 mm in most cases; and
- Levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

4 RESTORATION

This section details the proposed restoration methods (Table 3), monitoring requirements (Table 4) and restoration criteria (Table 5).

Table 3 details the SCL restoration methods, milestones, estimated timeframes and estimated costs. The unit costs for the restoration activities are generally based on the unit costs for the activities specified in the DES Estimated Rehabilitation Costs Calculator.

TABLE 3 RESTORATION METHODS

Restoration Milestones	Restoration Methods	Estiamted Timeframe (Months)	Estimated Cost ($)
Pre-clearing	Photographs of the disturbance area prior to any clearing.	Within 3 months prior to the commencement of clearing.	Not applicable.
Infrastructure Removal	Drill holes decommissioned: • Bore casing removed; • Bore holes backfilled and sealed with grout; and • Visual survey and photographs confirming all infrastructure has been removed.	3 months following completion of drilling activities.	• Bore casing removal, backfilled, and sealed: $6,859/bore x 8 bores = $54,872 • Visual survey: Not applicable
Landform Reprofiling	• Drill pads will be regraded, as necessary, to match the natural terrain – photographs taken to ensure consistency with pre-clearing terrain; • If the stockpiles are more than 6 months old, samples will be taken from all horizons to assess key soil fertility indictors and the need for fertiliser application; and • The soil will be replaced in the reverse order to which it was removed (i.e. any overburden will be replaced first and then capped with the topsoil).	3 months following completion of drilling activities.	• Regrade: $1,800/ha x 1.3 ha of drill pads= $2,340 • Stockpile soil samples: $600/site x 8 stockpile sites = $4,800 • Soil replacement: $3/$m^3$ x 1.3 ha of drill pads x 0.5 m estimated maximum depth of soil replaced = $19,500
Revegetation	• Ripping of topsoil; • Amelioration of topsoil with fertiliser, gypsum and/or lime, as necessary; and • Area will be left to regenerate naturally from seedstock within the topsoil.	3 months following completion of drilling activities.	• Ripping and grading: $385/ha x 1.3 ha of drill pads = $500.50 • Fertiliser: $315/ha x 1.3 ha of drill pads= $409.50

Restoration Milestones	Restoration Methods	Estiamted Timeframe (Months)	Estimated Cost ($)
			• Gypsum: $250/ha x 1.3 ha of drill pads= $325 • Lime: $860/ha x 1.3 ha of drill pads = $1,118
Erosion and Sedimentation	• Erosion and sediment controls will be applied, where necessary	During construction, operations, decommissioning and restoration, as necessary	• Weed and pest management and erosion and sediment control: $450/ha x (1.3 ha of drill pads + 0.5 ha of access tracks) = $810
Weed and Pest Management	• Weed and pest management will be applied, as necessary.	Ongoing, as necessary, until the successful re-establishment of vegetation.	
Restoration Criteria	Survey to be completed by a suitably qualified person to include: • Grazing and dryland cropping suitability classes restored to pre-clearance classes (Table 5); • Vegetation established with similar species and with a similar density as the immediately surrounding areas; • Weed and pest species are the same as or less than that of the immediately surrounding area; • Any erosion and sedimentation issues are the same as or less than that of the immediately surrounding areas; and • Drainage has been appropriately restored, where necessary.	Within 1 month of the end of the wet season following the completion of revegetation.	Not applicable
Ongoing Monitoring	See Table 3.	See Table 3.	Not applicable
TOTAL ESTIMATED RESTORATION COST			**$84,675**

Table 4 outlines the proposed monitoring program.

TABLE 4 MONITORING

Monitoring	Frequency
Pre-clearance photographs	Prior to the commencement of clearing
Operational photographs	During operations
Monitoring to determine the need for weed and pest management and erosion and sediment control	During construction, operations, decommissioning and restoration, as necessary
If stockpiles are more than 6 months old, samples will be taken from all horizons to assess key soil fertility indictors	Prior to decommissioning
Decommissioning photographs	After decommissioning
Visual survey confirming all infrastructure has been removed	After decommissioning
Restoration photographs	After restoration
Restoration survey to confirm criteria success	1 month after the end of the wet season following the completion of revegetation

The restoration criteria provided in Table 5 is based on the return of the disturbed SCL areas to the pre-clearance condition based on grazing and dryland cropping suitability classes. The land suitability of the pre-clearance SCL areas is summarised below and detailed in Appendix A.

TABLE 5 PRE-CLEARANCE LAND SUITABILITY CLASSES

Land Suitability Class and Definition	Gazing and Limitation Level	Dryland Cropping and Limitation Level
Class 1: Suitable land with negligible limitations that is highly productive and requires only simple management to maintain economic production.	• SMUs B2 and B2(rp) with level 1 limitations	• None present
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.	• SMUs A3 and B1 with level 2 limitations	• SMU B2 with level 2 limitations
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.	• None present	• SMUs A3 and B1 with level 3 limitations • SMU B2(rp) with level 2 limitations

FIGURES

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MORANBAH SOUTH EXPLORATION ACTIVITIES – SCL RESTORATION PLAN

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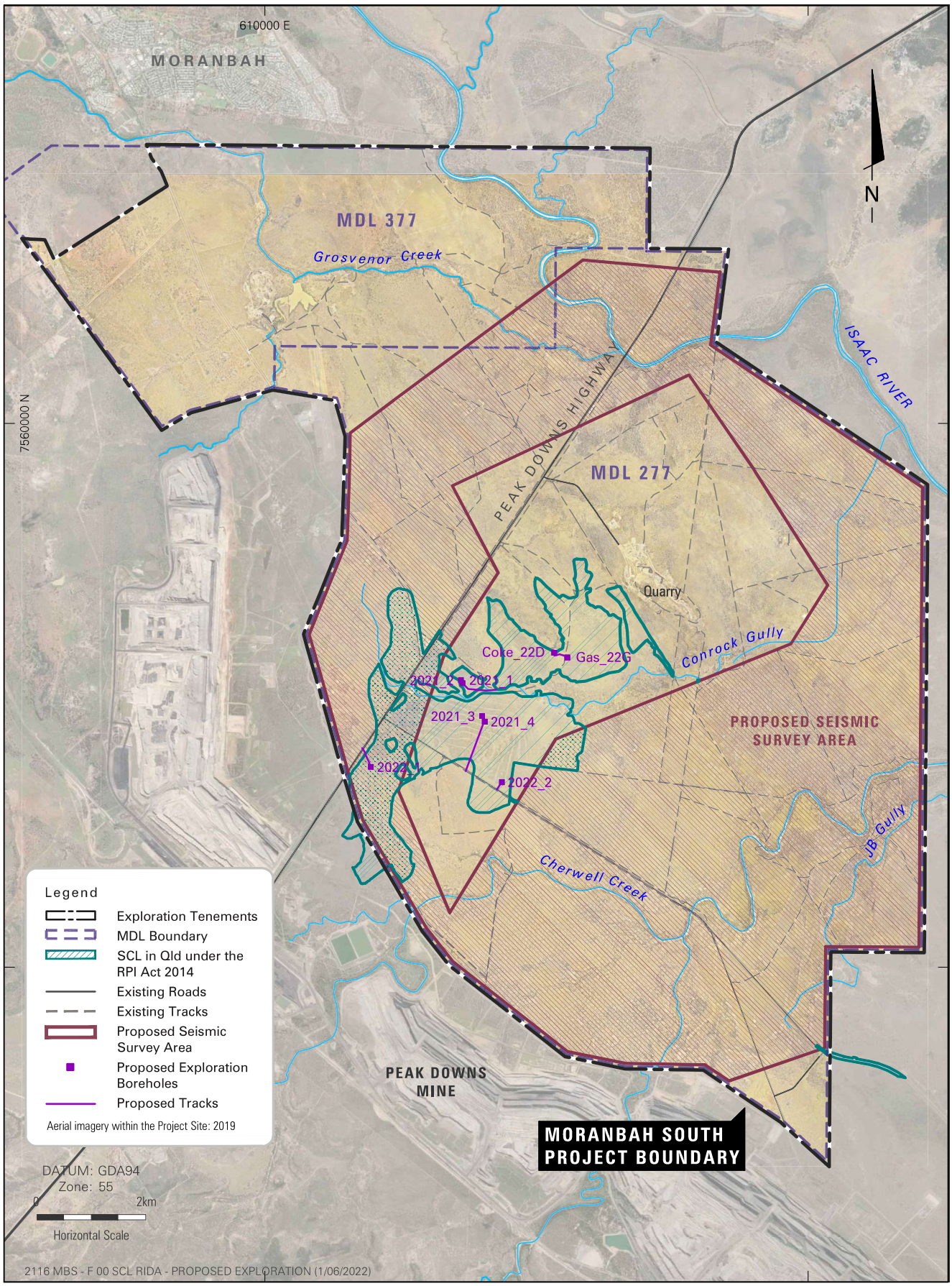
Location Plan

FIGURE 1



MORANBAH SOUTH EXPLORATION ACTIVITIES – SCL RESTORATION PLAN

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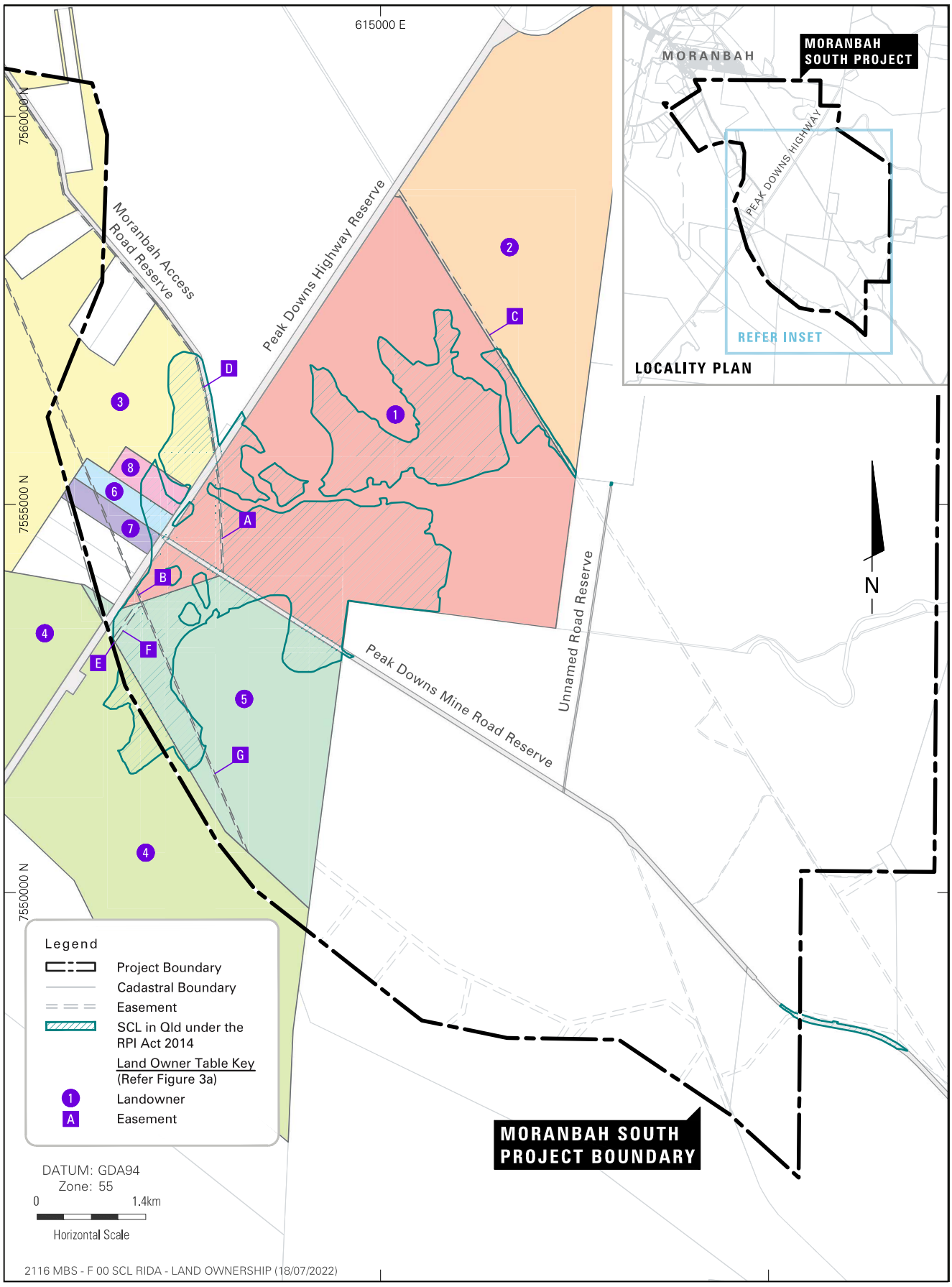
Proposed Exploration Activities

FIGURE 2



MORANBAH SOUTH EXPLORATION ACTIVITIES – SCL RESTORATION PLAN

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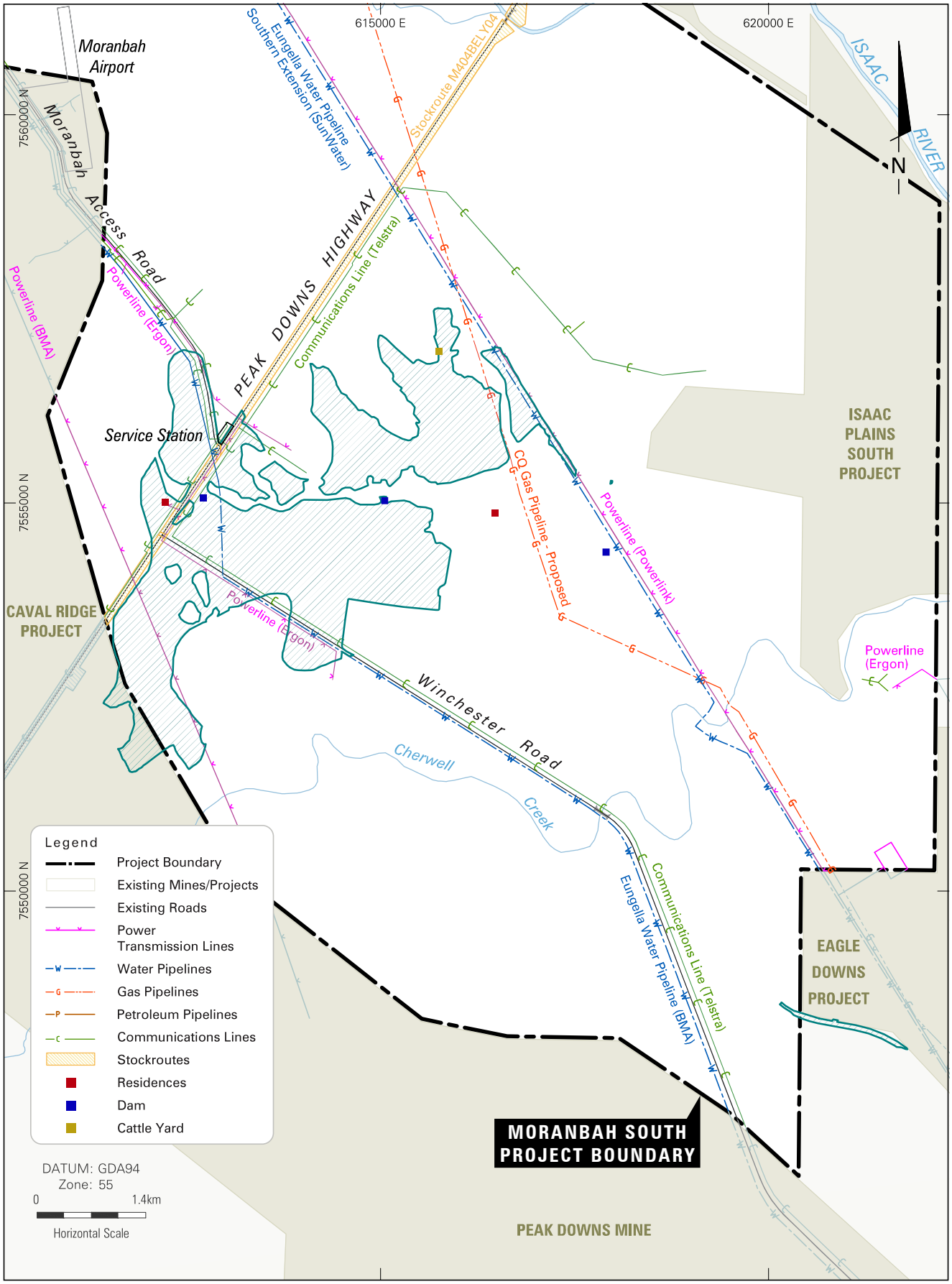
Land Ownership

FIGURE 3

LAND OWNERSHIP TABLE

No.	Lot	Plan	Ownership Type	Landholders/Trustees/Lessees	Landholders'/Trustees'/ Leessees' Postal Addresses	Label	Easements and Encumbrances
1	5	GV148	Freehold	Anglo Coal (Grosvenor) Pty Ltd Exxaro Australia Pty Ltd	**Coolibah Downs** Warren Connolly Stratford Station 1954 Stratford Rd Mt Coolon 4804 Qld wjconn@bigpond.com 0428415434	A B	Easement E on GV77 (601351571 (C561896H)) Easement B on GV80 (601351572 (C561897K))
2	23	GV148	Reserve	Crown Land Trustee: State of Queensland (represented by Department of Agriculture and Fisheries	LANDHOLDER - State of QLD Jennifer Burgemeister Operations Manager Quarry Products 25 Yeppoon Road, Parkhurst, QLD 4701 PO Box 6014, Red Hill Rockhampton, QLD 4701 T 0439 530290 E jennifer.burgemeister@daf.qld.gov.au	C	Easement A on GV92
3	2	SP260061	Freehold	BHP Coal Pty Ltd UMAL Consolidated Pty Ltd BHP Queensland Coal Investments Pty Ltd Mitsubishi Development Pty Ltd QCT Investment Pty Ltd QCT Mining Pty Ltd QCT Resources Pty Ltd Lease No 601072118 to: Alwyn Charles Rogash and Jennifer Kathleen Rogash	LANDHOLDER Stuart Pilcher Specialist Land Management 25 Maitland St Moranbah, QLD 4744 Australia stuart.pilcher@bhp.com M +61 400 948 035	D	Easement F on GV77
4	14	GV116	Lands Lease	Crown Land Lessees: BHP Coal Pty Ltd QCT Mining Pty Ltd Mitsubishi Development Pty Ltd QCT Investment Pty Ltd BHP Queensland Coal Investments Pty Ltd QCT Resources Pty Limited UMAL Consolidated Pty Ltd Sub lease: Telstra Corporation Limited		E	Easement BW on SP233520 (713557970)
5	13	GV225	Freehold	BHP Coal Pty Ltd UMAL Consolidated Pty Ltd BHP Queensland Coal Investments Pty Ltd Mitsubishi Development Pty Ltd QCT Investment Pty Ltd QCT Mining Pty Ltd QCT Resources Pty Ltd		F G	Easement BV on SP233519 (713557966) Easement C on GV80 (601334226)
6	6	RP615467	Freehold	BHP Coal Pty Ltd UMAL Consolidated Pty Ltd BHP Queensland Coal Investments Pty Ltd Mitsubishi Development Pty Ltd QCT Investment Pty Ltd QCT Mining Pty Ltd QCT Resources Pty Ltd			
7	7	RP615467	Freehold	BHP Coal Pty Ltd UMAL Consolidated Pty Ltd BHP Queensland Coal Investments Pty Ltd Mitsubishi Development Pty Ltd QCT Investment Pty Ltd QCT Mining Pty Ltd QCT Resources Pty Ltd			
8	11	SP135741	Freehold	BHP Coal Pty Ltd UMAL Consolidated Pty Ltd BHP Queensland Coal Investments Pty Ltd Mitsubishi Development Pty Ltd QCT Investment Pty Ltd QCT Mining Pty Ltd QCT Resources Pty Ltd			



MORANBAH SOUTH EXPLORATION ACTIVITIES – SCL RESTORATION PLAN

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Existing Infrastructure

FIGURE 4

APPENDIX A

2013 Moranbah South Coal Mine Environmental Impact Statement Soils and Land Capability Assessment

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Moranbah South Project
Soil and Land Suitability Assessment

Prepared for Hansen Bailey Pty Ltd on behalf of Anglo American Metallurgical Coal Pty Ltd
19 February 2013

GT Environmental Services Pty Ltd
10 Cressbrook Street
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1 INTRODUCTION

GT Environmental Services Pty Ltd (GTES) was commissioned by Hansen Bailey on behalf of Anglo American Metallurgical Coal Pty Ltd to complete a soil and land suitability assessment as part of the Environmental Impact Statement (EIS) for the Moranbah South Project (the project).

1.1 Project Description

The project involves the construction and operation of a Greenfield underground coal mine in Central Queensland. The project site (the area that corresponds to the current proposed mining lease (ML) for the project) is located approximately 150 km south-west of Mackay. The project site is directly to the south of the township of Moranbah in the Isaac Regional Council (IRC) Local Government Area (LGA) (**Figure 1**). The project site covers an area of approximately 17,497 ha.

The project proponent is a 50:50 unincorporated Joint Venture between Anglo Coal (Grosvenor) Pty Ltd and Exxaro Australia Pty Ltd. Anglo American Metallurgical Coal Pty Ltd is the manager of the project.

The project is anticipated to have a peak production rate of up to 18 million tonnes per annum (Mtpa) of Run-of-Mine (ROM) coal, which equates to approximately 14 Mtpa of high quality coking coal for the export market. Coal will be mined using longwall and board and pillar mining methods. There will be up to two longwalls and a board and pillar mine operating in a single coal seam. The Goonyella Middle coal seam is the target coal seam for the project. The project will have a mine life in excess of 30 years.

The majority of the mine surface facilities will be located to the east of the Moranbah Airport and will include underground mine access drift portals, conveyors, stockpiles, a coal preparation plant (CPP), rail loop and train loading facilities, workshops, administration buildings and various dams. A dry rejects emplacement area (DREA) will be located approximately 3.5 km to the south-east of the CPP. When the project is fully commissioned, coal will be washed and processed on-site, and product coal will be transported from site by rail. An accommodation village is proposed to be located in the north-western part of the project site. The project layout is shown on **Figure 2.**

For the purposes of this soil and land suitability assessment, the ‘study area’ comprises the project site, as shown on **Figure 2.**

1.2 Scope of Report

This report has been divided into three separate assessments:

- Assessment of soils at a soil mapping scale of 1:50,000 or better (Section 2);
- Assessment of existing agricultural land classes and Good Quality Agricultural Land (GQAL) (Section 3); and
- Assessment of Strategic Cropping Land (SCL) (Section 4).

2 SOIL ASSESSMENT

This section describes the soils assessment undertaken by GTES to assess the baseline soils environment of the Moranbah South Project study area and develop measures to manage topsoil during construction and operation of the project.

2.1 Regulatory Framework

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).

The soil survey has been scoped and conducted in accordance with the *Guidelines for Surveying Soils and Land Resources* (McKenzie *et al*., 2008) with additional reference to the *Australian Soil and Survey Handbook* (Gunn *et al*., 1988). The soils survey and field component of the works (including the assessment of observation and detailed sites) was carried out with reference to the *Australian Soil and Land Survey: Field Handbook* (National Committee on Soil and Terrain, 2009). Collection of soil samples for laboratory analysis has been 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).

Soil characteristics and soil profiles have been described using the *Australian Soil and Land Survey: Field Handbook* (National Committee on Soil and Terrain, 2009). 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, including *Land Resources Assessment of the Windeyers Hill Area, Isaac-Connors and Mackenzie River Catchments* (Burgess, 2003) as well as Lands of the Isaac Comet Area, Queensland (Story *et al.*, 1967).

2.2 Local Setting

The project site is situated in the Isaac River Catchment which flows into the Mackenzie River approximately 200 km south west of Moranbah, before flowing into the Fitzroy River 100 km further south. The project site comprises 17,497 ha of gently undulating land which has predominantly been used for cattle grazing with isolated areas of former cultivation for forage crops. Much of the area has been previously cleared of original vegetation and contour banks have been constructed in some areas for erosion protection for opportunist fodder cropping and perennial leucaena production.

Significant natural features include the Isaac River, Grosvenor Creek and Cherwell Creek, which traverse the northern and southern portions of the study area. In addition, several other small, unnamed drainage lines exist within the study area. Local topography is dominated by relic and recent alluvial plains, river terraces and gently undulating plains with slope gradients generally less than 3%. Occasional low hills also exist. Elevations range from 180 m Australia Height Datum (AHD) at the Isaac River, to 290 m AHD on the higher slopes on the western boundary of the project site.

2.2.1 Geology and Soils

The following summary of regional geology has been taken from geological information provided by the proponent. The Moranbah South deposit lies on the north-western flank of the Permo-Triassic Bowen Basin. The sedimentary strata in this area were deposited on the Collinsville Shelf, a stable tectonic environment on the western flank of the basin. Elements of two major coal bearing formations, both of Late Permian age, subcrop in the area, these being the Moranbah Coal Measures and overlying Fort Cooper Coal Measures. The Moranbah Coal Measures are fluvial and fluvio-deltaic in origin and formed in an upper delta plain depositional environment. A similar depositional environment is suggested for the Fort Cooper Coal Measures.

The typical stratigraphy in the project site consists of:

- a thin veneer of Quaternary soils and alluvial sediments;
- a variable thickness of Tertiary basalts and unconsolidated sediments (sandstones and claystones);
- the Late Permian Fort Cooper Coal Measures;
- the Late Permian Moranbah Coal Measures; and
- the underlying German Creek Formation.

The Quaternary/Tertiary stratigraphy is generally less than 25m thick but in the northern and western portion of the project site, weathered and fresh basalts up to 90m thick are present. These thicker occurrences are preserved in palaeochannels and contain groundwater. The depth of weathering varies from 1 to 110m (averages 30m), and is intimately associated with the Tertiary cover. Minor localised weathering of the upper Permian has occurred to about 10m depth.

The soils in the area are generally part of the Mackenzie Dawson Lowlands. These lowlands are made up of floodplains, clay plains and sandy bedrock lowlands. Bedrock is usually highly weathered and basalt areas that have not undergone leaching tend to retain silica and cations, which can form smectite (McKenzie et al., 2004). Smectite is a clay mineral that shrinks and swells during wetting and drying and where smectite dominates, Vertosols often form. Thus, Black and Brown Vertosols are very common across in locality and the study area . Also referred to as “cracking clays”, these soils are relatively uniform, with heavy clay textures. When dry, these clays allow rapid infiltration to occur and have particularly high water holding capacities. With the exception of watercourses draining directly from residual and colluvial landscapes overlying basalt, these soils do not form near riparian zones, but rather in less geomorphologically active areas in order to allow pedogenesis (soil formation) to occur.

Riparian zones within the study area are characterised by poorly developed soil, usually with two or more definite terraces. The higher terraces are usually less fertile, but more pedogenically developed than the lower terraces. The higher terraces are rarely flooded, but are often subject to erosion (McKenzie et al., 2004).

2.2.2 Vegetation

Some remnant vegetation remains within the study area however much of the area has been extensively cleared. Most remaining vegetation includes Poplar Box woodlands and mixed riparian communities associated with active drainage lines. Areas of remnant natural grassland areas are also present.

The composition of remnant vegetation communities basically follows soil types and parent material. Mixed Brigalow scrub occurred along low hills and lower lying old alluvial plains with Mountain Coolibah open downs occupying undulating uplands on basalt rocks. Extensive areas of Poplar Box woodlands occupied, or still occupy, relic and recent alluvial areas of sandy texture contrast soils.

2.2.3 Agricultural land use

A large proportion of the project site has been completely cleared of the original vegetation for pasture enhancement in support of beef cattle grazing. Smaller areas in the central portion of the study area have also been used for cultivation of opportunist forage crops, mainly sorghum. In addition, a significant area has been developed for leucaena fodder shrubs. Contour banks were constructed for erosion protection in most cultivated areas which includes the leucaena areas.

2.2.4 Existing disturbance and other land use

Existing built infrastructure covers 108 ha within the project site and comprises;

- two active quarries and associated infrastructure,
- part of the Moranbah airport,
- a dam in the north-west of the study area and,
- a variety of other infrastructure which include homesteads, the Peak Downs Highway, Moranbah Access Road, Winchester Road, Long Pocket Road, Railway Station Road, a service station, power and water pipelines.

Existing infrastructure and industrial operations at the project site are considered ‘disturbed land’ and are excluded from the soil assessment.

2.3 Existing Soils Information

A significant body of soils and land resources information relevant to the study area is available from both regional soil mapping and adjacent mining projects. This information has been used to inform preliminary soil mapping for the project site and assist in development of a field investigation as part of this assessment.

2.3.1 Regional Soils Information

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Queensland Government have undertaken regional scale mapping over extensive areas of the Bowen Basin. The following references have been consulted as part of the current assessment:

- *Lands of the Isaac-Comet Area, Queensland. CSIRO Land Research Series.* (Story *et al.*, 1967).

  This report mapped and described land systems which are landscape patterns comprising 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.

  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 *et al*. (1967) identified proved to be basically correct however too broad a basis for soil type boundary delineation at a 1:50,000 scale. Land and soil types described across the project site from this work are summarised below in **Table 1**.

Table 1: Land Types

Land Type	Land System	Vegetation and Soils
Sandy alluvial soils associated with active floodplains	Connors	Poplar Box woodlands and riverine vegetation with sandy texture contrast soils Springwood, Consuelo and Broad meadow
Sandy texture contrast soils on gentle colluvial and relic alluvial plains	Monteagle	Poplar Box mixed woodlands with areas of Silver Leaf Ironbark with isolated areas of sandy thin texture contrast or non-cracking clays with Brigalow Medway and Luxor soil types
Soils on fresh and weathered basalt	Oxford	Open grasslands with Mountain Coolibah lowlands on basalt with cracking clay soils known as May Downs soil type
	Waterford	Similar vegetation but occurs as low hills on basalt with Bruce and Glenora cracking clay soils
Clay soils on gentle colluvial and relic alluvial plains	Daunia, Racecourse	Brigalow and associated species on clay soils on plains and lowlands on weathered shale with Teviot and Rolleston soils.

Source: Story *et al.* (1967) Lands of the Isaac-Comet area, CSIRO.

- *Land Suitability Study of the Collinsville-Nebo-Moranbah Region* (Shields, 1984)

  This is a soil and land capability assessment for the Collinsville-Nebo-Moranbah Region showing the main land systems over an area inclusive of the project study area. This report represents relevant background information of soils and land use but is of limited value to due to broad mapping scale.

- *Land Resource Survey and Evaluation of the Kilcummin Area, Queensland (*Shields and Williams,1991)

  This report provides information on the Kilcummin area, located to the west of the study area. Soil mapping is presented at a 1:100,000 mapping scale.

  The description of basaltic soils provided in this report is particularly relevant to the project site based upon geological information which shows shallow and outcropping basalt units to be present. In addition, it forms a sound practical application of the Department of Mines and Energy land suitability assessment techniques (DME, 1995).

- *Land Resource Assessment of the Windeyer's Hill Area, Isaac-Connors and Mackenzie River Catchments, Central Queensland* (Burgess, 2003)

  This report provides detailed information on the soil and land resources within the Isaac-Connors and Mackenzie catchments. The project site is located in the Upper Isaac River catchment and strong correlations would be expected between the soil types identified at the project site those presented in the Burgess (2003) report.

  Field sampling was undertaken at a density that satisfies a 1:50,000 mapping scale, although mapping is presented at a 1:100,000 scale. The project site is not within an area directly mapped by the Burgess (2003) report.

  Burgess (2003) refined soil associations and boundaries from Land System mapping undertaken by Story *et al.* (1967). Two soil landscape units described by Burgess (2003) occur in the project site:

- Level to gently undulating plains and rises on unconsolidated Tertiary – Quaternary sediments; and
- Soil landscapes on fresh or partially altered Tertiary basalt.

The soil landscape units described in the Burgess (2003) report are discussed further in Section 3.

2.3.2 Existing Soils Reports Adjacent to the Project

A number of soils reports have been published for adjoining land as part of the EIS process or for mine planning purposes. The following reports were consulted to provide local information to supplement the regional information discussed in the previous section.

The major value of these reports for the Moranbah South Project is to confirm whether the site investigations at adjacent sites developed and agreed with the regional information, thereby indicating that the regional mapping has been demonstrated as broadly accurate by other investigations. It is also to show the types and characteristics of soil types which were identified at adjacent sites.

In each case, the reports displayed strong correlation with previously mapped Land Systems and expected soil types described for the area by Story *et al.* (1967).

Caval Ridge Project

This study was carried out across a 6,508 hectare (ha) area located adjacent to the western boundary of the project site. This data was utilised for comparisons of soil types soil chemistry and land suitability findings in addition to assisting in soil type boundaries to the project site boundary to the west. The Caval Ridge Study was carried out to assist the application for open-cut coal mining.

The majority of the Caval Ridge project site has been cleared of the original native vegetation but remnant vegetation units comprise Narrow-leaved Ironbark woodland, Wattle, Lancewood, Brigalow and Dawson Gum communities. Remnant vegetation type is heavily dependent upon soil type and landscape unit.

Six major soil units were described, none of which were found to be suitable for cropping apart from the shallow skeletal soil type, while all were suited to grazing of natural or improved pastures.

Eagle Downs Project

This study was carried out across a 4,550 ha area located approximately 20km to the south-east of the township of Moranbah and immediately adjacent to the south-eastern boundary of the project site. This study divided soils in eight units with the most predominant soils in the study area being:

- Relatively thin fine sandy, silty or loamy surface duplex soils mostly with neutral to alkaline often saline medium to heavy clay or heavy clay subsoils; Chromosols, Sodosols or Calcarosols Soil Orders.

- Uniform (non-cracking) clay soils, locally medium textured grading to medium to heavy clay subsoils, locally some very thin clay loamy surface horizons over structured tending to massive medium to heavy clay subsoils locally incipient cracking clays; mostly Dermosols or Hydrosols Soil Orders.

- Fine-textured uniform, (cracking) clay soils, high plasticity locally with thin self-mulching surficial soil horizons and dark brown, brownish black, brown or dark grey, heavy clay subsoils; Vertosols Soil Order.

Grosvenor Project

This study was carried out across a 10,421 ha area located adjacent to the north of the project site. This study identified and mapped soils, land suitability and Good Quality Agricultural Land across the study area. This study found sandy Kurosols, Dermosols and Tenosols to be the dominant soil types across the study area, with Vertosols representing a minor component of mapped soils.

Peak Downs Mine

In the period 2006 to 2012, GTES mapped soils and assessed land suitability over areas planned for future highwall expansion of the BHP Billiton Mitsubishi Alliance (BMA) Peak Downs Mine which adjoin the south-western boundary of Moranbah South. While this report is unpublished internal BMA information, GTES gained a thorough local understanding of soils in this locality.

2.3.3 Existing Soils Reports Within the Project site

Isaac Plains South Project

Part of the Isaac Plains South project site overlaps the eastern part of the Moranbah South project site. The Isaac Plains South project is part of the original Integrated Isaac Plains Project. A soil study was carried out by GTES in 2007 for the Integrated Isaac Plains EIS. It involved a 2,274 ha area immediately adjacent and partially overlapping the east of the Moranbah South project site.

The area of overlapping study area is 1,380 ha. GTES described 55 soil investigation sites within the overlapping study area (i.e. within the Moranbah South project site), comprising 30 observation sites and 25 detailed soil profile descriptions. Five of these soil investigation sites were submitted for full laboratory analysis. These overlapping soil investigation sites were used to complete mapping of Soil Mapping Units (SMUs) for the Moranbah South project site, reducing the required survey effort. Detailed soil profile descriptions from the Isaac Plans South Project are documented in **Appendix 1** and mapped on **Figure 3** with the prefix 'IP'.

Golders EIS Rejects Emplacement Area Conceptual Design Report

Golders (in prep.) undertook an investigation of a 230 ha (approx.) area in the central portion of the Moranbah South project site to characterise soil and substrate conditions ahead of designs for the proposed DREA. A total of 24 Backhoe pits were excavated, all of which were logged for soil profile descriptions, location and photographed. These have been included in the overall database. Additionally, the geologist identified substrate material.

2.4 Survey Methodology

Field investigations were undertaken to confirm the information on soil types and agricultural suitability outlined in the review of available soil studies. This section describes the rationale and methodology used for the field investigations at the project site and the activities undertaken to classify and analyse the main soil types located within the project site.

2.4.1 Investigation Layout

An initial understanding of the different types of soil and landscapes across the study area was developed though a review of available aerial photographs and geological, soil and topographic maps of the project site and surrounds. The aerial photographs and topographic maps were reviewed for the purpose of delineating landscape features and geomorphic processes within the study area. These were then correlated with existing soil and geological maps to gain an understanding of the relationships between geology and physical and biological processes, which may contribute to the formation of soil types within the study area. This background information was collated and used to derive a preliminary soil type map and legend showing indicative soil type distributions.

Additional source materials were reviewed, including relevant reports, borehole logs, cadastral data and geographic information systems presenting geological, vegetation, hydrological and hydrogeological data.

Detailed field investigations were undertaken using 'free survey' techniques (Gunn *et al*., 1988) to collect observational and sampling data. This data was used to confirm and refine the preliminary mapping.

2.4.2 Mapping Scale & Investigation Intensity

A soil mapping scale of 1:50,000 or better was applied to the project site. To satisfy this mapping scale across the project site, a medium (semi-detailed) density investigation of between 1 to 5 sites per square kilometre is recommended by the *Guidelines for Surveying Soil and Land Resources* (McKenzie *et al*., 2008). This is equivalent to 1 investigation site per 20 to 100 ha, or 0.05 to 0.01 investigation sites per ha. A comparable range of between 1 and 4 sites per square kilometre is recommended by the *Australian Soil and Survey Handbook* (Gunn *et al*., 1988). Of this number, approximately 20% should be detailed soil profile descriptions.

The field investigations for this project comprised 732 investigation sites on 17,497 ha of which 150 sites were detailed soil profile descriptions and 582 were surface observations. This is equivalent to approximately 1 site per 24 ha or 0.04 sites per ha with 20.5% being detailed descriptions. This investigation density easily satisfies the requirements for a soil mapping scale of 1:50,000.

Proposed ground disturbance will mainly be associated with the mine surface facilities and the DREA footprints. Therefore, a more detailed mapping scale and higher investigation density were applied to these areas. Soils in the vicinity of the mine surface facilities and DREA were mapped at 1:25,000 scale or better, using a moderately high (detailed) intensity field investigation comprising approximately 0.08 sites per ha.

2.4.3 Detailed Soil Profile Descriptions

Detailed soil profile descriptions were based upon trial pitting using a backhoe and hand augering methods which allow for suitably detailed assessment of the soil profile and sampling at representative depths. At each investigation site a good section of soil stratigraphy was exposed and high quality photographs were taken. Detailed soil profile descriptions confirm the preliminary mapping and surface observations.

Excavation depth varied dependent upon the stratigraphy encountered but was generally within one to two metres of the ground surface or to hard impenetrable or non-excavatable horizons. Soil profiles were logged in the field by a soil scientist.

The information typically collected from each detailed soil profile included:

- type of soil observation (e.g. trial pit, naturally exposed surface, hand auger etc);
- 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*), mottling and other colour patterns of each horizon;
- for each horizon, observations of field texture, pH, presence and abundance of segregations, coarse fragments, structure and pedality, pH and moisture content, consistence; and
- presence of organic matter, roots and prevalence of biological activity.

Trial pits excavated in the DREA footprint targeted the suitability of soils for use as rehabilitation capping material. Therefore a slightly reduced range of soil morphological attributes was recorded at each of these 24 investigation sites. Detailed information and photographs were collected including surface cover and condition (e.g. cracking), soil horizons, slope (%), rockiness (diameter and %), texture, colour, mottling and lithology of parent material.

The location of all detailed sites is presented in **Figure 3** and **Appendix 1**.

2.4.4 Laboratory Analysis

Representative sites were sampled for analysis of major soil horizons. In addition, major horizons of other detailed sites were also sampled and tested to provide a more detailed laboratory understanding across the project site. Samples for analysis were selected to ensure that major attributes affecting land suitability and topsoil re-use for rehabilitation were tested from a full range of depths within SMUs. No samples were taken at boundary zones of soil horizons to ensure all samples were representative of a particular soil layer so specific sampling depths varied between sites for this reason.

The analytical program is summarised in **Table 2**.
Table 3 shows the breakdown of sampling depths across each soil type and that a total of 253 samples were analysed from 108 sites which includes Isaac Plain laboratory samples (IP) of six (6) sites and 16 samples.

A sound database of soil chemistry has been compiled throughout major horizons of each SMU. In addition to the laboratory analysis assisting in assessment of agricultural suitability and chemical limitations to the re-use of soils in the rehabilitation of disturbed areas, it serves to identify soils that may require specific management measures.

Most samples submitted for testing were analysed for salinity, dispersion and pH attributes with surface soils tested for a further suite of parameters to determine fertility. Selected samples were also tested for additional parameters such as cations and particle size distribution to refine the characterisation of the source horizon. In addition, calculations were undertaken to determine the exchangeable sodium percentage and calcium to magnesium ratio where data was available. Overall, the samples were analysed for the following parameters:

- pH (1:5);

- electrical conductivity (EC [1:5]);
- chloride;
- available nitrogen and phosphate;
- cation exchange capacity and exchangeable ions;
- organic matter;
- selected metals (Al, Cu, Zn, Mn and Fe);
- particle size distribution; and
- Emerson aggregate test.

In addition, calculations were developed for exchangeable sodium % and calcium to magnesium ratio.

Soil laboratory analysis was undertaken by the following laboratories which are accredited by the National Association of Testing Authorities (NATA) with reference to Rayment and Lyons (2011) Soil Chemical Methods – Australasia;

- Environmental Analysis Laboratory (EAL) located in Lismore New South Wales;
- Sydney Analytical Laboratories (SAL) located in Seven Hills New South Wales; and
- Australian Laboratory Services (ALS) located in Brisbane, Queensland.

Laboratory results and laboratory certificates are presented in **Appendix 2**.

Table 2: Soil Analysis Program

Test	Application	Justification
pH	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	Appraisal of salinity hazard in soil substrates or groundwater and total soluble salts	The measure of electrical conductivity is used as a means of appraising soil salinity. The electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity
Chloride Content	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
Available Nitrogen and Phosphate	Presence of nitrogen and phosphate in their available form for plant uptake	Testing for these analytes provides an indication of the general fertility of soils and thus their suitability as a topdressing agent
Cation Exchange Capacity	Fertile soils have moderate to high CEC. Infertile soils have low CEC. Nutrient status, calculation of exchangeable sodium percentage (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
Exchangeable Ca, Mg, Na (Cations)		
Organic Matter	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

Test	Application	Justification
Particle Size Distribution (<2 mm)	Nutrient retention, exchange properties, erodibility, droughtiness, workability, permeability, sealing, drainage, interpretation of most other physical and chemical properties and soil qualities	Particle size distribution data provides an assessment of the composition of a soil (based upon the dominant grain size within a soil). This assists with confirmation of field observations as well as providing better grounds for identification of soil types and water holding capacity
Aggregate Stability Emerson Aggregate Test	Susceptibility to surface sealing under rainfall or irrigation, effect of raindrop impact and slaking, permeability, infiltration, aeration, seedling emergence and correlation with other properties	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 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
Al, Cu, Zn, Mn, Fe	Detection of 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

Table 3: Number of Soil Analysis – SMU and Number of Sites Sampled

Soil Mapping Units[1]	Number of Sites Sampled
A1	11
A2	13 (including 3 IP sites)
A3	34 (including 1 IP site)
B1	4
B2	23
B2rp	7
C1	7 (including 1 IP site)
C2	9 (including 1 IP site)
Sub total GTES sites	102
Sub total IP sites	6
Totals sites	108

[1] Refer Section 3 for descriptions of SMUs

2.4.5 Surface Observation Sites

In addition to data developed from detailed site descriptions and laboratory analysis, surface observation sites provided basic information for indicative soil type, slope, surface condition, landscape characteristics and assist in refining of soil boundaries. Some observation sites were recorded outside the actual survey area to confirm land use or soil type for more accurate soil boundary depiction through to the actual survey boundary.

The information collected from individual observation sites varies but generally includes:

- Indicated soil type deduced from position in the landscape, soil surface and vegetation type;
- landform type, position and slope gradient;
- major vegetation type and cover density;
- soil surface characteristics; and
- land characteristics including disturbance, microrelief, evidence of cultivation, significant erosional features, presence of coarse fragments and estimated % rock cover and outcropping bedrock.

Surface observation sites are included within **Appendix 3**.

2.5 Soil Mapping Units

Soil Mapping Units (SMUs) have been grouped according to basic soil morphology, position in the landscape and parent material and are summarised in **Table 4**. Individual soil types have been classified in accordance with the *Australian Soil Classification* (Isbell, 2002). In some instances, mapped SMUs may include other associated sub-dominant soil types. Comparable soil types described by Story *et al.* (1967) and Burgess (2003) are cross-referenced.

Seven soil mapping units have been established across the project site. A minor variant of a cracking clay soil type has also been described as surface rock phase. A soil phase may possess attributes which are somewhat different from the mainstream soil attributes but does not constitute any significant deviation from the agricultural suitability or basic soil morphology (Gunn *et al.*,1988).

Figure 3 illustrates the spatial distribution of all mapped SMUs at a 1:40,000 scale within the project site.

Table 4: SMUS and comparable soil types from other surveys

SMU	Concept Description	Dominant ASC (sub-dominant)	Burgess (2003)[1]	Story *et al.* (1967)[2]	Area (ha)
Sandy alluvial soils associated with active floodplains					
A1	Recent alluvial soils	Chromosol (Kandosol)	Bul Bul Hazelbrae, Booroondarra	Consuelo, Springwood Broadmeadow,	2051
Sandy texture contrast soils on gentle colluvial and relic alluvial plains.					
A2	Texture contrast and generally sodic soils on relic alluvial plains	Sodosol (Chromosol)	Hazelbrae	Luxor, Broadmeadow	4243
C1	Generally non-sodic texture-contrast soils on colluvium.	Chromosol (Sodosol)	Foxleigh, Mayfair	Luxor	1998
Soils on fresh and weathered basalt					
B1	Dark crusting and cracking clays	Crusty Vertosol	Bluchers	Bruce, Glenora	353
B2	Dark cracking clays	Self-Mulching Vertosol	Battery, Indicus	May Downs, Rolleston	2407
B2(rp)	As for B1 but surface rock phase				336
Clay soils on gentle colluvial and relic alluvial plains.					
C2	Non-cracking clays and coarse textured soils.	Dermosol, (Kandosol)	Burradoo, Bul Bul	Cheshire, Petrona	1700
A3	Cracking clays in alluvium and colluvial footslopes	Vertosol (Dermosol)	Battery, Bluchers	Rolleston, Vermont	4299
Disturbed Areas					108
Total Area					**17,497**

1. Burgess, J.W. (2003), *Land Resource Assessment of the Windeyers Hill Area, Isaac-Connors and Mackenzie River Catchments, Central Queensland*, QLD Department of Natural Resources and Mines

2. Story, R., Galloway, R.W., Gunn, R.H. and Fitzpatrick, E.A. (1967), Lands of the Isaac-Comet Area, Queensland, CSIRO Publishing, Melbourne.

2.5.1 Soil Mapping Unit A1 - Recent alluvial soils

Concept
This unit lies along recent floodplains and active drainage lines of major drainage networks of the Isaac River and Grosvenor and Cherwell Creeks. Landforms are flat to very gently undulating plains with soils that are alluvial, stratified and quite variable. Typically soils are texture contrast Tenosols and Chromosols with firm to hard setting sandy loams overlying deep buried soil layers which are clay loam to sandy clay.

Vegetation mapping shows Poplar Box woodland in the north around Grosvenor Creek and the Isaac River. A thin strip of riparian Coolibah woodland occurs along drainage lines in central east. Queensland Blue Gum or River Red Gum woodland occurs along the length of the Isaac River and Cherwell and Caval Creeks, fringed with Poplar and mixed Poplar woodlands. Fringing Poplar Box areas have been extensively cleared in some areas. Land use is grazing beef cattle on native pastures.

Soil Chemistry
Total number of sites for which analytical data is available for this SMU is 11 with a total of 20 individual samples. The type of analysis conducted on each and data for representative sites is shown in following Tables. Major chemistry trends from available data indicates;

- neutral to slightly alkaline reaction trends;
- low chloride and electrical conductivity throughout;
- low CEC, typical of very sandy soil;
- non sodic;
- Ca to Mg ratio which suggest surface stability;
- some sites indicated potential for subsoil dispersion;
- very low surface organic matter, nitrogen and phosphorus; and
- levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

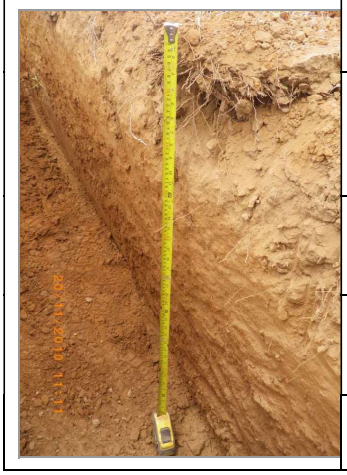
Land Suitability
The major limiting factor for a cropping use indicated from chemistry is low overall fertility, possible subsoil dispersion and low cation exchange capacity. Other aspects include physical attributes of soil texture and structure predisposing conditions of low water holding capacity and possible surface soil sealing.

Representative Sites
Two representative sites are presented (TP054 and TP060) which cover the majority of variation expected.

Representative Site TP054: Site Description

Representative site number	TP054		
Site type :	Detailed, Pit	**Main vegetation**	Tall open woodland of Poplar Box with Acacia spp, mixed grasses
Location GDA94 Zone 55	610116 mE 7564383 mN	**Disturbance**	Partially cleared
Landform element and pattern	Riparian flat on alluvial floodplain	**Micro relief**	Absent
		Permeability	Slow
Slope	<0.5	**Drainage**	Poor
Surface coarse fragments	<5% gravel. Mainly rounded quartz.	**Surface condition.**	Surface is wet, loose sandy
ASC Order (s) present in SMU	Tenosol.	**Land use**	Natural pastures. Low intensity grazing
Comparable soil type of Burgess (2003)	Bul Bul	**Substrate**	Alluvial sediments
Land Suitability Summary.	Effective soil depth : Texture contrast soils 0.6m, deep stratified loams 0.8m Rainfed Cropping: Class 5 Beef Cattle Grazing: Class 4		
Erosion Potential (Bourne and Tuck 2003)	Moderate risk of erosive flooding		
Topsoil Quality for mine rehabilitation	The topsoil depth varies from 0.2 - 0.3 m below ground level. The texture of the topsoil is coarse sandy and silty loams which are well drained and useful on higher sloping areas of rehabilitation. Water holding capacity is low and they will rapidly dry out. Recommended Topsoil Strip Depth: 0.2 m. Potential subsoil use: Not recommended as they are quite variable, may be dispersive and set very hard if placed on rehabilitation.		
Land condition	Basically stable across majority of the SMU with some erosive gullying near watercourses as well as minor areas of sheet wash and rill erosion.		

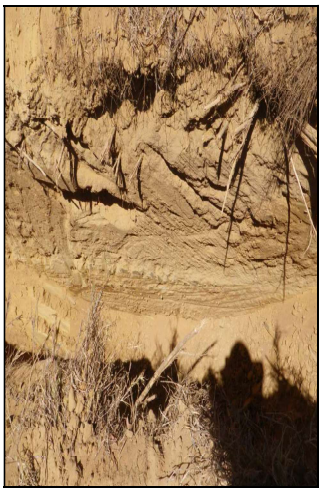
Representative Site TP054: Soil Profile

ASG : Brown Tenosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
	A11 0-0.2 clear to;	Brown 10YR4/4	Dry, pH5.5 rapid	Fine sandy loam, weak blocky, soft	roots 15%
	A12 0.20-0.30 abrupt to;	Light Brown 10YR3/6	Dry pH 6.0 rapid	Sandy Loam, massive moisture content, boundary	Roots 15%
	B21 0.30-1.10 abrupt to;	Pale Brown 10YR5/8	Moist pH 7.5 slow	Light Sandy Clay Loam, massive structure, firm	1.00-1.10m, Rounded mixed gravel <4mm. Roots to 0.50m
	D1 1.10-1.60	10YR5/6, 10% mottles 10YR6/3 and 10R4/6	Moist, pH 5 freely	Silty Clay Loam, coarse sand	nil
	D2 1.60-2.00	5%, red and orange mottles	Moist, pH 5.0	Light Medium Clay, massive structure	nil

Representative Site TP060: Site Description

Representative site number	TP060		
Site type :	Detailed, Pit	**Main vegetation**	Tall open woodland of Poplar Box with Acacia spp, mixed grasses
Location GDA94 Zone 55	610116 mE 7564383 mN	**Disturbance**	Partially cleared
Landform element and pattern	Located in or immediately adjacent to Riparian zones of major drainage lines (i.e. Cherwell Ck)	**Micro relief**	Absent
		Permeability	Very slow
Slope	< 0.5%	**Drainage**	Poor
Surface coarse fragments	<5% gravel. Mainly rounded quartz	**Surface condition.**	Surface is wet, loose sandy
ASC Order (s) present in SMU	Brown Chromosol	**Land use**	Natural pastures. Low intensity grazing
Comparable soil type of Burgess (2003)	Bul Bul	**Substrate**	Alluvial sediments

Representative Site TP060: Soil Profile

ASG : Brown chromosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
	A11 0-0.2 clear	Dark yellowish brown 10YR3/4	Dry pH 5.0 rapid	Sandy loam Massive - weak polyhedral	Thick roots observed 10%
	B21 0.2-0.5 clear	Yellow brown, 10YR5/8	Dry, pH 6.5 impeded	Light clay with minor sand content Weak angular, soft	nil
	B22 0.5-0.8 clear	Brownish yellow 10YR6/6	Moist pH 8.0 impeded	Medium clay mod polyhedral, firm	Few Mn nodules Roots to 0.50m
	B23 0.8-1.7 gradual	Light yellowish brown 10YR6/4 5% mottles 10YR7/3	Moist pH 6.0 very slow	Sandy clay blocky angular but weak	nil
	B24 1.7-2.0	Light grey 10YR6/1, 10YR7/3 mottles	Dry, pH 8.5 poor	Medium clay no structure present	nil

Laboratory Details: A1

The following laboratory data has been compiled for this SMU.

Type of Analysis*	Representative Samples (depth in m)	Other Samples (depth in m)			
Detailed	TP054 (0.2-0.3) TP060 (0.3-0.5)	TP044 (0.3-0.5)	TP058 (0-0.1)	TP011 (0.1-0.2)	TP016 (0.1-0.2)
Basic	TP054 (1.2-1.4) TP060 (0.7-0.8)	TP059 (1.2-1.3) TP009 (1.3-1.6) TP045 (0.7-0.8)	TP058 (1.8-2.0) TP011 (0.5-0.6) TP045 (0-0.2)	TP003 (0.5-0.6) TP012 (0.3-0.4) TP059 (0.4-0.5)	TP009 (0.6-0.7) TP012 (2.2-2.5) TP016 (0.6-0.7)

* Detailed: Organic matter, pH, EC, chloride, CEC, cations (Ca, Mg, Na, Al, K), metals, particle size, Emerson Aggregate Test (EAT)
Basic - pH, EC, chloride. (Some also have particle size distribution)

Laboratory Data for major soil horizons of selected profiles

Site. Depth (m)	Lab pH	Cl	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	Ex.Mn	Ex.Al
	1:5	mg/kg	µS/cm	MEQ%	%	MEQ%	MEQ %	MEQ %	MEQ %	MEQ %	MEQ%
TP054 (0-0.3)	6.5	105	125	2.5	2.4	0.06	0.17	1.6	0.5	0.07	<0.1
TP060 (0.3-0.5)	6.1	22	57	10.3	4.8	0.50	0.49	5.3	4.60	0.04	<0.1
TP060 (0.7-0.8)	7.9	125	190	-	-	-	-	-	-	-	-
TP054 (1.2-1.4)	6.4	87	90	-	-	-	-	-	-	-	-

Site, Depth (m)	Avail N	P	Al	Cu	Zn	Mn	Fe	Org Matter	Ca:Mg	Emmerson Agg. Test
	(mg/kg)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%		
TP054 (0.2-0.3)	1.5	<0.5	3250	4	3.5	140	0.72	1.2	3.2	3
TP060 (0.3-0.5)	1.5	<0.5	-	15	13	86	2.7	1.0	1.2	-

2.5.2 Soil Mapping Unit A2 - Texture contrast soils on relic alluvial plains

Concept
This unit occurs along relic alluvial plains in general proximity to drainage systems of the Isaac River and Grosvenor and Cherwell Creeks. Soils are generally Sodosols with areas of Dermosols and Chromosols. The surface is firm and sandy with minor rocks and stone which overlie quite coarse and hard subsoils which are, based on laboratory results, marginally sodic on average. Vegetation is mostly Poplar Box with Moreton Bay Ash and Bauhinia open woodlands also present. These woodlands have been extensively cleared for grazing beef cattle on native pastures.

Included in this unit are small areas of thin texture contract or non-cracking sandy clays of the C2 unit with Brigalow and Poplar Box. Generally these areas are too small to be mapped out at this scale.

Soil Chemistry
Total number of sites for which analytical data is available in for this SMU is 13 with a total of 29 individual samples (including IP laboratory data). The type of analysis conducted on each and data for representative sites is shown in following Tables.

Major chemistry trends from available data indicates:

- A neutral surface trending slightly alkaline soil reaction;
- low chloride increasing to moderate in B horizons;
- likely sodic and dispersive subsoil;
- Reasonable fertility in the surface layer but with very low cation exchange capacity, nitrogen and phosphorus. Overall, fertility could be considered low;
- Low Ca to Mg ratio suggests subsoil instability; and
- Levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

Land Suitability
The major limiting factor for a cropping use indicated from chemistry is basically the same as A1 in that overall fertility is low, the surface tends to set hard and seal and possible subsoil dispersion. The major limiting factors are physical attributes of soil texture and structure predisposing conditions of low water holding capacity. They are not considered suitable for cropping.

Representative Sites
Two representative sites are presented, TP130 and IP042. IP042 (GTES 2007) is slightly outside the actual survey area but is included here as it is considered to be a strongly representative site of the A2 unit for which laboratory data is available.

Representative Site: TP130/ IP042: Site Description

Representative site numbers	TP130 IP042		
Site type :	Detailed, Pit	**Main vegetation**	Poplar Box with native pastures
Location GDA94 Zone 55	TP130 - 616435 mE, 7564851mN IP042- 622227mE 7558353mN	**Disturbance**	Partial clearing
Landform element and pattern	Flat plain. Old alluvial plain	**Micro relief**	Nil
		Permeability	Slow
Slope	< 0.5%	**Drainage**	Poor
Surface coarse fragments	Nil	**Surface condition.**	firm sandy non-cracking
ASC Order (s) present in SMU	Sodosols with Chromosols and minor Dermosols	**Land use**	Grazing native pastures
Comparable soil type of Burgess (2003)	Hazelbrae	**Substrate**	Tertiary-Quaternary alluvium
Land Suitability Summary.	Effective soil depth : 0.6m Rainfed Cropping: Class 5 Beef Cattle Grazing: Class 4		
Erosion Potential (Bourne and Tuck 2003)	Mostly stabilised or partly stabilised, with small areas of active sheet and gully erosion		
Topsoil Quality for mine rehabilitation	The useable topsoil is confined to the A horizon which varies from 0.2 - 0.3m below ground level. The texture is medium clay loam with occasional medium clays. Opportunities exist for deeper stripping subject to more detailed observations Recommended Topsoil Strip Depth : 0.2 m Potential subsoil use : Not recommended as sets very hard and may be dispersive		
Land condition	Basically stable across majority of the SMU with minor areas of sheet wash and rill erosion		

Representative Site TP130: Soil Profile

ASG : Brown chromosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
	A11 0-0.2 abrupt to	Brown 10YR3/4	pH 5.5 well drained	Sandy clay loam, weak blocky, soft.	Nil gravel Roots common.
	B21 0.2-0.7 Clear to;	Yellowish brown 10YR4/6	pH 6.0, poorly drained	Medium clay, weak prismatic, hard	Roots to 0.60m
	B22 0.7-1.4+	10YR4/6 some yellow / grey mottles increasing below 1.40m	pH 6.5 slow drainage	Sandy light clay, weak blocky, hard	Few quartz gravels <4mm. no roots

Representative Site IP042: Soil Profile

ASG : Brown dermosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
Cleared alluvial plain. Previously Poplar Box probably with some Brigalow. Slope < 0.5%	A11 0 – 0.2 abrupt to	Brown 10YR5/4	pH 6.5 impeded	Light sandy clay, weak blocky	Nil gravel Roots common.
	B21 0.2 – 1.2	Yellowish brown 10YR4/4	pH 7.5, poorly drained	silty clay, firm polyhedral	No inclusions. roots to 0.50m

Soil Chemistry Details: A2

The following laboratory data has been compiled for this SMU.

Type of Analysis*	Representative Samples (depth in m)	Other Samples (depth in m)			
Detailed	TP008 (0-0.1) TP130 (0.4-0.6) IP 42 (0 – 0.2) IP 42 (0.4-0.5) IP 42 (0.7-0.8)	TP008 (0.25-0.35) TP016(0.1-0.2) TP115 (0.2-0.3) IP 24 (0-0.2)	TP008 (0.5-0.6) TP016(0.6-0.7) TP115(0.5-0.6) IP 24 (0.7-0.8)	TP022 (0.7-0.8) TP026 (0.3-0.4) IP 11 (0-0.2)	TP023A (0.4-0.6), TP070 (0.1-0.2) IP 11 (0.4-0.5)
Basic	TP130 (0.8-0.9) TP130 (1.5-1.6)	TP014 (0.3-0.4) TP020 (0.5-0.6)	TP014 (0.8-0.9) TP023A (1.3-1.5)	TP017 (0.4-0.5) TP070 (0.4-0.6)	TP017 (0.9-1.0) TP070 (1.4-1.5)

* Detailed: Organic matter, pH, EC, chloride, CEC, cations (Ca, Mg, Na, Al, K), metals, particle size, Emerson Aggregate Test (EAT)
Basic - pH, EC, chloride. (Some also have particle size distribution)
IP – Isaac Plain soil samples

Laboratory Data for major soil horizons of selected profiles

Site, Depth (m)	Tot N	P	Al	Cu	Zn	Mn	Fe	Org Matter	Ca:Mg	Emmerson Test
	(mg/kg)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%		
TP008 0 – 0.1	500	2.2	-	<5	9	508	10500 (mg/kg)	1.1	3.1	-
TP115 0-0.1	1350	3.4	-	21	26	1000	42800 (mg/kg)	2.4	4	-
IP 42 0 – 0.2	-	3	3.1 %	12	<1 ppm	40	51	1.7	2.5	-
TP115 0.2-0.3	3.5	3	6450	5	8	320	1.8	0.9	1.5	-
IP 42 0.4 – 0.5	-	<1	0.3%	13	<1 ppm	19	28	2.4	0.9	-
TP130 0.4 – 0.6	0.5 (nitrate)	0.5	0.016	12	16	630	25	-	1.0	1.0
TP115 0.5-0.6	1.5	0.5	0.019	12	22	540	2.5	-	0.7	4.0
IP 42 0.7– 0.8	-	<1	0.3%	11	<1 ppm	41	22	1.2	0.7	-

Site. Depth (m)	Lab pH	Cl	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	Mn	Ex.Al
	1:5	mg/kg	µS/cm	MEQ%	%	MEQ%	MEQ%	MEQ%	MEQ%	ppm	MEQ%
TP008 0 – 0.1	6.4	<10	15	3.2	<1	<0.1	0.2	2.2	0.8	5	<0.1
IP 42 0 – 0.2	5.7	65	260	10	6.2	0.6	0.5	6.1	2.5	39	0.3
TP115 0-0.1	8.4	10	47	36.2	<1	<0.1	0.5	31.4	4.4	43	<0.1
TP115 0.2-0.3	6.6	25	145	11.5	6.17	0.71	0.13	6.7	4.25	0.18	<0.1
TP130 0.4 – 0.6	7.3	41	110	13.7	8.03	-	-	-	-	-	-
IP 42 0.4 – 0.5	7.1	428	500	24	12.9	3.2	0.6	9.5	11.1	19	0.07

Site. Depth (m)	Lab pH	Cl	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	Mn	Ex.Al
	1:5	mg/kg	µS/cm	MEQ%	%	MEQ%	MEQ%	MEQ%	MEQ%	ppm	MEQ%
TP008 0.5 – 0.6	7.0	-	89	11.8	6.2	0.7	0.3	5.6	5.1		0.3
TP115 0.5-0.6	8.6	610	705	23.3	20.1	4.7	0.1	8.5	11.9	0.09	<0.1
IP 42 0.7– 0.8	8.2	602	710	30	13.2	4.0	0.6	10.5	14.8	41	0.08
TP130 0.8 – 0.9	8.3	140	255	-	-	-	-	-	-	-	-
TP130 1.5 – 1.6	8.7	510	540	-	-	-	-	-	-	-	-

Site, Depth (m)	Bicarb. P	CS	FS	SILT	CLAY
	(mg/kg)	(%)	(%)	(%)	(%)
IP 42 (0 – 0.20)	**10**	**23**	**38**	**21**	**19**

2.5.3 Soil Mapping Unit A3 – Cracking clays in alluvium and colluvial footslopes

Concept
This unit consists of black and brown Vertosol soils and occurs extensively along the central portion of the survey area on lower slopes and plains. These soils are strongly influenced by colluvial and alluvial deposition of basaltic derived soils and have greater fine sand and silt content than in situ basalt clays as a result of these processes. Accordingly, they tend to form weak sandy surface crusts and exhibit coarser soil structure. Surface rock may be present but not to levels which would preclude cultivation.

A small area of melon hole gilgai was observed to the extreme west of the project site immediately north of the Peak Downs Highway but generally, surface microrelief is restricted to scattered and shallow linear gilgai.

Substrate north of the Peak Downs highway tends to be either weathered basalt of alluvial sediments while south of the highway most areas lie above sandstone.

The A3 unit has been extensively cleared for pasture production and was originally Brigalow with areas of Mountain Coolibah and Bloodwood.

Soil Chemistry
A large amount of laboratory data was compiled for this soil unit as the area is programmed for construction of earthen mine infrastructure which includes reject placements and environmental dams. Total number of sites for which analytical data is available in for this SMU is 34 with a total of 89 individual samples (including IP laboratory data). The data was gathered to assist in engineering designs and comprehensively assess soil horizons for rehabilitation potential, in particular capping of such structures.

The type of analysis conducted on each and data for representative sites is shown in following Tables. Overall chemistry trends from this data indicates;

- Approximately 20% of sites tested indicated saline conditions to levels which will affect plant rooting depth by 0.7m depth . A larger number of sites had high chloride below 1.0m depth. Salinity may be an issue in topsoil stripping of deeper soil layers for re-use for rehabilitation;
- pH ranged from neutral to strongly alkaline at depth however they did not exceed 8.7 on any sites tested;
- Exchangeable sodium percentage indicating possible dispersive characteristics below about 0.7m depth was also observed in about 20% of sites tested;
- Less than 10% of sites had elevated levels of both chloride and ESP;
- Overall fertility is quite good however in some situations potassium, nitrogen and phosphorus were just below minimum crop requirements. Metals are not limiting for plant growth; and
- Levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

Land Suitability
Soils are suited to cropping as they consist mainly of deep well-structured cracking clays which are non-saline or sodic with high soil water storage potential. Isolated small areas of lesser quality soils with sodic and / or saline tendencies may occur but comprise about 20% or less of the overall unit. These areas occur intermittently throughout the SMU and cannot

be mapped out at this scale of sampling. Cropping suitability class is slightly downgraded in comparison to the basalt clays (B1 and B2) soils for this reason.

Representative Sites

One representative site is presented (TP116).

Representative Site TP116: Site Description

Representative site numbers	**TP116**		
Site type :	Detailed, Pit	**Main vegetation**	Mostly dense tussock grass which includes blue grass and Buffel. Some regrowth of Sally Wattle and Whitewood.
Location GDA94 Zone 55	611605mN 7560367mE	**Disturbance**	Cleared
Landform pattern	Very gently undulating plains of alluvial and colluvial deposition	**Micro relief**	nil
		Permeability	Medium
Slope	1 – 2%	**Drainage**	Quite well drained
Surface coarse fragments	Coarse small (<5mm) mixed gravels. <1% of surface	**Surface condition.**	Cracking and self mulching
ASC Order (s) present in SMU	Black Vertosol	**Land use**	Grazing native pastures
Comparable soil type of Burgess (2003)	Battery	**Substrate**	Variable with alluvium
Land Suitability Summary.	Rainfed Cropping: Class 3 Beef Cattle Grazing: Class 2		
Erosion Potential (Bourne and Tuck 2003)	Low erosion potential with adequate surface cover Contour banks have been constructed in some areas		
Topsoil Quality for mine rehabilitation	The better quality topsoil of these soils is varies from 0.3 - 0.4 m below ground level. The texture is medium clay and opportunities exist for deeper stripping Effective soil depth : 0.8 – 1.0m Recommended average topsoil strip depth : 0.3 m Potential subsoil use : Strip to 1.0m. It would be suitable for capping of such mine disturbance as rejects or tailings emplacements		
Land condition	Basically stable across majority of the SMU. Low erosion potential however local areas of concentrated run-off has initiated gullying		

Representative Site TP116: Soil profile

ASG : Black vertosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
	A1 0 – 0.2 abrupt to;	Dark brown 10YR2/1	dry, pH 5.5	Light clay Strong granular mulch,	few (<1%) small rounded mixed gravels
	B21 0.2– 0.75 clear to;	Dark brown 10YR3/1	Moist pH 7.5 well drained	Light medium clay, strong subangular blocky, firm.	Roots common to 0.75m. No inclusions.
	B22 0.75 – 1.2 Gradual to;	Dark brown 10YR3/1	Moist, pH 8.0, well drained	Light clay, very firm strong sub-angular blocky,	5% fine sandstone gravels.
	B23 1.2 – 1.6 Abrupt to;	Brown 10YR3/3	Dry, pH 7.5, impeded	Light clay, moderate lenticular, firm.	Few small sandstone gravels.

ASG : Black vertosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
			drainage		
	C	Very Pale	Dry pH 8.0	weathered material – probably sandstone fine grained and soft	nil

Laboratory Details : A3

The following laboratory data has been compiled for this SMU.

Type of Analysis*	Representative Samples (depth in m)	Other Samples (depth in m)			
Detailed	TP116 (0-0.2) TP116 (0.4-0.6)	TP030 (0.5-0.7) TP073 (0.6-0.7) TP085 (0.2-0.3) TP092 (0.5-0.6) TP102 (0-0.1) TP106 (0.2-0.3) TP108 (0.4-0.6) TP112 (0-0.1) TP118 (0.3-0.5) TP125 (0.5-0.6)	TP048 (0-0.1) TP080 (0.1-0.2) TP085 (0.4-0.5) TP094 (0-0.1) TP103 (0-0.1) TP107 (0-0.1) TP109 (0.3-0.5) TP121 (0.2-0.4) TP127 (0-0.2) IP 57_70-80	TP062 (0.1-0.2) TP084 (0.6-0.8) TP091 (0-0.2) TP094 (0.4-0.5) TP103 (0.5-0.6) TP107 (0.5-0.6) TP109 (0.8-0.9) TP123 (0.2-0.3) IP 57_0-20	TP073 (0.1-0.2) TP085 (0-0.1) TP091 (0.4-0.5) TP104 (0.1-0.2) TP108 (0.2-0.3) TP111 (0.1-0.4) TP117 (0.1-0.3) TP125 (0.4-0.5) IP 57_30-40
Basic	TP116 (0.8-1.0)	TP010 (0.2-0.3) TP030 (0-0.3) TP039 (0.5-0.6) TP062 (1.1-1.2) TP091 (0.6-0.7) TP102 (0.5-0.6) TP106 (0.6-0.8) TP109 (0.1-0.2) TP112 (1.4-1.5) TP118 (1.3-1.5) TP121 (1.1-1.3) TP127 (1.0-1.2)	TP019 (0.2-0.3) TP034 (0.6-0.7) TP046 (0.2-0.3) TP080 (0.5-0.6) TP092 (1.4-1.5) TP102 (0.8-0.9) TP106 1.5-1.6) TP111 (0.6-0.8) TP117 (0.3-0.4) TP118 (1.8-2.0) TP123 (0.7-0.8) TP127 (1.8-2.0)	TP019 (1.8-1.9) TP034 (1.5-1.6) TP046 (0-0.1) TP084 (0.9-1.0) TP090A (0.6-0.7) TP094 (0.8-1.0) TP103 (1.0-1.1) TP107 (1.2-1.4) TP112 (0.5-0.6) TP118 (0.0-0.3) TP121 (0.4-0.6) TP125 (0.8-0.9)	TP028 (0.4-0.5) TP039 (0.2-0.3) TP048 (0.9-1.0) TP085 (0.7-0.8) TP090A (1.0-1.1) TP094 (1.0-1.2) TP104 (0.8-0.9) TP108 (0.6-0.8) TP112 (1.0-1.2) TP118 (0.9-1.1) TP121 (1.0-1.2) TP125 (1.2-1.3)

* Detailed: Organic matter, pH, EC, chloride, CEC, cations (Ca, Mg, Na, Al, K), metals, particle size, Emerson Aggregate Test (EAT)
Basic - pH, EC, chloride. (Some also have particle size distribution)
IP – Isaac Plain soil samples

Laboratory Data for major horizons of selected profiles

Depth (m) Site.	Lab pH	Cl	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	Ex.Mn	Ex.Al
	1:5	mg/kg	µS/cm	MEQ%	%	MEQ%	MEQ%	MEQ%	MEQ%	MEQ%	MEQ%
TP085 (0-0.1)	8.5	37	325	22.5	3.20	0.72	0.28	18.9	4.00	0.13	<0.1
TP116 (0-0.2)	5.5	7.0	23	120	21.5	3.21	0.69	0.11	11.3	11.2	0.12
TP108 (0.2-0.3)	7.5	130	350	25	2.32	0.58	0.24	14.5	11.0	0.12	<0.1
TP109 (0.3-0.5)	7.8	28	390	24.4	1.84	0.45	0.08	14.4	11.7	0.15	<0.1
TP116 (0.4-0.6)	7.5	7.4	92	135	22.6	12.61	2.85	0.09	9.7	11.5	0.12
TP108 (0.4-0.6)	7.6	400	610	25.4	2.44	0.62	0.17	14.1	11.2	0.17	<0.1
TP109 (0.8-0.9)	7.9	24	285	24.6	4.67	1.15	0.07	13.6	11.4	0.12	<0.1
TP116 (0.8-1.0)	7	7.4	710	830	-	-	-	-	-	-	-

Depth (m) Site,	Avail N	P	Al	Cu	Zn	Mn	Fe	Org Matter	Ca:Mg
	(mg/kg)	mg/kg	%	mg/kg	mg/kg	mg/kg	%	%	
TP085 (0-0.1)	<0.5	<0.5	2.7%	21	29	1040	2.9	1.9	4.7
TP116 (0-0.2)	6.0	<0.5	2.5%	13	23	780	3.0	-	-
TP108 (0-0.3)	0.5	<0.5	4.0%	21	44	790	3.9	-	1.3
TP085 (0.2-0.3)	<0.5	<0.5	2.2%	11	20	800	2.4	1.9	6.4
TP085 (0.4-0.5)	1.0	<0.5	2.6%	22	29	910	2.9	1.5	3.9
TP116 (0.4-0.6)	7.0	<0.5	2.7%	13	24	720	3.1	-	-
TP108 (0.4-0.6)	1.0	0.5	4.1%	20	44	740	3.8	-	1.5

Typical particle size distribution

Site, Depth (m)	Sand >50µm	Sand >20µm	Silt <50µm	Silt < 20µm	Clay <2µm
TP102 (0-0.1)	13.5%	23.6%	19.2%	9.1%	67.3%
TP107 (0.5-0.6)	16.9%	19.3%	13.0%	10.7%	70.1%

2.5.4 Soil Mapping Unit B1 – Dark crusting and cracking clays on basalt

Concept
This unit is not extensive and occupies intergrade areas between A3 and B2 soil types. Soils are Vertosols which lie along lower landform areas and have formed from colluvial influences of basaltic derived soils. They have a more pronounced fine sand and silty texture than the B2 soils which leads to a weak sandy surface crust. Subsoil structure is somewhat coarse but not a significant limitation as they are well drained. Areas of significant surface rock occur sporadically across the unit but generally not to levels which would impede cultivation.

The B1 unit has been extensively cleared for pasture production and was originally Mountain Coolibah and Bloodwood downs country

Soil Chemistry
Total number of sites for which analytical data is available in for this SMU is 4 with a total of 9 individual samples. Elevated salinity and moderately sodic conditions were recorded in some sites however the majority of sites have an effective soil depth of at least 0.9m depth. The type of analysis conducted on each and data for representative sites is shown in following Tables. Main chemistry trends from this data indicates that;

- Overall fertility is sound;
- Salinity, pH or general fertility are not significant limiting factors to a cropping use;
- moderate sodic conditions may occur below 0.8m; and
- Levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

Land Suitability
Soils are suited to cropping as they exhibit good soil depth and water storage potential.

Representative Sites
One representative site is presented (TP088).

Representative Sites TP088: Site Description

Representative site numbers	**TP088**		
Site type :	Detailed, Pit	**Main vegetation**	Cleared for pastures. (80-90% cover. Odd Mountain Coolibah
Location GDA94 Zone 55	615621mN 7557390mE	**Disturbance**	Cleared
Landform pattern	Flat to very gently undulating plains	**Micro relief**	Minor normal gilgai in lower areas
		Permeability	Medium
Slope	0.5 – 2%	**Drainage**	Quite well drained
Surface coarse fragments	Localised areas of basalt cobble 60-200mm diameter up to 20% of the surface. (generally < 5%)	**Surface condition.**	Cracking with weak silty crust

ASC Order (s) present in SMU	Crusty black Vertosol	**Land use**	Grazing improved pastures
Comparable soil type of Burgess (2003)	Bluchers	**Substrate**	Basalt
Land Suitability Summary.	The effective rooting depth of this soil is approximately 0.9 m below ground level and water storage potential is estimated at >100mm Rainfed Cropping: Class 3 Beef Cattle Grazing: Class 2		
Erosion Potential (Bourne and Tuck 2003)	Low erosion potential with good land management to prevent bare surface for extended periods		
Topsoil Quality for mine rehabilitation	The better quality topsoil of these soils is 0.3 - 0.5 m below ground level. The texture is medium clay and opportunities exist for deeper stripping Effective soil depth : 0.8 – 1.0m Recommended average topsoil strip depth : 0.4 m Potential subsoil use : Subsoils to 1.0m offer additional rehabilitation potential. Possibility of elevated salinity but not considered extensive. It would be suitable for use either on spoil rehabilitation or capping of such mine disturbance as rejects or tailings emplacements.		
Land condition	Basically stable across majority of the SMU. Low erosion potential however local areas of concentrated run-off has initiated gullying		

Representative Site TP088: Soil Profile

ASG : Crusty black vertosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
	A1 0 – 0.03 abrupt;	Dark brown 10YR3/2	Dry , pH 7.0	Fine sandy clay weak granular	Minor small gravels
	B21 0.03-0.3 gradual to;	Black 10YR2/1	Moist, pH8.0 well drained	Medium clay, strong blocky, hard	Roots common, trace soft lime,
	B22 0.3-0.75 gradual to;	Black 10YR2/1	pH 7.0, very slowly drained, moist	light medium clay (sandy), firm polyhedral	Roots common
	B23 0.75- 0.9 Clear to;	Black 10YR2/1	pH 7.5 well drained	Medium clay (coarse sandy), moderate lenticular, firm	Few roots past 0.7m
	C 0.9+	-	-	-	Weathered bedrock

Laboratory Details: B1

The following laboratory data has been compiled for this SMU.

Type of Analysis*	Representative Samples (depth in m)	Other Samples (depth in m)			
Detailed	TP088 (0-0.2) TP088 (0.4-0.5)	TP089 (0.3-0.5)			
Basic	TP088 (0.7-0.8)	TP006 (0.5-0.6) TP089 (1.2-1.3)	TP013 (0.3-0.4)	TP013 (0.9-1.0)	TP089 (0.9-1.0)

* Detailed: Organic matter, pH, EC, chloride, CEC, cations (Ca, Mg, Na, Al, K), metals, particle size, Emerson Aggregate Test (EAT)
Basic - pH, EC, chloride. (Some also have particle size distribution)

Laboratory Data for major soil horizons of selected profiles

Site. Depth (m)	Lab pH	Cl	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	Ex.Mn	Ex.Al
	1:5	mg/kg	µS/cm	MEQ%	%	MEQ%	MEQ%	MEQ%	MEQ%	MEQ%	MEQ%
TP088 (0-0.2)	8	27	310	22.7	2.29	0.52	0.36	19.2	4.1	0.14	<0.1
TP088 (0.4-0.5)	7	31	295	23.3	8.37	1.95	0.24	18.6	3.75	0.12	<0.1
TP088 (0.7-0.8)	7.5	-	-	-	-	-	-	-	-	-	-

Site, Depth (m)	Avail N	P	Al	Cu	Zn	Mn	Fe	Org Matter	Ca:Mg	Emmerson Test
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%		
TP088 (0-0.2)	<0.5	1.5	0.017	10	16	1000	1.4	2.4	4	-
TP088 (0.4-0.5)	<0.5	2.0	1.8%	9.5	17	870	1.4	-	4	2

Site, Depth (m)	Sand >50µm	Sand >20µm	Silt <50µm	Silt < 20µm	Clay <2µm
TP088 (0.7-0.8)	12%	14%	17%	11%	46%

2.5.5 Soil Mapping Unit B2 – Dark cracking clays on basalt

Concept
This unit is quite extensive and occupies undulating plains throughout the central portion of the survey area which, prior to clearing, carried Mountain Coolibah and Bloodwood on open downs country. Soils are well structured, deep black Vertosols which have formed on basalt rock. They are quite consistent in attributes and are well suited to a cropping use. The most severe limitation for cropping is a moderate erosion risk from long sloping terrain with gradients up to 3% (mostly 1.5 – 2.5%). Contour banks had been constructed in some areas for this reason. Localised areas of significant surface rock were identified in some areas but it is not widespread.

Soil Chemistry
Total number of sites for which analytical data is available for this SMU (which includes B2rp sub unit) is 30 with a total of 71 individual samples. The type of analysis conducted on each and data for representative sites is shown in following Tables. Main chemistry trends from this data indicates that;

- Saline and sodic subsoils were found in approximately 15% of sites tested. In each case it was below 0.6m depth;
- Overall fertility is quite good;
- Soil pH is not limiting to 1.0m depth and was generally in a range from slightly to moderately alkaline;
- Most sites had an effective soil depth which exceeded 1.4m depth;
- Estimated water storage potential exceeds 120mm in most cases; and
- Levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

Land Suitability
Soils are well suited to cropping and grazing of improved and native pastures as they exhibit good soil depth, structure and water storage potential.

Representative Sites
Only one representative site (TP101) description is presented for this soil unit as soil morphology and chemistry was very consistent across most sites described and sampled.

Representative Site TP101: Site Description

Representative site numbers	**TP101**		
Site type :	Detailed, Pit	**Main vegetation**	Cleared for pastures. (80-90% cover. Odd Mountain Coolibah
Location GDA94 Zone 55	615021mN 7558956mE	**Disturbance**	Cleared
Landform pattern	Gently undulating plains	**Micro relief**	Minor linear gilgai
		Permeability	Slow
Slope range	1.5 – 3%	**Drainage**	Well drained
Surface coarse	Localised areas of	**Surface**	Cracking and self-mulching

fragments	basalt cobble 60-300mm diameter up to 20% of the surface	**condition.**	
ASC Order (s) present in SMU	Black Vertosol	**Land use**	Forage cropping. Leucaena and improved pastures
Comparable soil type of Burgess (2003)	Battery Indicus	**Substrate**	Basalt
Land Suitability Summary.	The effective rooting depth of this soil exceeds 1.0 m and water storage potential is estimated at >120mm. No major limitations exist apart from moderate erosion risk for cultivation on slopes >2%. Rainfed Cropping: Class 2 Beef Cattle Grazing: Class 1		
Erosion Potential (Bourne and Tuck 2003)	Low erosion potential with good land management to prevent bare surface for extended periods		
Topsoil Quality for mine rehabilitation	The better quality topsoil of these soils is 0 - 0.5 m depth however it remains good quality basically until weathered bedrock is encountered. The texture is medium heavy clay and significant opportunities exist for deeper stripping. Effective soil depth : 1.0 – 1.4m Recommended average topsoil strip depth : 0.5 m Potential subsoil use: Subsoils to substrate offer additional rehabilitation potential to a depth of 1.4m. It would be suitable for use either on spoil rehabilitation or capping of such mine disturbance as rejects or tailings emplacements		
Land condition	Stable across majority of the SMU. Low erosion potential however local areas of concentrated run-off has initiated gullying. Areas of previous cropping use have not degraded from erosion		

Representative Site TP101: Soil profile

ASG : Black vertosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
	A1 0 – 0.02 abrupt;	Dark brown 10YR3/2	Dry , pH 8.0	Light clay strong granular, firm	Minor small gravels
	B21 0.02- 0.3 gradual to;	Black 10YR2/1	Moist, pH8.0 well drained	Medium clay, strong lenticular, smooth, firm	Roots common
	B22 0.3-0.7 gradual to;	Black 10YR3/2	Moist pH 8.5, very slowly drained	Medium heavy clay , firm polyhedral	Roots common. Minor soft lime
	B23 0.7-1.5 Clear to;	Black 10YR3/1	Dry pH 9.0 well drained.	Medium clay, moderate lenticular, very firm	5% basalt gravel 5-10% soft carbonate
	C 1.50+	-	-	-	Weathered basalt

Laboratory Details: B2 (includes B2rp)

The following laboratory data has been compiled for this SMU.

Type of Analysis*	Representative Samples (depth in m)	Other Samples (depth in m)			
Detailed	TP101 (0-0.1) TP101 (0.8-0.9)	TP038 (0.4-0.6) TP071 (0.1-0.2) TP082 (0.7-0.8) TP093 (0.3-0.4) TP097 (0.5-0.6) TP099 (0.5-0.6) TP114 (0-0.2) TP119 (1.2-1.4) TP105 (0.4-0.5)	TP040 (0.4-0.5) TP074 (0.1-0.2) TP086 (0.2-0.3) TP095 (0.3-0.4) TP098 (0.0-0.2) TP100 (0.0-0.1) TP110 (0.1-0.3) TP114 (1.2-1.4) TP101-(0.8-0.9)	TP053 (0.3-0.4) TP075 (0.2-0.3) TP087 (0-0.2) TP096 (0-0.1) TP098 (1.0-1.2) TP100 (0.5-0.6) TP113 (0.1-0.2) TP119 (0-0.2) S143 (0.5-.0.60)	TP066 (0.1-0.2) TP079 (0.1-0.3) TP093 (0-0.1) TP096 (0.5-0.6) TP099 (0-0.1) TP113 (0.6-0.8) TP119 (0.3-0.5) TP122 (0.3-0.5) TP099 (0.6-0.7)
Basic	TP101 (1.4-1.5)	TP024 (0.6-0.8) TP053 (0-0.2) TP066 (0.5-0.6) TP071 (1.2-1.3) TP077A (0.4-0.6) TP087 (0.4-0.5) TP110 (1.0-1.2) TP119 (1.2-1.4)	TP024 (0-0.2) TP053 (0.7-0.8) TP068 (0.1-0.2) TP074 (0.6-0.7) TP079 (0.5-0.6) TP087 (0.9-1.0) TP110 (1.4-1.5) TP122 (0.6-0.8)	TP038 (0.8-1.0) TP057 (0-0.2) TP068 (0.5-0.6) TP075 (0.7-0.8) TP082 (1.0-1.1) TP099 (1.0-1.1) TP113 (0.4-0.5) TP122 (1.0-1.2)	TP040 (1.4-1.5) TP057 (0.4-0.5) TP071 (0.5-0.6) TP077A (0.2-0.4) TP082 (1.9-2.0) TP047/0.6-0.8 TP114 (0.6-0.8) TP047/0.2-0.4

* Detailed: Organic matter, pH, EC, chloride, CEC, cations (Ca, Mg, Na, Al, K), metals, particle size, Emerson Aggregate Test (EAT)

Basic - pH, EC, chloride. (Some also have particle size distribution)

Laboratory Data for major soil horizons of selected profiles

Site. Depth (m)	Lab pH	Cl	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	Ex.Mn	Ex.Al
	1:5	mg/kg	µS/cm	MEQ%	%	MEQ%	MEQ%	MEQ%	MEQ%	MEQ%	MEQ%
TP101 (0-0.1)	7.7	34	360	23.2	4.31	1.00	0.10	14.7	9.0	0.13	<0.1
TP101 (0.8-0.9)	8.4	160	670	21.5	40.00	8.6	0.06	6.1	8.5	0.12	<0.1
TP101 (1.4-1.5)	8.6	1450	1630	-	-	-	-	-	-	-	-
TP101 (0-0.1)	7.7	34	360	23.2	4.31	-	-	-	-	-	-
TP099 (0-0.1)	7.8	19	345	23.5	2.38	0.56	0.24	15.8	7.8	0.16	<0.1
TP099 (0.5-0.6)	8.0	44	385	23.2	14.66	3.40	0.10	12.8	8.2	0.14	<0.1
TP099 (60-70)	8.3	-	62	73	1.7	1.3	0.2	44.8	26.7	-	-
TP114 (80-90)	8.5		94	67	1.8	1.2	0.1	33.5	32.1	-	<0.1

Site, Depth (m)	Avail N	P	Al	Cu	Zn	Mn	Fe	Org Matter	Ca:Mg	Emmerson Test
	(mg/kg)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	-	-
TP101 (0-0.1)	0.5	<0.5	3.8%	19	41	690	3.4	1.5	1.7	-
TP101 (0.8-0.9)	<0.5	<0.5	4.2%	21	42	730	3.9	-	0.7	-
TP099 (0-0.1)	2.0	<0.5	3.6%	16	32	880	3.5	1.7	2.0	-
TP099 (0.5-0.6)	1.0	<0.5	3.0%	16	30	900	3.0	-	1.6	4

Site, Depth (m)	Sand >50µm	Sand >20µm	Silt <50µm	Silt < 20µm	Clay <2µm
TP101 (0.8-0.9)	30.9%	35.2%	12.2%	7.9%	56.9%
TP122 (0.3-0.5)	17.0%	23.0%	19.0%	13.0%	64.0%
TP079 (0.1 -0.3)	29.0%	29.0%	8.0%	8.0%	63.0%

2.5.6 Soil Mapping Unit B2(rp) – rock phase

Concept
This SMU is a phase (Gunn *et al.,* 1988) of B2 as a result of surface rock which can be mapped out at this sampling scale. The unit includes surface basalt rock in a size range of 60 – 350mm diameter however they generally occur as quite small discrete areas (<5% of the total area) where rock which is greater than 60mm diameter may occupy 15% of the surface area.

From a land suitability assessment viewpoint, the rock cover is not sufficient to be considered to be a significant cropping limitation. Soil morphological attributes which include colour, texture and structure were essentially the same as the broader B2 SMU.

As this SMU is simply a rocky phase of B2, soil chemistry trends described for B2 apply. Nevertheless, chemistry attributes of the major B horizon were checked at site S143 which indicated good consistency with the overall B2 SMU. The subsoil 0.6m layer indicated a desirable pH level, non-saline or sodic conditions with high cation exchange capacity and calcium magnesium ratios.

This site was a location for the Strategic Crop Land rockiness investigation and % surface rock which exceeded 60mm diameter varied from 1.5 – 13.6% across 5 quadrates (average approx. 5%).

Laboratory Data for major soil horizon of site S143

Site. Depth (m)	Lab pH	Mg/K Ratio	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	Ca/Mg Ratio	Ex.Al
	1:5	-	µS/cm	MEQ%	%	MEQ%	MEQ%	MEQ%	MEQ%	-	MEQ%
S143 (0.5-0.6)	7.7	141	78	61.2	0.4	0.2	0.2	39.1	21.7	-1.8	<0.1

Additional laboratory data specifically relating to the B2(rp) soil type is presented in **Appendix 2**.

Plate P1: Site S143. RI-04, Counting Position 5

The above photo depicts Rock quadrat RI-04 (counting position 5) at Site S143 for which 15 rocks >60mm diameter were recorded with a total surface cover of 13.6%.The average surface percentage in the B2(rp) SMU as a whole was about 5% with most sites recording

less than the precent cover in this photograph. This level of surface rock is not considered a significant limitation to cultivation for crops.

2.5.7 Soil Mapping Unit C1 - Generally non-sodic texture contrast soils on colluvium

Concept
This unit occurs along undulating plains of sandy colluvial material and higher positions of relic alluvial plains. Small areas of the C2 non-cracking clay occur sporadically within this unit however such areas are generally too small to map out at this scale.

C1 is differentiated from A2 mainly on the basis of occupying higher landform position in general proximity to drainage systems of the Isaac River and Grosvenor and Cherwell Creeks. C1 exhibits a higher dominance of non-sodic Chromosol soils in association with Sodosols and minor Dermosols. The surface is firm coarse sandy which overlie quite coarse and hard subsoils.

Vegetation has been extensively removed but was mainly Poplar Box, Bauhinia, Cassia, Acacias and Sandalwood with pockets of Brigalow. Land use is grazing beef cattle on native pastures.

Soil Chemistry
Total number of sites for which analytical data is available in for this SMU is 7 with a total of 14 individual samples (including IP laboratory data). High salinity below 0.5m depth was found in some sites however none were sodic in tests conducted. The type of analysis conducted on each and data for representative sites is shown in following Tables.

Main chemistry trends from this data indicate;

- Very saline subsoils were found in half the sites tested with chloride levels > 1000mg/kg in each;
- None of the sites indicated sodic conditions;
- Overall fertility is low;
- Soil pH is not limiting to 1.0m depth and was in a range from 6.3 to 8.6;
- From salinity and subsoil structural attributes, effective soil depth would rarely exceed 0.6m depth;
- Water storage potential would rarely exceed 60mm; and
- Levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

Land Suitability
The major limiting factor for a cropping use indicated from chemistry is low overall fertility, possible subsoil dispersion and low cation exchange capacity. Other aspects include physical attributes of soil texture and structure predisposing conditions of low water holding capacity and possible surface soil sealing.

Representative Sites
One representative site is presented (TP056).

Representative Site TP056: Site Description

Representative site number	**TP056**		
Site type :	Detailed, Pit	**Main vegetation**	Occasional Poplar Box and Narrow Leaf Ironbark. Regrowth of Whitewood, Sally Wattle. Sparse native pastures. (<50% cover)
Location GDA94 Zone 55	6124666mN 7563706mE	**Disturbance**	Cleared / thinned
Landform pattern	Flat to gently undulating plains	**Micro relief**	Nil
		Permeability	Slow
Slope range	1 %	**Drainage**	Well drained surface but restricted in subsoil
Surface coarse fragments	Minor mixed gravels <5mm diameter	**Surface condition.**	Firm sandy non cracking
ASC Order (s) present in SMU	Chromosol	**Land use**	Grazing
Comparable soil type of Burgess (2003)	Foxleigh	**Substrate**	Unknown
Land Suitability Summary.	The effective rooting depth of this soil is 0.5 – 0.6m and water storage potential is low at < 60mm. Although water storage is a major limitation, the deeper sandy A horizon facilitates rapid pasture response to short but high intensity storm events as moisture is not tied up in a dry heavy clay matrix such occurs with heavy clay vertosols. For this reason it presents options for grazing use Rainfed Cropping: Class 5 Beef Cattle Grazing: Class 3		
Erosion Potential (Bourne and Tuck 2003)	Moderate erosion potential requiring good land management to prevent bare surface for extended periods		
Topsoil Quality for mine rehabilitation	The better quality topsoil of these soils is 0 - 0.3 m depth Effective soil depth : 0.6m Recommended average topsoil strip depth : 0.2 m Potential subsoil use : Subsoils are not recommended for re-use in spoil rehabilitation due to tendency to seal and set hard. However the apparent non-sodic conditions may offer potential for use in capping rejects of tailings emplacements or construction of dam walls. Further testing would be necessary to confirm this potential		
Land condition	Generally stable and not degraded		

Representative Site TP056: Soil Profile

ASG : Brown chromosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
	A11 0-0.1 clear to;	Light brown 7.5YR4/3	dry pH 5.0 freely drained	Fine Sandy Loam, weak polyhedral peds, soft.	roots common. No segregations
	A12 0.1-0.3 Abrupt to;	Brown 7.5YR3/2	dry pH 5.5 well drained	Sandy Clay Loam, moderate polyhedral peds, firm	No coarse fragments or segregations. Roots common
	B21 0.3-0.6 Gradual to;	10YR6/6, 5% dark grey mottles	Dry pH 8.0 slowly drained	Light Medium Clay, coarse firm blocky	5% small (<4mm) ironstone nodules and angular gravel. Few roots below 0.6m
	B22 0.6-1.0 Diffuse to;	10YR6/6, 5-10% dark mottles	Dry pH9.0, poorly drained	Sandy Clay, strong columnar, hard	fine gravels 10%
	B23 1.1-1.9	Pale yellow and black mottles,	Dry pH9.0	Sandy clay , angular polyhedral peds , firm	No inclusions or roots

Laboratory Details:

The following laboratory data has been compiled for this SMU.

Type of Analysis*	Representative Samples (depth in m)	Other Samples (depth in m)			
Detailed	TP056 (0.2-0.3)	TP031 (0.2-0.3) IP 59_30-40	TP041 (0.4-0.6) IP 59_70-80	TP050 (1.4-1.5)	IP 59_0-20
Basic	TP056 (0.8-1.0)	TP031 (0.5-0.6) TP052 (0.4-0.5)	TP041 (0.8-1.0) TP052 (1.6-1.7)	TP042 (0.6-0.8)	TP050 (0-0.2)

* Detailed: Organic matter, pH, EC, chloride, CEC, cations (Ca, Mg, Na, Al, K), metals, particle size, Emerson Aggregate Test (EAT)
Basic - pH, EC, chloride. (Some also have particle size distribution)
IP – Isaac Plain soil samples

Laboratory Data for major soil horizons of selected profiles

Site. Depth (m)	Lab pH	Cl	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	.Mn	Ex.Al
	1:5	mg/kg	µS/cm	MEQ%	%	MEQ%	MEQ%	MEQ%	MEQ%	mg/kg	MEQ%
TP056 (0.2-0.3)	6.4	45	61	2.8	1.7	0.03	0.23	2.20	0.49	120	<0.1
TP056 (0.8-1.0)	9	8.3	190	260	<0.5	<0.5	3820	6.0	6.5	390	0.86
TP031 (0.5-0.6)	8.0	1400	1560	-	-	-	-	-	-	-	-

Site, Depth (m)	Avail N	Tot N	P	Al	Cu	Zn	Mn	Fe	Org Matter	Ca:Mg	Emmerson Test
	(mg/kg)	Mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%		
TP056 (0.2-0.3)	0.03	-	0.23	2.20	0.49	0.12	<0.1	0.03 (%)	0.75	-	3

Site, Depth (m)	Sand >50µm	Sand >20µm	Silt <50µm	Silt < 20µm	Clay <2µm
TP026 (0.2-0.3)	85.0%	87.0%	3.0%	1.0%	12.0%
TP031 (0.2-0.3)	45.0%	56.0%	29.0%	18.0%	26.0%

2.5.8 Soil Mapping Unit C2 – Non-cracking clays and coarse textured soils

Concept
This unit consists of sandy brown Dermosols and Kandosols and minor areas of thin texture contrast soils which occur along gently undulating plains and low ridgelines over Tertiary sediments. Vegetation is mixed Brigalow and Blackbutt with associated Poplar Box, Bauhinia and Sandalwood. The soil surface is sandy and may be hard setting with a strew of mixed lateritic gravels <5mm in diameter.

Soil Chemistry

Total number of sites for which analytical data is available is 9 with a total of 21 individual samples (including IP laboratory data). Elevated salinity and sodium below 0.7m depth was found in just one site although others were saline below 1.2 m depth. The type of analysis conducted on each and data for representative sites is shown in following Tables. Main chemistry trends from this data indicate that;

- Salinity, pH or sodium are not significant limitations to plant growth;
- general fertility is low to moderate; and
- Levels of metals do not indicate issues from elevated quantities of heavy metals or phytotoxicity issues.

Land Suitability
Soils are not suited to cropping and have been utilised for grazing. The major limiting factor for a cropping use indicated from chemistry is reduced water storage potential as a result of quite hard and coarse structured subsoils.

Representative Sites
One representative site is presented (TP049).

Representative Site TP049: Site Description

Representative site number	**TP049**		
Site type :	Detailed, Pit	**Main vegetation**	Cleared for pastures with only moderate cover (50-60%). Regrowth of Brigalow, Whitewood, Leichardt Bean
Location GDA94 Zone 55	609071mN 7562038mE	**Disturbance**	Cleared with regrowth approx. 10 years old
Landform pattern	Gently undulating plains and low rises	**Micro relief**	Minor normal gilgai in lower areas
		Permeability	Very slow
Slope	1 – 3%	**Drainage**	Quite well drained
Surface coarse fragments	5% mixed laterite gravels.	**Surface condition.**	Non-cracking, very firm sandy
ASC Order (s) present in SMU	Brown Dermosol and Kandosol	**Land use**	Grazing native pastures
Comparable soil type of Burgess (2003)	Burradoo, Bul Bul	**Substrate**	Tertiary sediments
Land Suitability Summary.	The effective rooting depth of this soil is approximately 0.7 m below ground level and water storage potential is estimated at 65-80mm.		

	Rainfed Cropping: Class 5. Beef Cattle Grazing: Class 3
Erosion Potential (Bourne and Tuck 2003)	Moderate erosion potential with good land management required to prevent bare surface for extended periods
Topsoil Quality for mine rehabilitation	The better quality topsoil of these soils is 0.3 m below ground level Recommended average topsoil strip depth : 0.2 m Potential subsoil use: Subsoils offer little rehabilitation potential. They set very hard and would shed water and erode if placed on sloping rehabilitation. There may be some potential for use as a capping layer but further testing would be required to confirm
Land condition	Evidence of some removal of the surface layer from sheet erosion Not significantly degraded

Representative Site TP049: Soil Profile

ASG : Crusty black vertosol	Horizon Depth (m) Bound	Colour Mottles Bleach	Moisture Field pH Drainage	Texture Structure Consistence	Coarse Fragments Segregations Root
	A1 0-0.3 abrupt;	Light yellowish brown 10YR5/4	Dry , pH 7.0	Fine silty clay weak subangular blocky, firm	Minor small gravels
	B21 0.3-0.6 gradual to;	Yellowish brown 10YR5/6	Moist, pH8.0 slowly drained	Light medium clay, coarse polyhedral, hard	Roots common, rounded ironstone gravel 10%,
	B22 0.6-0.9 gradual to;	Light brown 7.5YR5/8	Dry pH 8.0, very poorly drained,	Light medium clay (sandy), firm polyhedral	Roots very few. No inclusions
	C 0.9+	-	-	-	Weathered bedrock – sandstone appearance

Laboratory Details: C2

The following laboratory data has been compiled for this SMU.

Type of Analysis*	Representative Samples (depth m)	Other Samples (depth in m)			
Detailed	TP049 (0.0-0.1) TP049 (0.7-0.8),	TP033 (0.2-0.3) TP126 (0.2-0.3)	TP035 (0.2-0.3) IP 64_0-20	TP055 (0-0.2) IP 64_40-50	TP120 (0.4-0.7) IP 64_70-80
Basic	TP049 (0.4-0.5)	TP027 (0.4-0.6) TP051 (0.2-0.3) TP120 (1.6-1.7)	TP027 (0.8-1.0) TP051 (0.5-0.6) TP126 (0-0.1)	TP033 (0.6-0.7) TP055 (0.6-0.8)	TP035 (0.7-0.8) TP120 (0.9-1.0)

* Detailed - Organic matter, pH, EC, chloride, CEC, cations (Ca, Mg, Na, Al, K), metals, particle size, Emmerson.
Basic - pH, EC, chloride. (Some also have particle size distribution)
IP – Isaac Plain soil samples

Laboratory Data for major soil horizons of selected profiles

Site. Depth (m)	Lab pH	Cl	EC	CEC	ESP	Ex.Na	Ex.K	Ex.Ca	Ex.Mg	.Mn	Ex.Al
	1:5	mg/kg	µS/cm	MEQ%	%	MEQ%	MEQ%	MEQ%	MEQ%	%	MEQ%
TP049 (0-0.1)	6.7	<10	23	7.7	1.5	0.1	0.1	5.2	2.2	-	<0.1
TP049 (0.4-0.5)	7.1	56	120	-	-	-	-	-	-	-	-
TP049 (0.7-0.8)	8.5	530	605	-	-	-	-	-	-	-	-
TP070 (1.4-1.5)	7.9	5	105	-	-	-	-	-	-	-	-

Site, Depth (m)	Avail N	P	Al	Cu	Zn	Mn	Fe	Org Matter	Ca:Mg	Emmerson Test
	(mg/kg)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%		
TP049 (0-0.1)	0.1 (NO3) 570 (Tot N)	5.2	-	8	19	373	17400 (mg/kg)	1.4	2.2	-

Site, Depth (m)	Sand >50µm	Sand >20µm	Silt <50µm	Silt < 20µm	Clay <2µm
TP049 (0.7-0.8)	0.18	0.24	0.3	0.24	0.52
TP126 (0-0.1)	0.43	0.57	0.29	0.15	0.28

2.6 Topsoil management

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

2.6.1 Materials suitable for plant growth

Areas of the project site will be subject to ground disturbance due to construction and operations activities associated with the project. Key areas of disturbance will include the DREA and the mine surface facilities. Areas which may be disturbed as a result of mining and support facilities will require stripping of topsoil and possibly subsoil for reuse in rehabilitation programs.

All soil types have been assessed to determine their suitability for stripping and re-use as plant growth material in rehabilitation. The survey area includes significant topsoil reserves with beneficial material for rehabilitation exceeding 1.0m depth in some areas. 'Double' stripping refers to the removal of the 'topsoil' layer followed by subsequent removal of suitable quality 'subsoil'. This practice can enhance the volumes of materials available for rehabilitation and SMUs B1, B2 and A3 will be considered for double stripping. The upper soil layer will be 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.

In instances where topsoil and subsoil are stripped, they will be stockpiled separately.

The survey area includes non-cracking clay soils where saline subsoils were recorded. Often, non-cracking clay soils associated with Tertiary sediments in Central Queensland (Bourne and Tuck 1993) are sodic and saline at depth. The depth to the salt accumulation layer (or salt bulge) may be quite variable but greater than 0.4m deep in most cases. Most non-cracking clay subsoil which has accumulations of salt is not recommended for re-use as a plant growth material in rehabilitation, not only because of salt but also the associated sodic conditions predisposing coarse hard setting behaviour.

Topsoil used in rehabilitation will be applied in accordance with the specifications in a topsoil management plan.

Depending on the quality of the underlying mine waste material requiring rehabilitation, it may be possible to enhance rehabilitation performance by the approximate replacement of the original soil profile. Accordingly, the potential for subsoil use as a growth medium has also been assessed for each soil type. Specific comments in relation to specific soil types follow.

Alluvial sandy and texture contrast soils (A1, A2, and C1)

- generally coarser textured (i.e., sandier) surface layers overlying hard and possibly sodic clay subsoils;
- stripping depth basically varies with the depth of the sandy upper horizon;
- most of these soil units can be conservatively stripped to 0.2m before hard clay is encountered;
- Laboratory data suggests that salinity is not an area of concern and general fertility is low but acceptable;
- Useable soil depth may vary up to 0.5m in some areas which occur intermittently; and
- The stratified alluvial creek channels are dominated by deep sandy loams which may be taken quite deep (> 1.0m).

These soils are better suited to application on lower sloping sites due to higher erosion potential however they readily germinate and support both grasses and native trees. For the establishment of topsoil stripping contracts, an average strip depth of 0.2m would utilise most of the useful material.

Upland cracking clays (B1 and B2)

- very good quality soil derived from basalt in areas of colluvial accumulation;
- well-structured and freely drained subsoils;
- no significant salinity or sodicity issues to at least 0.9m depth in most instances;
- A conservative stripping depth of 0.4 m (B1) and 0.5m (B2) has been recommended for the best quality growth material with potential subsoil reserves up to 1.4m depth from the B2 and 1.0m in B1;
- Basically, all of the dark clay above the weathered or competent substrate material offers potential in mine rehabilitation if desired.

This soil is useful on a range of rehabilitation applications although potential problems may be encountered in the initial establishment of fine seeded pastures due to poor soil to seed contact as a result of the shrinking / swelling soil attributes.

Lower lying cracking clays (A3)

- Deep cracking clays;
- good quality topsoil but possible variable subsoils;
- effective soil depth may show local variation as a few sites (<10%) recorded elevated salinity and sodic subsoils below 0.8m depth; and
- A conservative overall topsoil stripping recommendation of 0.3m is made with subsoil potential to 1.0m.

Non-cracking clays (C2)

- hard setting sandy clays often with lateritic gravels and hard subsoils;
- not good quality topsoils for rehabilitation and subsoils are very likely sodic, very hard and possibly saline;
- The recommended stripping depth is 0.2m with subsoil material not recommended as a growth medium;
- increased tendency to seal, set hard and shed water if placed on sloping rehabilitation; and
- may offer potential capping layers or be suitable for earthen dam wall construction however this has not been assessed in any detail in this survey.

Table 5 presents the stripping depths for topsoil and subsoil materials for each soil unit. The distribution of topsoil stripping depth units is shown on **Figure 4**.

Table 5: Available Topsoil Stripping for Plant Growth Enhancement

Soil Unit	Soil Name	TOPSOIL Strip Depth (m)	SUBSOIL Strip depth (m)
A1	Recent alluvial soils	0.2	0.2 - 1.0m in the deep sandy profiles No subsoil recommended in texture contrast soils
A2	Texture contrast and generally sodic soils on relic alluvial plains	0.2	No subsoil is recommended below the sandy upper soil layer.
A3	Cracking clays in alluvium and colluvial footslopes	0.3	0.3 – 1.0m. Stockpile separately from topsoil
C1	Generally non-sodic texture-contrast soils on colluvium.	0.2	No subsoil recommended below the sandy upper soil layer
C2	Non-cracking clays and coarse textured soils.	0.2	Subsoil below 0.2m not recommended as a growth medium Subsoil may be suitable for embankment construction or road base (subject to soil mechanics testing to confirm)
B1	Dark crusting and cracking clays	0.4	0.4 – 1.0m. Subsoils suitable to weathered or competent substrate
B2 and B2(rp)	Dark cracking clays and surface rock phase	0.5	0.5 – 1.4m. Subsoils are basically suitable to weathered or competent substrate.

2.6.2 Capping Materials Available for Rehabilitation of the DREA

The DREA consists of soil types A3 and B2 each of which offers significant sources of materials for rehabilitation and capping. Three material types are described;

- the ‘topsoil’ material which is the best quality growth medium;
- ‘subsoil’ material below the ‘topsoil’ which would be suitable as a plant root exploitation zone as well as a capping layer; and
- deeper material best suited as a capping layer.

Table 6 summarises available topsoil and subsoil resources within the DREA.

Table 6: Available Stripping Depth - DREA

SMU	Topsoil (m)	Subsoil* (m)	Capping material (m)
A3	Surface - 0.3	0.3 – 1.0	1.0 – 1.5
B2	Surface – 0.5	0.5 – 1.4	1.4 – 2.0

* this material also suitable as capping material

The ‘capping’ material may include weathered calcareous substrate material which would be expected to assist in neutralisation of any potentially acid forming materials from rejects areas. It is, however, noted that the EIS Geochemistry Report found that all rejects samples that were tested were non-acid forming.

2.6.3 Stockpiling - DREA

Four separate stockpile types will be constructed:

1. The ‘topsoil’ layer from both soil types is quite similar and may be placed together;
2. ‘subsoil’ from B2 only;
3. ‘subsoil’ from A3 should be placed separately if possible due to a higher risk of salinity and dispersion tendency than high quality basalt soil; and
4. ‘capping materials’ may be stockpiled together for both soil types.

3 AGRICULTURAL LAND SUITABILITY ASSESSMENT

Land suitability in Central 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.

SPPs are planning instruments for matters of state interest that are required to be considered by the administering authority for any development applications under the Sustainable Planning Act (SP Act). The Queensland Government is in the process of developing a single State Planning Policy to replace the various current SPPs in existence. This single State Planning Policy is expected to be adopted in March 2013. The project is not subject to the SP Act and therefore SPPs are not directly relevant to the project. However, principles in the SPPs are useful in considering the environmental impacts of the project.

3.1 Land Suitability Classes

The LSAT Guidelines (DME, 1995), as shown in **Table 7,** were employed to assist in determination of land suitability across the study area.

Table 7: 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)
- Susceptibility to Water erosion (e)
- Rockiness
- Nutrient deficiency (n)
- Salinity (s)
- Microrelief (g)
- Topography (t)
- Soil Physical Factors (p)

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 8**. Suitability classes and major limiting factors of each soil type for rainfed cropping and grazing is shown in **Figure 5** and **Figure 6**.

Table 8: 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
A1	Recent alluvial soils – texture contrast - stratified deep loam	moisture – m5 nutrients – n2 erosion - e2 flooding – f3	5	moisture – m4 nutrients – n2 erosion - e2	4
A2	Texture contrast and generally sodic soils on relic alluvial plains	moisture – m5 flooding – f2 erosion – e2 nutrients – n2	5	moisture – m4 nutrients – n2 erosion - e2	4
A3	Cracking clays in alluvium and colluvial footslopes	moisture – m3 salinity – s3 nutrients – n2 rockiness – r1	3	moisture – m2 nutrients – n2 erosion - e2	2
C1	Generally non-sodic texture-contrast soils on colluvium.	moisture – m5 erosion – e2 nutrients – n2 rockiness – r1	5	moisture – m3 nutrients – n2 erosion - e2	3
C2	Non-cracking clays and coarse textured soils.	moisture – m5 nutrients – n2 erosion – e2 rockiness – r1	5	moisture – m3 nutrients – n1 erosion - e1	3
B1	Dark crusting and cracking clays	moisture – m3 nutrients – n2 erosion – e2 rockiness – r1	3	moisture – m2 nutrients – n1 erosion - e1	2
B2	Dark cracking clays and surface rock phase	moisture – m2 nutrients – n2 erosion – e2 rockiness – r1	2	moisture – m1 nutrients – n1 erosion - e1	1
B2(rp)		moisture – m2 nutrients – n2 erosion – e2 rockiness – r3	3	moisture – m1 nutrients – n1 erosion - e1 rockiness – r1	1

3.1.1 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, gravel, 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. Basically, this involved estimates of field texture combined with field pH, electrical conductivity and depths to hard soil horizons.

Table 9 shows the criteria which Shields and Williams (1991) proposed for assessment of the moisture availability limitation for crops in this region. **Table 10** shows PAWC limitation severity for each SMU.

Table 9: Criteria for PAWC limitations for cropping

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%

PAWC suitability estimates indicates that the deep well-structured basaltic black earths (B1 and B2) hold significant water (100mm+) which plants may access unrestricted to at least 0.90m depth in most cases.

The A3 soils also have good water storage capability in the main however they tend to be more varied with localised areas of reduced soil depth due to coarser and somewhat harder subsoil's than the basalt soils. Shields and Williams (1991) considered crops on land whose only major limitation was moisture at severity level 2-3 (i.e. A3, B1 and B2 soil types) would succeed on 60-70% of years in the Kilcummin district.

The alluvial texture contrast and non-cracking clays soils range from sandy duplex to hard uniform clay are not considered to be suitable for cropping due to limited water storage potential.

Table 10: PAWC limitation levels for SMUs

Soil Unit	Concept	Est. effective rooting depth (m)	PAWC (mm)*	Dryland cropping Limitation level	Grazing Limitation level
A1	Recent alluvial soils – texture contrast - stratified deep loam	 0.6 – 0.7 0.8 – 1.2	 45 – 60 45 - 90	5	4
A2	Texture contrast and generally sodic soils on relic alluvial plains	0.6 – 0.8	45 - 60	5	4
A3	Cracking clays in alluvium and colluvial footslopes	0.8 – 1.0	90 - 110	3	2

Soil Unit	Concept	Est. effective rooting depth (m)	PAWC (mm)*	Dryland cropping Limitation level	Grazing Limitation level
C1	Generally non-sodic texture-contrast soils on colluvium.	0.6 – 0.7	50 – 80	5	3
C2	Non-cracking clays and coarse textured soils.	0.6 – 0.8	60 - 85	5	3
B1	Dark crusting and cracking clays	0.8 – 1.0	95 - 120	3	2
B2 and B2(rp)	Dark cracking clays and surface rock phase	1.0 – 1.4	130+	2	1

* Deduced from SCL Act Guidelines Table 9

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 was observed on areas previously cultivated which is most likely due to the use of surveyed contour banks. Soils with little or no cropping potential e.g. the hard alluvial clays and sandy loams have some risk or erosion if exposed.

Rockiness

A detailed rock cover assessment was conducted which counted rock numbers which exceeded 600mm diameter across all areas identified as potential SCL land (SCL Act 'Trigger Map' 2012). From this data the % cover was calculated at over 200 individual sites.

It was possible to map out an area where rocks >600mm were present along the surface. This area is identified as B2 (rp -rocky phase). From this data it can be concluded that <5% of the land surface has surface cobble in a range of 10-20%.

Nutrient deficiency (n)

Shields and Williams (1991) states that soil nutrient deficiency has not been recognised as a major problem for crop production on traditionally cultivated soils in the Central Highlands and the levels of nutrient deficiency found in this survey are not considered severe. The major upland soil types have minor levels of limitation as a result of nutrient deficiency.

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. Increasing salinity in the soil profile was evidenced in any soil types in this survey. The only soil type which indicated subsoil salinity was clay alluvial A3 soils where approximately 30% of sites had salinity at levels sufficient to restrict effective soil depth to < 0.7m depth.

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 study area, areas of normal and linear gilgai were recorded however their effect on cultivation and impeded trafficability of machinery is considered negligible. Only one small area of A3 to the extreme west of the study area was found with a significant melon hole limitation.

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.

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.

3.1.2 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.

All soil units are suited to beef cattle grazing with significant areas having potential for improved pastures. The harder setting clays and duplex alluvial soils may be less productive overall due to more severe limitations from restricted soil water availability, erosion susceptibility and fertility. They are also more prone to degradation with overstocking pressure, should erosive subsoil layers be exposed. However, it should be noted that pasture growing on the sandier soils can respond quickly to limited rainfall events, whereas the high PAWC soils such as the well structured and cracking clays may offer restricted moisture to support pasture from small rainfall events as the pasture cannot recover low moisture levels from clay soils. Thus during periods of extended dry in which only sporadic small rainfall events occur when the clay soil moisture store is depleted, the sandy soils can offer rapid pasture growth for cattle.

This site does not have significant limitations to a grazing use. This is the use that most of the land is currently put to and overall the land is in good condition. Much of the site has been cleared for improved pasture and the Buffel is well established.

3.2 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 11 describes ALC's and their relationship with Land Suitability Classes for grazing and cropping.

Table 11: 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.

Agricultural Land Class	Land Suitability (Cropping)	Land Suitability (Grazing)	Description
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.
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)

The Belyando Shire Council Shire Planning Scheme (2008) has mapped and described ALC's over an area which includes the project site. Within the project site itself, ALCs A, C1, C2 and C3 are mapped. ALC's considered to be GQAL are A, B and C1. However, it is accepted that the mapping scale used to identify these areas was quite small and proponents of major projects are required to investigate GQAL at a higher mapping intensity. Accordingly, this survey has reclassified GQAL classes on the basis of data from this survey.

Following a reassessment of ALCs on the basis of higher scale information from this survey, GTES has reclassified pre-existing ALC boundaries. Essentially this process has confirmed that pre-existing ALC types and distribution is correct with minor adjustments to reflect the field validated SMU boundaries (refer **Figure 7**).

Table 12 aligns the appropriate GQAL ALC with SMUs.

Table 12: 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.	A3, B1, B2, B2(rp)
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.	-
C1	**Land suitable for improved pastures**. In some circumstances may be considered as good quality agricultural land	-
C2	**Land suitable for native pastures.**	C1, C2
C3	Land suitable for limited grazing of native pastures	A1, A2
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	-

3.3 Summary of Land Suitability Areas

Table 13 shows the area (ha) for each land suitability class together with GQAL.

Table 13: Areas (ha) for classes of cropping, grazing and GQAL land

Land Suitability – Cropping		Land Suitability – Grazing		GQAL	
Class	**Area (ha)**	**Class**	**Area (ha)**	**ALC**	**Area (ha)**
1		1	2743	A	7396
2	2407	2	4652	B	
3	4989	3	3699	C1	
4		4	6294	C2	3699
5	9993	5		C3	6294
Dist	108	Dist	108	Dist	108

4 STRATEGIC CROPPING LAND ASSESSMENT

4.1 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. Potential SCL may be mapped within one of two 'protection areas'. Protection areas are afforded the highest level of protection under law. Alternatively, potential SCL will be within a 'management area' which affords lower levels of protection to reflect its generally lower quality or strategic importance. Each area carries a specific set of development requirements.

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 14**.

Table 14: 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; and
- Assess the field validated soil type characteristics and mapping extents against the SCL criteria 4 to 8 presented in the SCL Guidelines.

4.2 Existing SCL Trigger Map

The project site lies within the SCL Regional Trigger Map C4 – Moranbah and Emerald Region. The project site is within a management area, approximately 100 km north of the Central Protection Area. The trigger map shows an area of 2,382 ha of potential SCL within the project site, mainly distributed within the central and western areas (refer **Figure 8**).

4.3 Exclusion of Potential SCL

4.3.1 SCL Criteria 1-3

A total of 238 soil survey sites were described in the SCL area which included 51 detailed soil survey investigations and 187 observation level soil survey sites (Refer **Table 15**). The location of detailed soil survey sites within the SCL area is presented in **Figure 8**. This represents a sampling intensity of about 1 site every 10 hectares.

All sites were measured for slope and gilgai microrelief in accordance with the SCL Guidelines to assess if they should be excluded as SCL. Initial observations at these sites indicated possible excessive rockiness at some locations so further detailed manual counts were undertaken to satisfy the SCL Guidelines for this criterion. Manual rockiness counts were undertaken as follows:

- 44 rockiness investigation sites comprising the average of 5 adjacent 1 m x 1 m quadrats manual counts; and
- 53 rockiness check sites comprising of a single 1 m x 1 m quadrat manual count.

The location of these rockiness detail and check sites are presented in **Figure 8**. Data collected for all site descriptions within the SCL area are detailed in;

- Appendix 1 – Detailed soil survey sites,
- Appendix 3 - Observation soil survey sites and;
- Appendix 4 – Surface rock evaluation sites.

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

4.3.2 Conflicting Land Uses

The project site contains built infrastructure and areas of existing disturbance. However, comparison of the mapped potential SCL and areas of existing disturbance at the project site shows that these areas of existing disturbance are currently mapped as non-SCL. Therefore, no exclusion areas on the basis of built infrastructure are required.

A substantial amount of work has been undertaken by ecologists for the EIS Flora and Fauna Report to field validate remnant Regional Ecosystem (RE) vegetation (protected under the Queensland Vegetation Management Act 1999) in the study area. The field validated mapping has identified areas of remnant vegetation which have not been previously recorded in available government mapping; some of this vegetation occurs within the boundary of the

strategic cropping land management area (see **Figure 9**). The proponent will be required to submit a Strategic Cropping Land Validation Application to DNRM to amend the SCL boundary to exclude these areas, prior to commencement of construction.

4.3.3 Cropping History

It was not possible to obtain a full cropping history of all the properties within the SCL area, but a review of current landuses, aerial photography and landowner interviews indicated that there has been cropping (leucaena and sorghum) in parts of the SCL area. SCL therefore cannot be excluded on the basis of cropping history.

4.4 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.

All SMUs within the project site are represented by a dominant soil type (i.e. greater than 70% of the mapping unit). Of the seven SMUs described in the project site as a whole, only three occur within the SCL area in sufficient amounts to be considered. These are the A3, B1 and B2 (including the surface rock phase (B2rp)) SMUs. Small areas of A1 and C2 were also identified but no discrete area was of sufficient size (i.e>10ha) to form an SCL exclusion area. C2 is too small to be represented by a mappable unit on **Figure 8**.

The SCL Guidelines require that a minimum of 2 detailed sites and 1 analytical site are undertaken per soil type and this requirement is satisfied in the SCL area for the dominant soils (B2 and A3). The B1 SMU comprises a comparatively small part of the SCL area so laboratory data was extrapolated from representative analytical sites sampled nearby in the main soil survey area.

Laboratory data of attributes relevant to SCL criteria assessment was obtained from 41 sites. This provides for an overall analytical site density of 1 site per 18 ha. **Table 15** includes numbers of the types of soil survey sites undertaken in the SCL area, and the area (ha) of each SMU within the SCL are is presented in **Figure 8**. Note that the remnant vegetation areas have not been excluded from the areas presented in Table 15 and a small area of SCL not shown on Figure 8 is presented in Figure 3 in the south east corner of the survey boundary. This small section of the survey boundary contains SMU A3 and C1 with the corresponding sample locations, TP062 and GT-2.

Table 15: Site Details of SMUs for the SCL area

SMU	Concept Description	Numbers of Soil Survey sites described			Area (ha)
		Detailed	Analytical	Observation Sites[1]	
Soils on fresh and weathered basalt					
B1	Dark crusting and cracking clays (very minor occurrence)	1 – TP088	0	1	**23**
B2	Dark cracking clays	20 GT-8, TP066, TP068, TP071, TP074, TP075, TP077a TP079, TP082, TP084, TP086, TP097, TP098, TP099, TP105, TP110,	17 TP066, TP068, TP071, TP074, TP075, TP077a TP079, TP082, TP086, TP097, TP098, TP099, TP105, TP110, TP113, TP114,	102	**1312**

SMU	Concept Description	Numbers of Soil Survey sites described			Area (ha)
		Detailed	Analytical	Observation Sites[1]	
		TP113, TP114, TP122	TP122		
B2 rocky phase	Dark cracking clay with surface rock recorded	8 GT-1, S143, TP087, TP093, TP095, TP096, TP100, TP101	7 S143, TP087, TP093, TP095, TP096, TP100, TP101,	17	**293**
Clay soils on gentle colluvial and relic alluvial plains.					
A1 and C2	Active sandy creek channels and alluvial levees. (NOTE – no areas of sufficient size to constitute an exclusion area)	1 GT-7,	0	3	**12**
A3	Cracking clays in alluvium and colluvial footslopes	21 GT-3, GT-5, GT-7, TP062, TP080, TP085, TP090A, TP091, TP092, TP094, TP102, TP103, TP104, TP106, TP107, TP108, TP109, TP111, TP116, TP117, TP123, TP125,	18 TP080, TP085, TP090A, TP091, TP092, TP094, TP102, TP103, TP104, TP106, TP107, TP108, TP109, TP111, TP116, TP117, TP123, TP125,	55	**728**
Soil Boundary confirmation sites		-	-	9	-
TOTALS		51	42	187	**2368**

1 – Observation sites are based upon initial review. These are not shown on Figure 8 however observation sites are presented in Appendix 3.

The SCL assessment of dominant soil type characteristics against SCL criteria is summarised in **Table 16**.

Table 16: Summary of SCL Assessment

SCL Criteria	SMU		
	A3	B1	B2 and B2rp
1 – Slope	PASS < 3% all sites	PASS < 3% all sites	PASS < 3% most sites.
2 – Rockiness	PASS Very minor surface rock component recorded at all sites	PASS Minor areas of basalt cobble >60mm diameter were recorded but percentage surface cover did not exceed 5% in any sites.	PASS The B2 unit has < 2% of the surface area with rock >60mm diameter. The B2(rp) ranges from 2-15% (average 6%) of the surface area with rock >60mm diameter
3 – Gilgai Microrelief	PASS Very weakly developed or non existent.	PASS Insignificant microrelief component limited to isolated areas of shallow linear gilgai	PASS Minor shallow linear gilgai
4 – Soil Depth	PASS All sites tested and described exceeded 600 mm effective soil depth with most exceeding 0.9m.	PASS All sites tested and described exceeded 600 mm effective soil depth. Elevated salinity and moderately sodic conditions were recorded in some sites however the majority of sites (>80%) have an effective soil depth of at least 9m depth	PASS All sites tested and described exceeded 600 mm effective soil depth. Almost all sites exceeded 1.0m.
5 – Soil Wetness	PASS Moderately well drained	PASS Well drained throughout	PASS Well drained throughout

SCL Criteria	SMU		
	throughout.		
6 – Soil pH	PASS pH within range to at least 1.0m depth.	PASS pH within range to at least 1.0m depth.	PASS pH within range to at least 1.0m depth.
7 - Salinity	PASS All sites tested were non saline (Cl <800 mg/kg) to at least 0.7m soil depth.	PASS Most (> 80%) of sites tested were non saline (Cl <800 mg/kg) to at least 0.9m soil depth. None were saline before 0.6m depth.	PASS Most (> 80%) of sites tested were non saline (Cl <800 mg/kg) to at least 0.9m soil depth. None were saline before 0.6m depth
8 – Soil Water Storage	PASS Estimates using DERM (2011) field water storage estimate exceeded 100 mm in approximately 80% of sites.	PASS Estimates using DERM (2011) field water storage estimate exceeded 100 mm in most sites.	PASS Estimates using DERM (2011) field water storage estimate exceeded 120 mm in most sites.
SCL Status of Soil	**PASS**	**PASS**	**PASS**
Criteria that Fail	None	None	None

4.5 SCL Assessment Summary

The following summarises the SCL assessment with the revised SCL presented on **Figure 9**:

- Three SMUs (A3, B1 and B2 (including B2(rp)) are identified within the area identified on the Trigger Map as potential SCL;
- All three SMUs have been confirmed as SCL; and
- Minor areas of SMUs C2 and A1 were identified within the Trigger mapped area however none were of sufficient size (i.e >10ha) to constitute an exclusion area.

As noted in Section 4.3, there is a small area of SCL that will be excluded as SCL because of a conflicting land use (remnant vegetation).

5 OVERALL CONCLUSION

Based on the scope of the report, the following is concluded and summarised in **Table 17**;

- Seven soil mapping units are present within the project site, A1, A2, A3, B1, B2, (including sub unit B2(rp)), C1 and C2;
- The assessment of existing land suitability for cattle grazing finds that the project site does not have significant limitations to a grazing use. This is the use that most of the land is currently put to and overall the land is in good condition. Much of the site has been cleared for improved pasture and the Buffel is well established;
- The assessment of existing land suitability for rainfed cropping finds that significant areas of suitable soils occur for this use. SMUs deemed suitable for cropping are the B1, B2 and A3 which occupy 7,342 ha;
- Assessment of GQAL reported that 7,342 hectares has potential for crop land, 3,785 hectares are suitable for grazing of native or improved pastures and 6,300 hectares are suitable for limited grazing of native pastures;
- Existing disturbance across the project site is 108 hectares.
- All potential SCL from trigger mapping was verified as SCL on the basis of soil characteristics. There is, however, remnant vegetation on some SCL and areas of remnant vegetation are not considered to be SCL; and
- Significant quantities of topsoil and subsoils exist in all areas of proposed mining disturbance.

Table 17: Soil Mapping Unit Summary

Soil Unit	Description	Agricultural Land Classes		GQAL	SCL
		Cropping - Class	Grazing – Class	Class	Assessment
A1	Recent alluvial soils – texture contrast - stratified deep loam	5	4	C3	Minor occurrence. Insufficient size for assessment
A2	Texture contrast and generally sodic soils on relic alluvial plains	5	4	C3	none present
A3	Cracking clays in alluvium and colluvial footslopes	3	2	A	Pass
B1	Dark crusting and cracking clays	3	2	A	Pass
B2	Dark cracking clays and surface rock phase	2	1	A	Pass
B2(rp)		3	1	A	Pass
C1	Generally non-sodic texture-contrast soils on colluvium.	5	3	C2	none present
C2	Non-cracking clays and coarse textured soils.	5	3	C2	Minor occurrence. Insufficient size for assessment

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7 GLOSSARY OF TERMS

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

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 milli-equivalents 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.

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.

8 GLOSSARY OF ACRONYMS

AHD	**Australian Height Datum**
ALC	**Agricultural Land Classes**
ALS	**Australian Laboratory Services**
BMA	**BHP Billiton Mitsubishi Alliance**
CPP	**Coal Preparation Plant**
CSIRO	**Commonwealth Scientific and Industrial Research Organisation**
DME	**Department of Mines and Energy**
DREA	**Dry rejects emplacement area**
EAL	**Environmental Analysis Laboratory**
EIS	**Environmental Impact Statement**
ERD	**Effective Rooting Depth**
GQAL	**Good Quality Agricultural Land**
GTES	**GT Environmental Services**
HB	**Hansen Bailey**
IP	**Isaac Plains**
IRC	**Isaac Regional Council**
LGA	**Local Government Area**
LSAT	**Land Suitability Assessment Techniques**
MIA	**Mine Infrastructure Area**
ML	**Mining Lease**
Mtpa	**Million Tons per Annum**
NATA	**National Association of Testing Authorities**
PAWC	**Plant available water capacity**
ROM	**Run-of-Mine**
RP	**Rocky Phase**

SAL	**Sydney Analytical Laboratories**
SCL	**Strategic Cropping Land**
SMU	**Soil Mapping Unit**

FIGURES

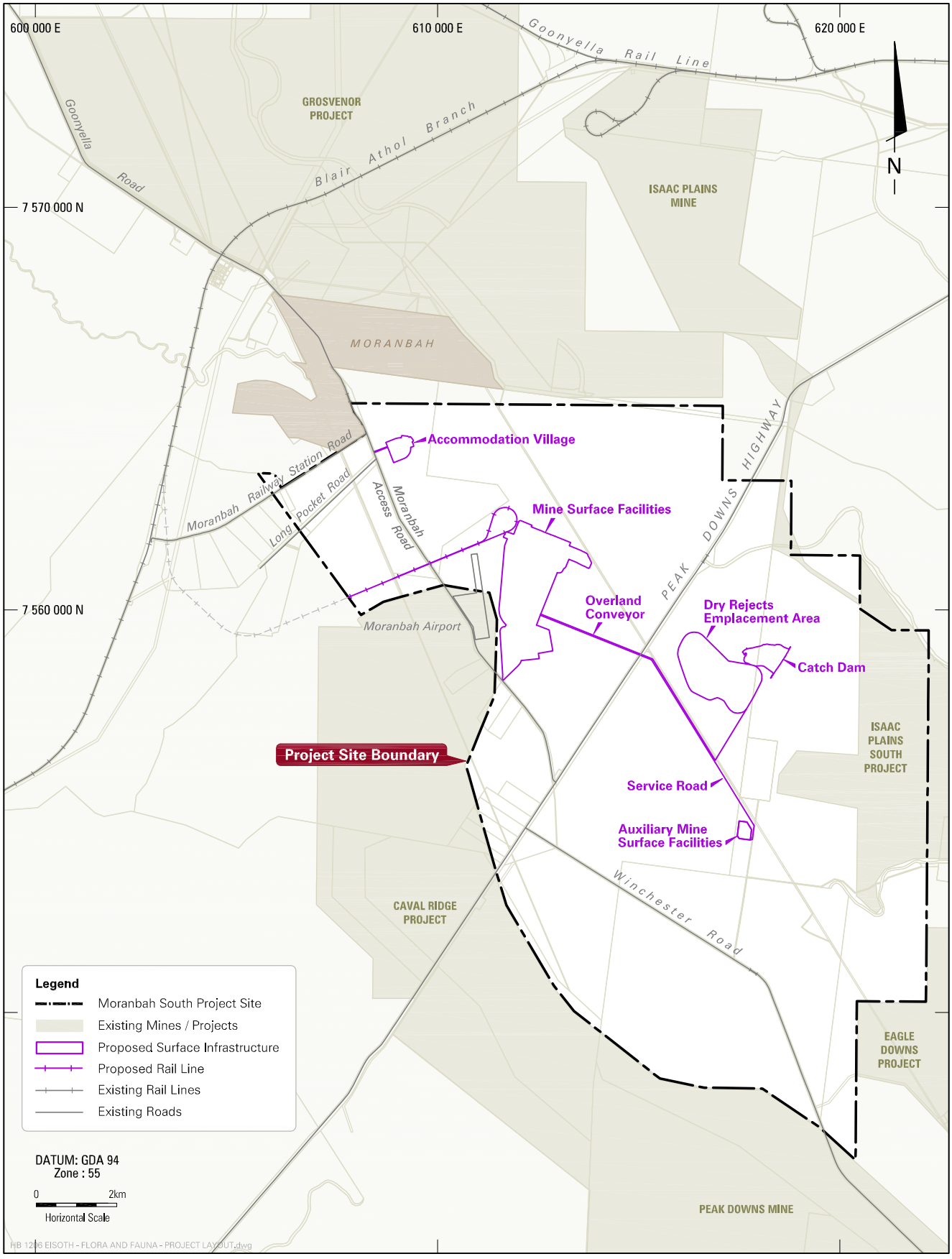
Figure 1	**Location Plan**
Figure 2	**Project Layout**
Figure 3	**Soil Mapping Units and Detailed Sites**
Figure 4	**Available Topsoil Stripping Depths**
Figure 5	**Existing Land Suitability – Rainfed Cropping**
Figure 6	**Existing Land Suitability – Beef Cattle Grazing**
Figure 7	**Revised GQAL Classes**
Figure 8	**SCL Trigger Map and SMUs**
Figure 9	**Revised SCL**

MORANBAH SOUTH PROJECT

AngloAmerican exxaro Hansen Bailey ENVIRONMENTAL CONSULTANTS

Location Plan

FIGURE 1



MORANBAH SOUTH PROJECT

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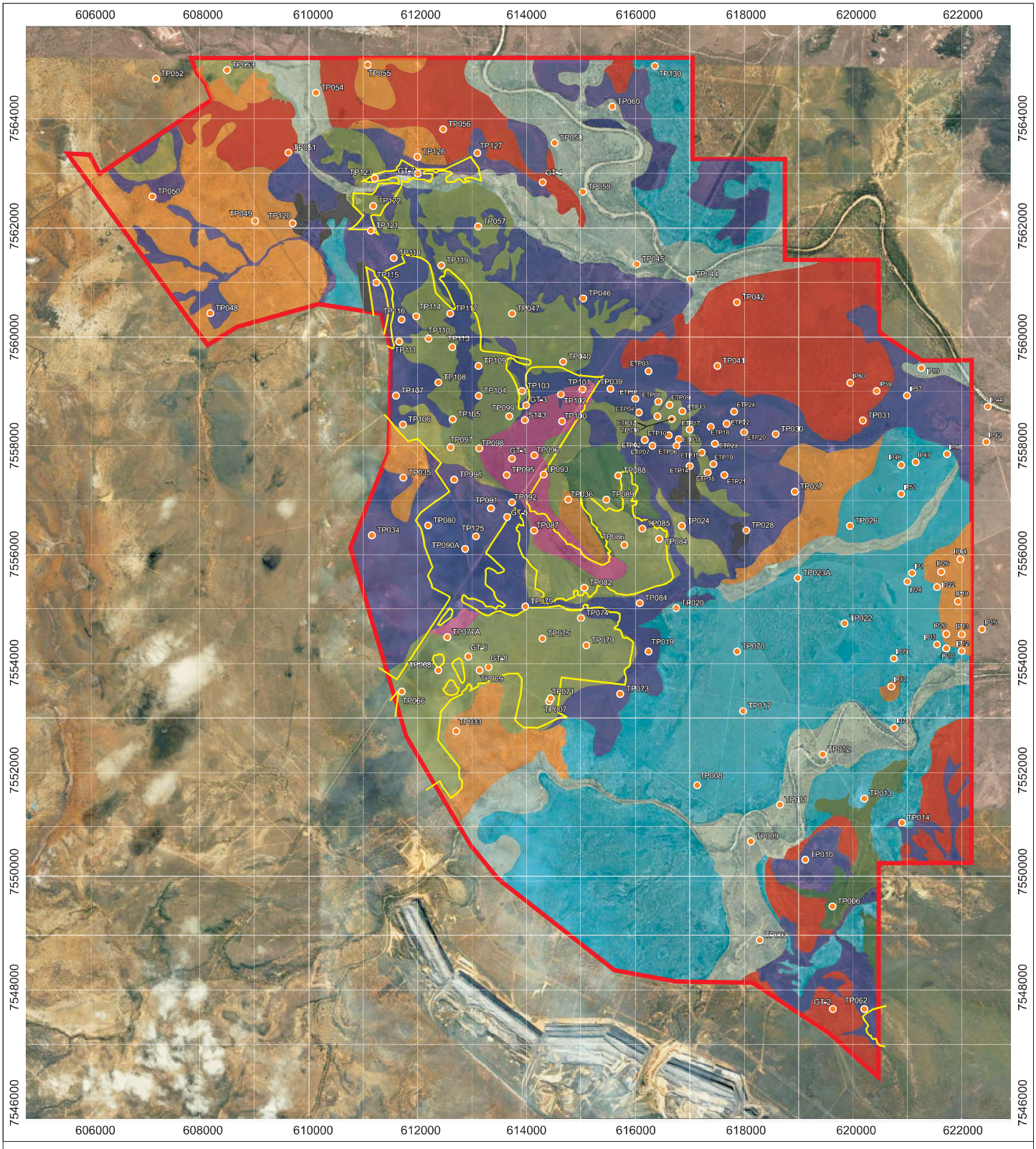
Project Layout

FIGURE 2



Legend

- Survey Boundary
- Queensland Government Proposed SCL Boundary
- Soil survey site
- A1 - Recent alluvial soils consisting of texture contrast and deep loams (Area 2051ha)
- A2 - Texture contrast soils which are generally sodic on relic alluvial plains (Area 4243ha)
- A3 - Cracking clays on alluvium and colluvial footslopes (Area 4299ha)
- C1 - Generally non-sodic texture-contrast soils on colluviums and alluvium (Area 1998ha)
- C2 - Non-cracking clays and course textured soils on tertiary sediments (Area 1700ha)
- B1 - Dark crusting and cracking clays on basalt (Area 353ha)
- B2 - Dark cracking clays on basalt (Area 2407ha)
- B2(rp) - B2 surface rock phase (Area 336ha)
- Disturbed (Area 108ha)

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Moranbah South Project
Figure 3: Soil Mapping Units and Detailed Sites

Drawn: GREG TUCK 18-02-2013
Checked: GRAHAM TUCK 18-02-2013

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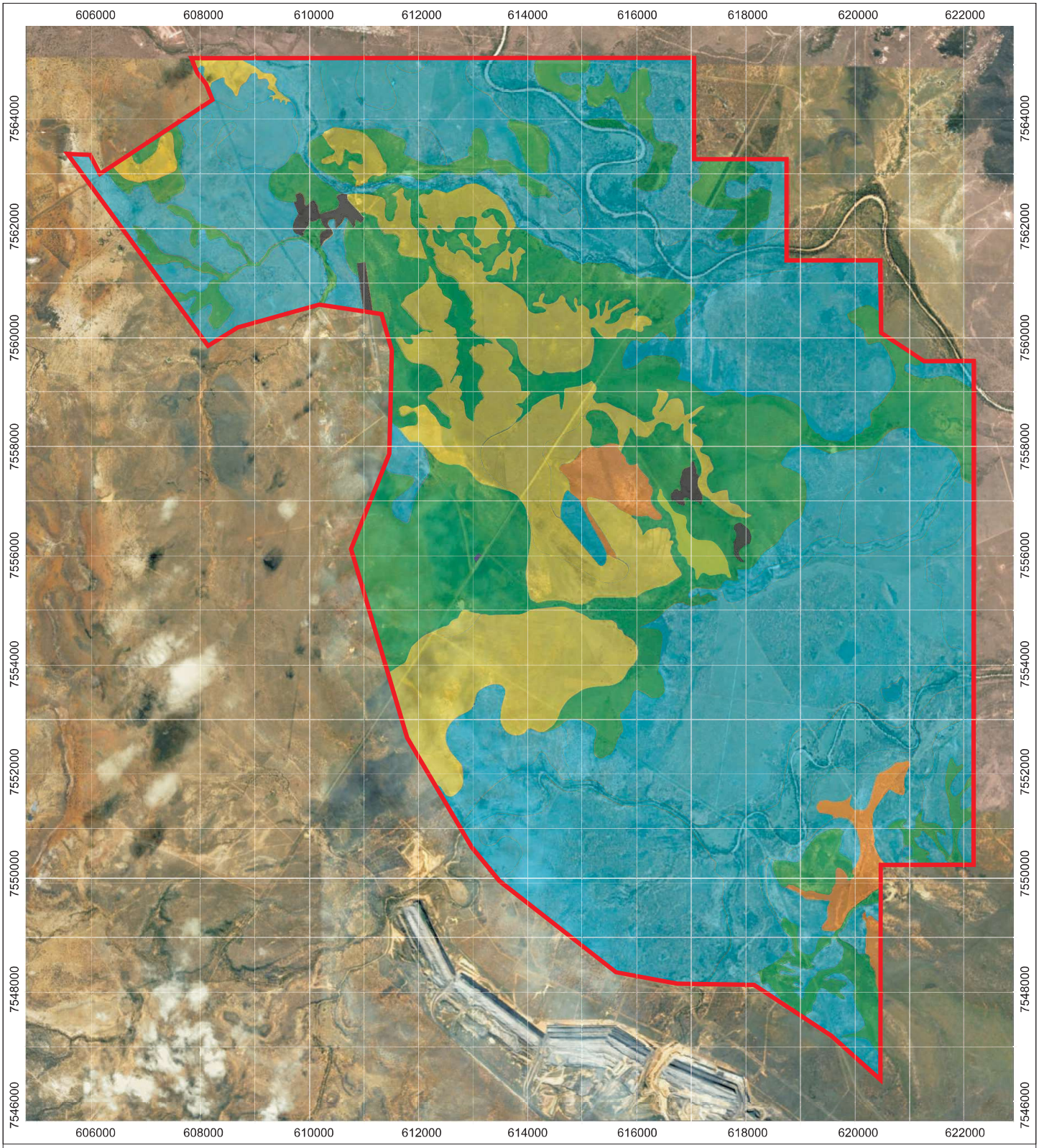

Legend

- Survey Boundary
- 0.2m (Area: 9992ha)
- 0.3m (Area: 4299ha)
- 0.4m (Area: 353ha)
- 0.5m (Area: 2743ha)
- Disturbed (Area: 108ha)

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Moranbah South Project
Figure 4: Available Topsoil Stripping Depths

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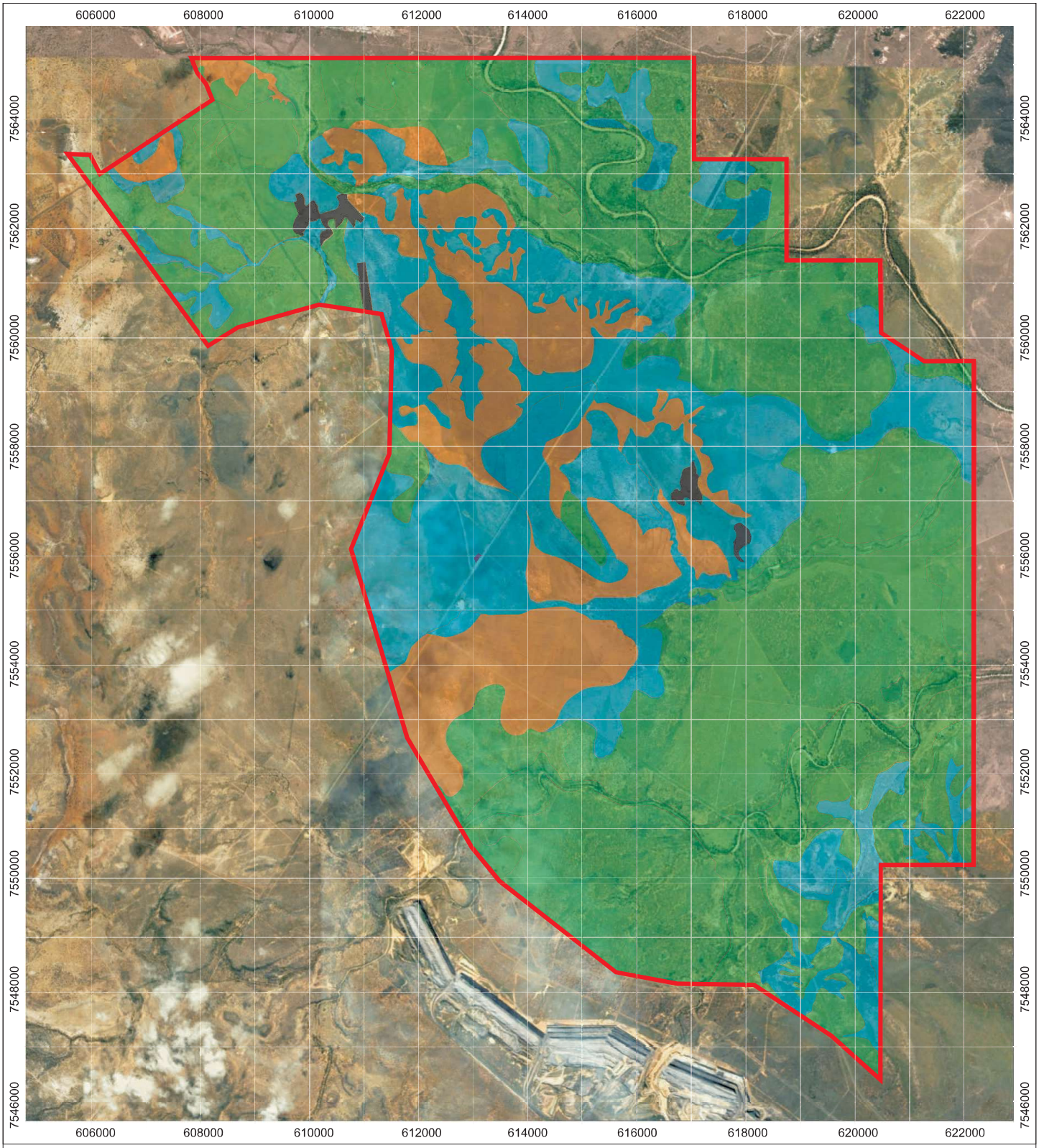
Projection: GDA94 Zone 55



Legend

- Survey Boundary
- Class 2 (Area: 2407ha)
- Class 3 (Area: 4989ha)
- Class 5 (Area: 9993ha)
- Disturbed (Area: 108ha)

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Moranbah South Project
Figure 5: Existing Land Suitability - Rainfed Cropping

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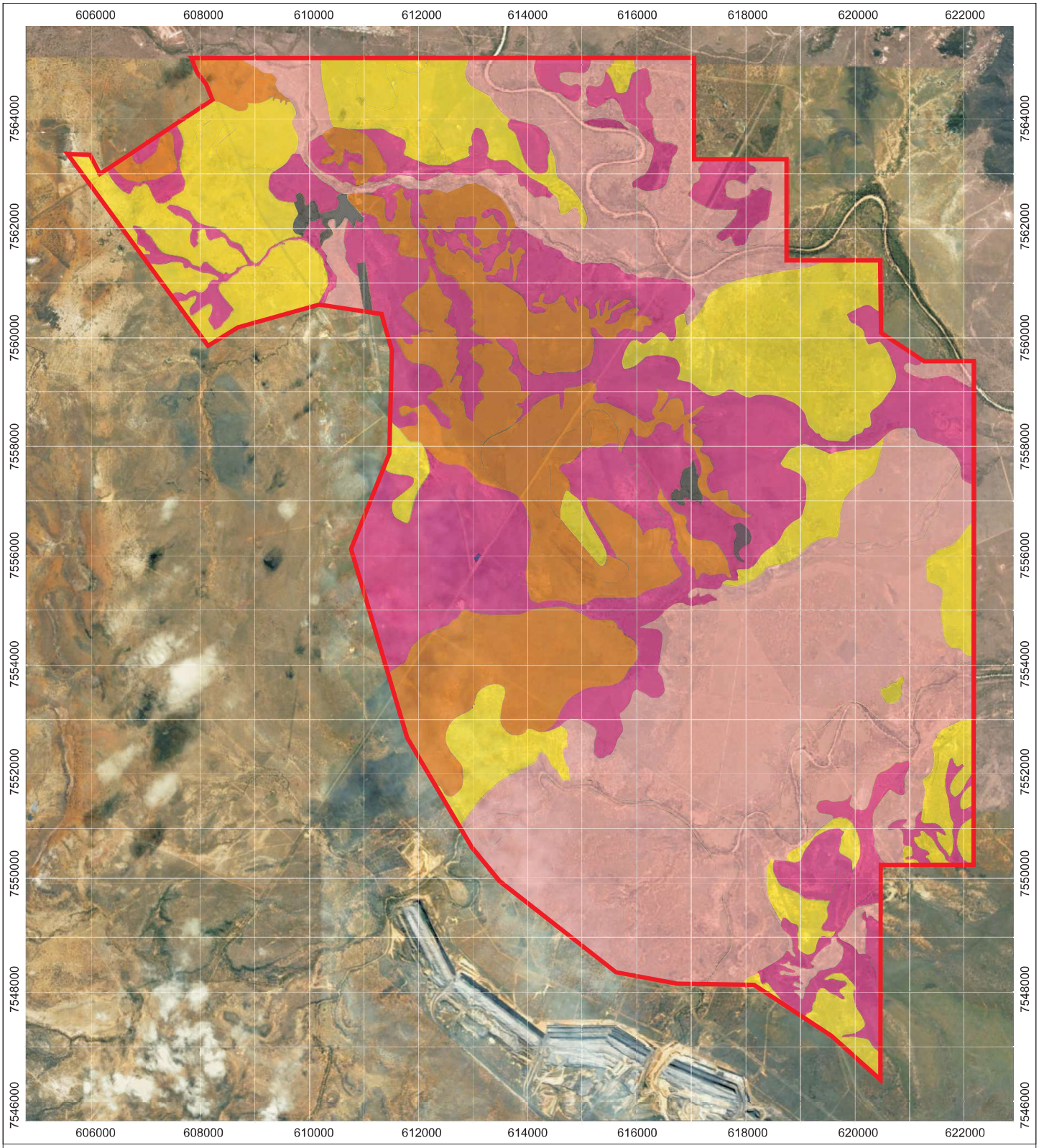

Legend

- Survey Boundary
- Class 1 (Area: 2743ha)
- Class 2 (Area: 4652ha)
- Class 3 (Area: 3699ha)
- Class 4 (Area: 6294ha)
- Disturbed

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Moranbah South Project
Figure 6: Existing Land Suitability - Beef Cattle Grazing

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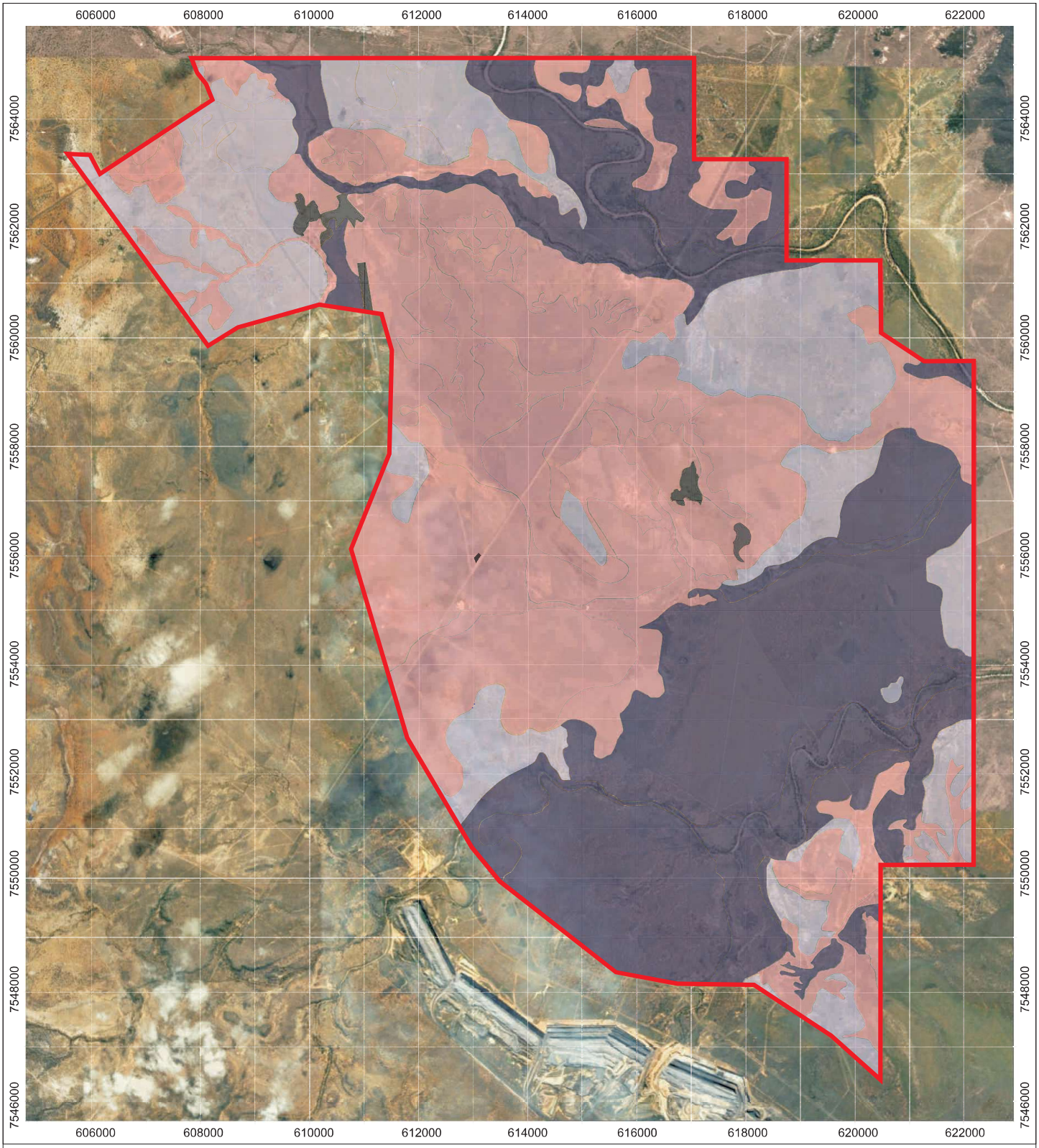

Legend

- Survey Boundary
- A — Crop land suitable for current and potential crops (Area: 7396ha)
- C2 — Suitable for improved pastures (Area: 3699ha)
- C3 — Suitable for limited grazing of native pastures (Area: 6294ha)
- Disturbed (Area: 108ha)

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Moranbah South Project
Figure 7:
Revised GQAL Classes

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Projection: GDA94 Zone 55

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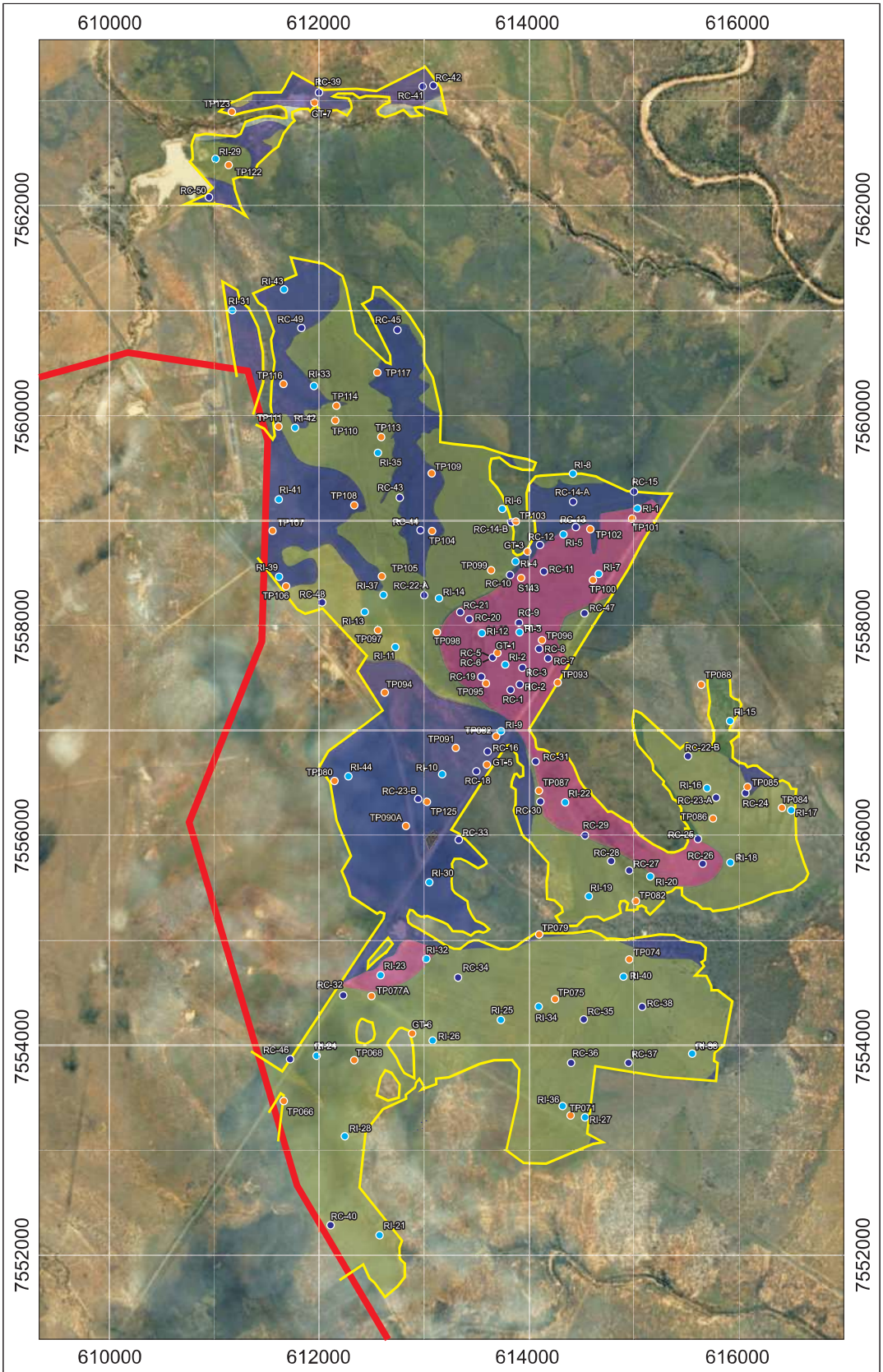

Legend

- Survey Boundary
- Queensland Goverment Proposed SCL Boundary
- Rockiness Investigation Site
- Rockiness Check Site
- Soil Survey Site
- A1 - Recent alluvial soils consisting of texture contrast and deep loams (Area: 12ha)
- A3 - Cracking clays on alluvium and colluvial footslopes (Area: 728ha)
- B1 - Dark crusting and cracking clays on basalt (Area: 23ha)
- B2 - Dark cracking clays on basalt (Area: 1312ha)
- B2(rp) - B2 surface rock phase (Area: 293ha)
- Disturbed (Area: 2ha)

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Figure 8:
SCL Trigger Map and SMU's

Drawn: GREG TUCK 18-02-2013
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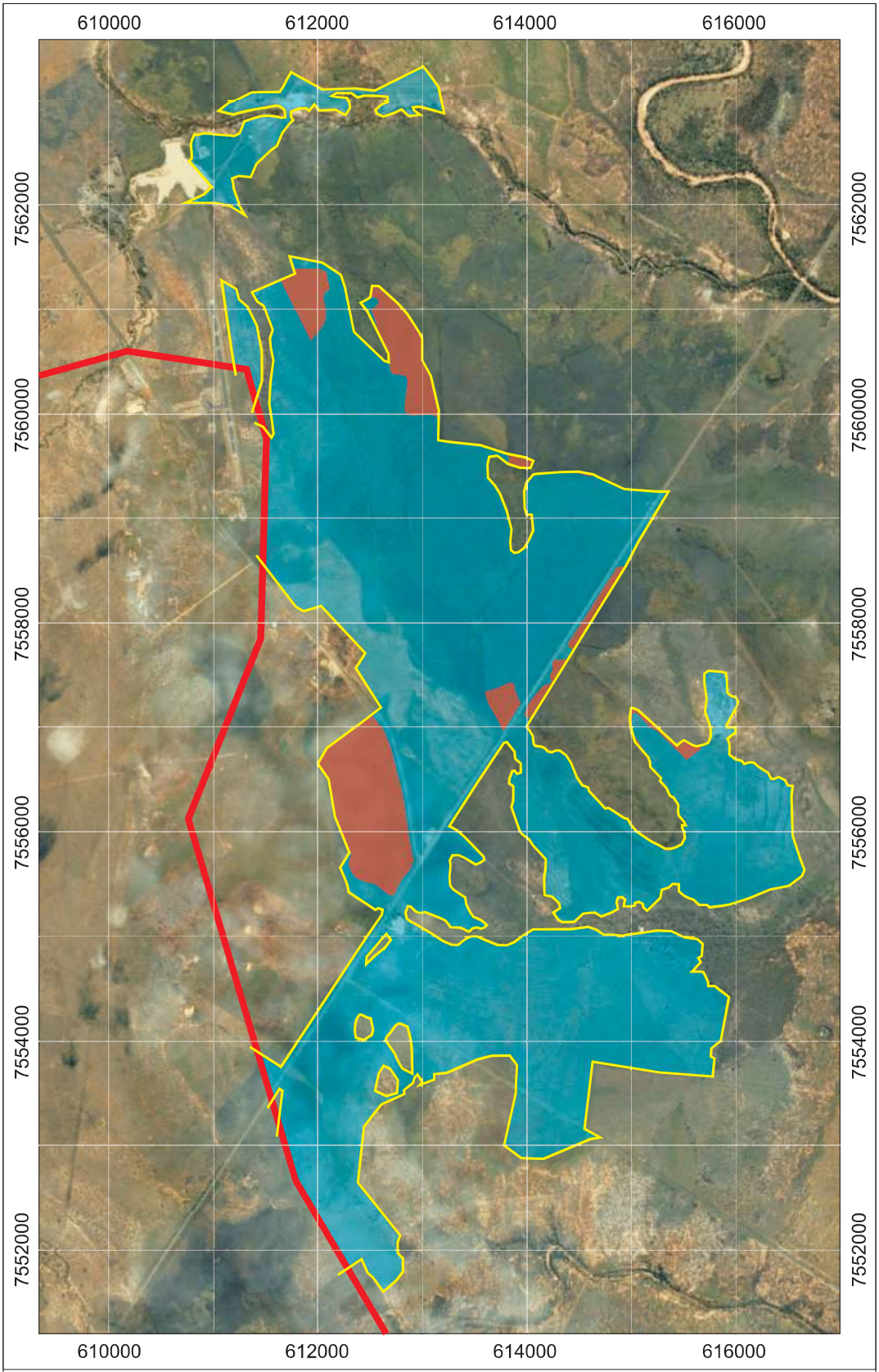
Metres

Projection: GDA94 Zone 55



Legend

- Survey Boundary
- Queensland Goverment Proposed SCL Boundary
- Verified SCL (Area 2168ha)
- Non SCL - Remnant Vegetation (Area: 202ha)

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Moranbah South Project
Figure 9:
Revised SCL

Drawn:	GREG TUCK	18-02-2013
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Page 1 of 1

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Projection: GDA94 Zone 55

APPENDICES

Appendix 1 **Detailed site descriptions**

Appendix 2 **Laboratory Data and Information (Available on Request)**

Appendix 3 **Observations site descriptions**

Appendix 4 **Rockiness Evaluation of the SCL Area (Available on Request)**

APPENDIX 1 DETAILED SITE DESCRIPTIONS

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance, Major vegetation	Landform, surface, microrelief, Rock / stone (size, %)	Soil Profile Description Horizon, depth (cm), structure, colour, texture mottles , field pH, , consistence, Inclusions, segregations, roots, moisture, boundary.	Photo (s)
	m E	m N								
GT01	613757	7557722	B2rp	Detailed, pit	Black vertosol	16/10/12	Cleared for pastures. Sally Wattle regrowth. >80% grass cover.	Undulating plain Upper slope. Slope 2.5% Surface cracking, self mulching. Few (<2%) basalt cobble.	A1 0 – 4 cm. Strong granular self mulch, firm, 10YR3/2, medium heavy clay, pH 7.0, abrupt to; B21 4 – 45cm. Strong polyhedral, firm, 10YR2/1, medium heavy clay, pH 8.0, gradual to; B22 45 – 110cm. Strong lenticular smooth faced, 10YR2/1, medium heavy clay, trace carbonate nodules, pH 8.5. C 110cm. weathered basalt.	
GT02	614004	7558649	B2rp	Detailed, pit	Black vertosol	17/10/12	Cleared for pastures. 85% grass cover	Gently undulating plain Midlope. Slope 1%. Surface cracking, self mulching. Surface basalt cobble .60mm is 15-20%.	A1 0 – 4 cm. Strong granular self mulch, 10YR3/2, medium clay, pH 7.5, abrupt to; B21 4 – 55cm. Strong polyhedral, firm, 10YR2/1, medium heavy clay, pH 7.5, gradual to; B22 55 – 140cm. Strong lenticular smooth faced, 10YR2/1, medium heavy clay, trace carbonate nodules, pH 8.5. C 140cm+ weathered and fresh basalt rock.	

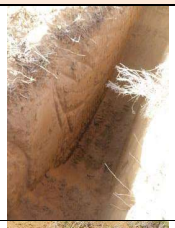
Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
GT03	614004	7558694	A3	auger		. 17/10/12	Sally Wattle and grasslands	Slope 0.5 % 10-15% basalt cobble up to 300mm. Cracking self mulching.	A1 0 – 2cm. 10YR3/3, coarse fine sandy mulch, fine sandy clay. pH 7, dry, abrupt to; B21 2 – 30cm. 10YR3/2, medium clay, firm prismatic, pH 8.00, roots common, dry , clear to; B22 30 -100cm+. 10YR3/1, light sandy clay, coarse subangular blocky, dry, hard, pH 7.0, 5% mixed gravel , moist,	
GT04	614334	7562769	C1	boundary observation		17/10/12				
GT05	613635	7556706	A3	c/c, 20%		17/10/12	Uudulating plain, Brigalow, Sandalwood, Whitewood, Leopardwood, Wilga	Cracking, strong granular, cover mixed laterite gravels 7-70mm (av <40mm)	A1 0 – 25cm. 7.5YR3/2, fine sandy clay, granular / subangular, pH 7, dry, abrupt to; B21 25–70cm. 7.5YR3/1, medium clay, very firm prismatic, pH 7.0, roots stop at 70cm. clear to; B22 70 -110cm+. 10YR3/1, sandy clay, strong subangular blocky, quite firm, dry, pH 7.5.	
GT06	612918	7554079	B2	obs site		18/10/12		Boundary Brigalow (east) Mt Coolibah (west)		
GT07	611985	7563018	A3	Hand auger	Dermosol / weak Vertosol	18/10/12	cleared Poplar Box with R/G Bauhinia, Bloodwood	near alluvia, , firm weak cracking.	A1 0 – 20cm. 7.5YR4/3, coarse fine sandy clay, firm. pH 7, dry, abrupt to; B21 20 – 90cm+ 7.5YR3/3, medium clay, very firm blocky, pH 7.5, roots common to 80cm, dry ,	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
S143	613920	7558471	B2rp	Detailed, 50mm hand auger	Black vertosol	16/10/12	Cleared. 95% buffell mixed grasses. Few Sally Wattle.	Gently undulating plain. Midslope. Cracking, self mulching. Slope <2%. basalt cobble>60mm , 5% of surface	A1 0-15cm Silty clay, Dark 10YR2/3, mod subangular blocky, pH 7.5, B21 15 – 80+cm. medium clay, 10YR2/2, strong lenticular, smooth ,5% soft carbonate, pH 8.5,	Resampled 16/10/12 by GTES. Depths 50-60 to check for dispersion – NOT DISPERSIVE PHOTO 10.
TP003	618143	7548974	A1	Detailed , pit	Arenic rudosol	15/11/11	Mostly cleared. Originally eucalypt woodlands.	Firm sandy surface. Gently undulating plain – alluvial. Nil rock. Slope<0.5%	A11 0-30cm. Loamy sand, 7.5YR4/4, apedal, soft, common roots,pH 5.0 A1230- 150cm. Clayey sand, 7.5YR4/6, apedal, loose, roots to 100cm, pH 5.5, diffuse to; B21 150 – 180cm sandy clay loam, 5YR4/6, very firm, 10% rounded quartz gravels, weak blocky, pH 7.0.	 
TP004	No site	-	-	-	-	-	-	-	-	-
TP005	No site	-	-	-	-	-	-	-	-	-
TP006	619552	7549509	B1	Detailed , pit	Vertosol	13/11/11	Cleared – open grassland	Undulating plain. Slope 1.5%. Occasional basalt rocks (<5% of surface & 30-70mm diameter)	A1 0-30cm Medium clay 10YR3/1, weak blocky peds 1-4mm, moist/dry, roots, <0.5cm quartz, pH6, diffuse; B21 30-90cm Medium clay 10YR3/1, very firm, lenticular with slickensides, moist/dry, roots, pH7 B22 90-140cm Medium clay 10YR3/4, polyhedral peds, 10% gravel <0.25cm quartz, moist dry, pH 7.5	 
TP007	No site	-	-	-	-	-	-	-	-	-

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP008	616988	7551615	A2	Detailed , pit	Chromosol	15/11/11	Cleared / poisoned trees. Previously Poplar Box. Grazingt native pastures.	Surface is firm, sandy. Nil stone. Slope 1%.	A1 0-20cm Sandy clay loam, 10YR3/3, massive, dry <0.5cm gravel, roots <1cm, pH6 B21 20-40cm Light medium clay, 10YR3/4, very firm, polyhedral peds, few / no roots, moist/dry, pH7. B22 40-180 Medium clay, 10YR4/1, firm, polyhedral peds, mixed gravel <0.5cm, moist dry, pH9 @ 160cm. 5% soft carbonate	 
TP009	618030	7550563	A1	Detailed , pit	Kandosol	15/11/11	Mostly cleared. Originally eucalypt woodlands.	Firm sandy surface. Gently undulating plain – old alluvial.	A11 0-30cm. Loamy sand, 7.5YR4/4, massive, soft, common roots, pH 5.0 A1230- 130cm. Coarse sand, 7.5YR4/6, massive, loose, roots to 100cm, pH 5.5, diffuse to; B21 150 – 180cm sandy clay, 10YR5/6, very firm, 10% rounded quartz gravels, weak blocky, 15% red, yellow mottles, pH 4.5	
TP010	619137	7550277	A3	Detailed , pit	Vertosol	13/11/11	Cleared for improved pastures.	Gently undulating plain. Soil cracks to 60cm. Strong granular mulch. Surface basalt rocks < 5% cover. <60mm diameter.	A1 0-40cm Medium clay, 10YR3/1, firm, moderate polyhedral peds, dry, small slickensides, quartz gravel <0.5cm, roots, pH7.5 B21 40-60cm Medium clay 10YR3/2, firm blocky, light mottle, moist/dry, roots, pH8 C 60cm weathered bedrock. End of hole at 1m	

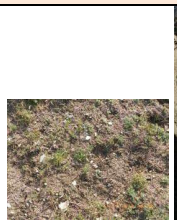
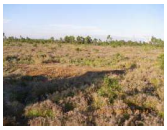
Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP011	618658	7551300	A1	Detailed , pit	Chromosol	13/11/11	Mostly cleared Poplar Box.	Firm sandy. Gently undulating plain. Slope 1%	A1 0-25cm Loamy sand, 7.5YR3/4, massive, roots <0.5cm, dry, pH5.5 B2 25-120cm Clayey sand, 7.5YR4/6, loose, roots, gravel inclusions, moist/dry, pH5 B21 120-170cm Clayey sand, 5YR4/6, loose, gravel, roots, moist/dry, pH6.5 End of hole at 170cm	
TP012	619371	7552266	A1	Detailed , pit.	Arenic rudosol	14/11/11	Cleared for pasture	Undulating plain. Firm sandy surface. Slope 1%	A11 0-30cm Soft sand, 10YR3/4, roots, dry, pH5.5 A12 30-40cm Loamy sand, soft 10YR4/3, no roots, dry/moist, pH6, clear A13 40-70cm Sandy loam, 10YR5/4, massive, roots, dry, pH6, abrupt boundary B21 70-110cm Clayey sand, 10YR3/6, massive, hard, slight mottling, moist, pH7 B22 110-200cm Light sandy clay loam, massive 10YR3/6, roots, moist, pH7, gradual boundary D1 200-250cm Loamy sand, massive, 10YR4/6, moist, pH6.5. End of hole at 250cm	 

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP013	620157	7551357	B1	Detailed , Pit	Black vertosol	13/11/11	Cleared for pastures	Soil cracks to 1cm. Linear gilgai with brown non cracking mounds within 5m. Slope 1.5%	A1 0-60cm Medium clay 10YR3/1, straight, subangular blocky, 3% quartz, roots <0.5cm, slickensides, dry to 20cm then moist/dry to 60cm, pH6.5 B22 60-120cm Medium clay 10YR3/2, moderate polyhedral, 20% gravel, moist/dry, pH7.5 120-150cm Weathered bedrock, dry, pH7 End of hole at 150cm	 
TP014	620792	7551004	A2	Detailed pit	Chromosol	14/11/11	Cleared for grazing	Flat plain. Surface firm, sandy. No gravelsslope 2%	A1 0 -10cm, Fine sandy clay loam, 10YR3/2, coarse blocky, firm, pH 6.0, A2 10-12cm sporadic bleach. B21 12 – 65cm. Light clay (sandy), hard, 10YR2/1, polyhedral, pH 7.0; clear; B22 65- 100cm. Heavy clay, hard, 10YR3/3, moderate polyhedral, pH 8.0, few carbonate nodules, gradual; B23 100 – 150cm. Light medium clay, 10YR3/3, strong polyhedral, few carbonate & manganese nodules , pH 8.5. D1 150 – 200cm. Sandy clay, 10YR5/6, weak blocky, firm, pH 8.0	 
TP015	No site	-	-	-	-	-	-	-	-	-

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP016	619912	7552795	A1	Detailed , pit	Kandosol	15/11/11	Mostly cleared. Originally eucalypt woodlands.	Firm sandy surface. Gently undulating plain – old alluvial.	A11 0-20cm. Loamy sand, 7.5YR4/4, massive, soft, common roots,pH 4.5 A12 20- 130cm. Coarse sand, 7.5YR4/6, massive, loose, roots to 100cm, pH 5.5, diffuse to; B21 150 – 190cm sandy clay, 10YR3/4, very firm, 10% rounded quartz gravels, weak blocky, 5% red, yellow mottles, pH 4.5	
TP017	617999	7553338	A2	Detailed , pit	Chromosol	13/11/11		Sandy, firm No gravels. Slope <1%.	A11, 0-30cm Clayey sand, 7,5YR3/4, soft, weak polyhedral, roots <0.5cm <50%, pH5.5 A12, 30-60cm, clayey sand, 10YR5/6, soft, polyhedral peds to 3cm, pH6, diffuse to; B21 60-140cm Sandy clay, 10YR5/6, firm, massive, red & grey mottles, roots, pH7 B22 140-200cm Sandy clay, 10YR5/1, firm, polyhedral peds, red (5%) and grey (10%) mottles, pH 8	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP019	616265	7554184	A3	Detailed pit	Dermosol	12/11/11	Previously Brigalow	Firm sandy, non-cracking surface. 10% mixed lateritic gravels. Slope <1%. Old alluvial plain.	A1 0 – 20cm. 10YR3/2, Sandy clay loam. pH 8.0, block and hard, dry, abrupt to; B21 20 – 50cm. 10YR2/1, sandy clay, strong polyhedral, firm, pH7.0, roots common, dry, few rounded gravels to 1cm (<5%), gradual to; B22 50-90cm. 10YR3/1, medium clay, very firm, moderate lenticular, pH 7.0, moist, gradual; B23 90 -140cm. 10YR3/3, heavy clay sandy, hard, blocky, 5% mottles, pH 7.5. D1 140-190cm clayey sand, massive, 10YR5/6, pH 7.5. C 100cm weathered rock, Shale	 
TP020	616880	7554877	A2	Detailed pit	Chromosol / sodosol	12/11/11	Thinned vegetation. Sally Wattle.	Grass cover <40%. Hard sandy.	A11 0-20cm. Very firm, massive loamy sand. 10YR3/3, pH 6.0. A12 20- 40cm. clayey sand, 7.5YR4/6, very firm, massive (apedal), pH 6.5 B21 40 – 80cm. Silty clay, 10YR5/8, weak polyhedral, very firm, 5% dark mottles 10YR2/2. pH 7.0, B22 80- 120cm Light clay (sandy), 10YR5/4, massive, hard, pH 8.0 B23 120-200cm Medium sandy clay, very hard, weak blocky, increasing mottles with depth, pH 8.5.	 
TP021	No site	-	-	-	-	-	-	-	-	-

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP022	619933	7554774	A2	Detailed pit	Sodosol	24/11/11	Thinned for pasture. Poplar Box and acacias.	Hard and sandy. No stone. Slope 1%	A11 0-20cm. Very firm, fine sandy loam, 7.5YR3/4, pH 4.5. A12 20- 40cm. Sandy loam, 7.5YR4/6, very firm, massive (apedal), pH 5 A21 40 – 60cm. Silty clay loam, 10YR5/8, weak polyhedral, very firm, few roots, sporadic bleach. pH 6.0, B22 60- 140cm medium clay (sandy), very firm, coarse platy, 5% red and yellow mottles, 10YR5/6, massive, hard, pH 7.0, gradual to; D1 140-180cm. Light silty clay. Weak blocky, 10YR6/6, increasing weathered material (sandstone). pH 8.5.	 
TP023 A	618901	7555495	A2	Detailed pit	Dermosol	18/11/11	cleared	Firm sandy, non-cracking surface. Some mixed lateritic gravels. Slope 1%.	A1 0 – 30cm. 10YR5/4, Sandy clay . pH 6.0, weak polyhedral, hard, dry, abrupt to; B21 30 – 70cm. 10YR4/3, sandy clay, strong platy, firm, pH7.0, roots common, dry, few rounded gravels to 1cm (<5%), gradual to; B22 70- 170cm. 10YR6/8, silty clay, very firm, moderate polyhedral, pH 9.0, 10% yellow grey mottles, moist, gradual; D1 170cm+ sandy clay loam, 10YR5/6, massive.	 

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP024	616802	7556439	B2	Detailed pit	Black vertosol	11/11/11	Scattered Sally Wattle. Pastures	Weak cracking and crusting. Minor rock <5% gravels.	A1 0 – 3cm. 10YR3/3, Coarse granular mulch. pH 7.0, medium clay, dry, abrupt to; B21 3 – 60cm. 10YR3/2, medium clay (silty), coarse polyhedral, firm, pH 7.5, roots common, dry, few rounded gravels to 1cm (<5%), gradual to; B22 60-100cm. 10YR3/2, medium clay, soft, moderate polyhedral, pH 8.0, minor roots <1% moist, gradual; B23 100 -160cm. 10YR3/3, light sandy clay, soft, weak blocky, pH 7.0. C 100cm weathered rock.	 
TP025	No site	-	-	-	-	-	-	-	-	-
TP026	620103	7556381	A2	Detailed , pit	Kurosol	14/11/11	Cleared for pastures.	Gently undulating plain. Surface firm sandy. Slope 1.5%	A11 0- 30cm. Fine clayey sand, 10YR3/4, weak blocky, roots common, pH 5.0, clear; A12 30- 50cm. sandy loam, firm, massive,, 10YR3/4, pH 5.5, B21 50- 130cm. silty clay, 10YR6/8, weak polyhedral, 5% mottling,(red), 5% gravels, pH 7.5, gradual, B22 130 – 200cm. Medium clay, very firm, 10YR6/3, pH 9.0, C 60 – 130cm weathered bedrock. 2.5YR4/4. Hard rock at 130cm	 

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP027	618884	7556899	C2	Detailed , pit	Dermosol	14/11/11	Cleared for pastures. Near a soil boundary. Not representative A3 or C2	Gently undulating. Slope <0.5%	A1 0- 40cm. Fine sandy clay loam, 10YR3/3, weak blocky, roots common, pH 5.5, clear; B21 40- 60cm. Light medium clay, 10YR2/1, moderate polyhedral, pH 8.0, C 60+cm weathered bedrock	 
TP028	618103	7556385	A3	Detailed , pit	Black vertosol	12/11/11	Cleared for pastures.	Undulating plain slope <0.5. 15% surface stone.	A1 0- 4cm strong granular mulch, 10YR2/2, medium clay, B21 4- 110cm Medium clay, 10YR2/1, strong lenticular, smooth, firm, pH 7.5, moist, C 110cm. hard rock	 
TP029	No site	-	-	-	-	-	-	-	-	-

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP030	618364	7558117	A3	Detailed, pit	Vertosol	14/11/11	cleared	Cracking, weak crust. Nil rock. Slope 1.5%	A1 0-50cm, Medium Clay, 2.5YR3/6, blocky peds, dry moisture content, pH 8.0, gradual boundary; B21 50-80cm, Light Clay, 7.5YR3/6, lenticular peds, dry/moist, pH 8.0; BC 80-90cm Weathered and gravelly clayey sand, 2.5YR7/2, dry moisture content, pH 8.0; C 90-110cm, Weathered yellow rock, 2.5YR7/2, dry moisture content, pH 8.0. End of the borehole at 110cm.	  

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP031	620111	7558398	C1	Detailed, pit	Sodosol / Chromosol	14/11/11	Mostly clear of original vegetation for pasture	Surface hard and sandy. Nil rock. Slope 1.5%. Gently undulating plain.	A11 0-10cm, Loam fine sandy, 10YR3/2, polyhedral peds, dry moisture content, pH 5.5, clear boundary; A21 10-30cm, sandy clay loam, stiff structure, 10YR3/4, polyhedral peds, appears to be sporadically bleached, few roots observed, dry moisture content, pH 5.5, clear boundary; B21 30-50cm, Medium clay, 10YR4/4, slicken sides, dry/moist moisture content, pH 8.0, gradual boundary; B22 50-100cm, Heavy Clay, 10YR3/4, dry/moist moisture content, pH 6.0, gradual boundary; BC 100-130cm, Sandy Clay, 7.5YR4/4, dry/moist moisture content, abrupt boundary; C 130-180cm, Weathered shale, dry moisture content. End of borehole at 180cm.	
TP032	No site	-	-	-	-	-	-	-	-	-

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP033	612594	7552748	C2	Detailed pit	Dermosol	l15/11/11	cleared		A1 0-40cm, Silty clay, 5YR3/2, stiff, blocky, gravel <50%, sub-angular cobbles, Ironstone, roots <1.5cm dia, dry moisture content , pH 7.0, clear boundary; B21 40-90cm, heavy clay, stiff, blocky peds, sub-angular gravel <5%, dry/moist moisture content, pH 8.0, diffuse boundary; B22 90-130cm, Light Clay, 7.5YR4/4, stiff, polyhedral peds >20%, sub-angular gravel, dry/moist moisture content, pH 8.5, possible weathered bedrock, diffuse boundary; C 130-150cm, Bedrock. End of borehole at 150cm.	 
TP034	611102	7556394	A3	Detailed pit	Brown Vertosol	17/11/11	Detailed 17/11/2011	Cracking surface	A1 0-40cm, light medium clay, very firm polyhedral peds, 10YR4/4, sub-rounded ironstone and gravel 30-50%, roots observed, soil cracking in top 40cm at <1cm, dry moisture content, ph 6.5, diffuse boundary; B21 40-80cm, Light medium clay , 10YR4/3, very firm, 20-30% ironstone, gravels sub-rounded, apedal, grey mottles <5%, moist moisture content, pH 7.5, diffuse boundary; B22 80-175cm, Medium heavy clay, very firm, lenticular peds 2-5cm slicken sides, 20-30% grey mottles, evidence of old roots present, large sub-rounded cobbles, moist moisture content, pH 5.0. End of borehole at 175cm	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP035	611660	7557328	C2	Detailed pit	Chromosol	17/11/11	Detailed 17/11/2011		A1 0-40cm, Sandy Clay, 5YR3/2, firm, sub-rounded <50% gravel, apedal, roots <0.5cm, dry moisture content, pH 5.5, clear boundary; B2 40-190cm, Heavy Clay, 10YR4/4, firm sub-rounded, sub-angular gravel <0.5cm <5%, minor roots <0.5cm, minor dark mottles <0.5cm, weak lenticular peds, slickensides, moist moisture content, pH 9.0. End of borehole at 190cm.	 
TP036	614713	7556930	B1	Detailed pit	Black vertosol	5/11/11	Cleared for pastures	weak cacking Surface stone & cobbles 30-40%.	A1 0-20cm, Light medium clay, 10YR2/1, cobbles approximately 30-40%, roots observed <10%, large blocky peds, pH 7.0, no cracking observed, clear boundary; B22 20-40cm, Medium clay, 10YR2/1, roots observed <5%, coarse gravel 15%, slickensides, polyhedral peds, pH 7.0, distinct boundary; C 40-70cm, Weathered rock (sandstone) with sandy clay, grey with white and yellow mottles 10YR4/2, pH 8.0. End of Borehole at 70cm.	 
TP037	No site	-	-	-	-	-	-	-	-	-

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP038	616635	7558400	B2	Detailed pit	Black vertosol	11/11/11	Scattered Bloodwood and Sally Wattle	Weak cracking with thin sandy crust. Minor rock <5% gravels. Few basalt cobbles (<10%)	A1 0-40cm Medium clay, 10YR 2/1, very firm with polyhedral peds, cobbles and fine to thick roots <2cm, dry/moist moisture content, pH 7.0 , diffuse boundary; B21 40-80cm Very light clay, 10YR2/1, polyhedral peds, slickensides, stone and boulders, moist moisture content, pH 8.0, clear boundary; BC 80-100 Sandy clay, 10YR3/3 with grey weathered rock, weak structure, moist moisture content, pH 8.0. Refusal on weathered shale type bedrock at 100cm.	
TP039	615519	7559003	A3	Detailed pit	Black vertosol	11/11/11	Cleared for improved pastures	Strong self mulching and cracking Minor rock <5% gravels. Few basalt cobbles (<5%). Slope 1%.	A11 0-10 firm Light clay, 10YR2/1, coarse white rounded sand throughout <5%, polyhedral peds,dry moisture content, pH 7.0; A12 10-50cm very firm Medium clay, 10YR2/1, lenticular peds, coarse sand <5%, dry/moist moisture content, pH 7.0; B21 50-90cm very firm heavy clay, lenticular and slickensides, moist, pH 6.0 , clear boundary; C1 90 – 160cm Sandy Clay loam, 10YR5/8, weathered grey rock observed, moist moisture content, pH 6.0, abrupt boundary; C2 160-200cm Clayey Sand, 10YR3/3, effectively weathered rock, dry/moist moisture content, pH 8.0. End of the borehole at 200cm.	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP040	614616	7559445	B2	Detailed pit	Black vertosol	28/10/11	Cleared for improved pastures	weak cracking 10% basalt cobble. Slope 1.5%	A1 0 – 4 cm. 10YR3/2, Strong granular mulch. pH 6.5, light medium clay, dry, abrupt to; B21 4 – 80cm. 10YR2/1, medium clay, strong polyhedral, firm, pH7.5, roots common, dry , rounded pale gravels to 1cm (<5%), gradual to; B22 80-130cm. 10YR2/1, light medium clay, moderate lenticular, pH 7.5, minor roots <1% rounded sandstone gravel , moist, gradual; BC 130 -170cm. 7.5YR6/6, fine sandy clay loam, increasing weathered material (sandstone or shale) 5YR7/1. 5% quartz gravel.	
TP041	617512	7559429	C1	Detailed pit	chromosol	D,B 11/11/11	Cleared for pastures. Grazing	Sandy, very firm. <5% gravels.	A1 0 – 40cm Fine sandy loam, 10YR3/4, Stiff blocky peds, undeveloped smooth faces, dry moisture content, pH 6.5, clear boundary; B21 40-60cm Light clay, 10YR3/6, firm sub-rounded peds, slates and disperses on contact with water, dry/moist moisture content, pH 8.0, diffuse boundary; B23 60-80cm Layer of white weathered shale type of rock, diffuse boundary; B22 80-100cm Medium clay, 7.5YR5/6, grey mottles, disperses on contact with water, dry/moist moisture content, pH 7.5, abrupt boundary. End of borehole at 100cm	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP042	617950	7560519	C1	Detailed pit	Kandosol	11/11/11	Poisoned eucalypt now grassland.	Flat old alluvial plain. Slope <0.5%	A11 0-30cm stiff Sand, , 10YR5/4, massive structure, roots observed, dry moisture content, pH 7.0; sharp boundary; A12 30-60 very soft Sand, 10YR4/4, massive structure, dry/mnoist structure, pH 8.0, abrupt boundary; B21 60-120cm firm Sandy clay, 7.5YR5/8, red and grey mottles 10YR6/4, soil disperses when immersed in water, dry/moist moisture content, pH 8.0, clear boundary; B22 120-150cm as above, structure is firmer, 10YR6/6 with black mottles present, pH 9.0. End of borehole is 1.5m	 
TP043	No site	-	-	-	-	-	-	-	-	-

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP044	617044	7560930	A1	detailed	Dermosol	11/11/11	Mixed eucalypt open forest. Extensive thinning.	Firm sandy. Minor rock with <5% gravels. Slope <0.5%	A1 0-20cm Fine sandy clay loam, 10YR2/1, stiff apedal structure, coasre gravel throughout and roots <5%, dry moisture content, pH 7.0, clear boundary; B21 20 -60cm Light clay, very firm, 10 YR3/2, angular polyhedral peds, fine, angual gravel and fine roots, dry/moist moisture, pH 8.0, clear boundary; B22 60 – 90cm Medium clay, 10YR4/4, minimal to nil pedal structure, yellow and red coarse sand present, dry/moist moisture content, pH 8.0, diffuse boundary; B23 (B23) 90-140cm Heavy clay, 10YR3/3, coarse white and red sand, black mottles 10YR2/, angular polyhedral peds, dry/moist moisture content, pH 8.0, diffuse boundary; BC Medium clay, 10YR5/1, grey mottles, weathered sandstone suspected, pH 8.0. End of borehole at 150cm.	 

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP045	616015	7561335	A1	Detailed pit	Dermosol	20/11/11			A1 0-40cm, fine Sandy Clay Loam, hard, lenticular peds, 10YR3/6, roots observed fine <10%, dry moisture content, pH 5.0, clear boundary; A21 40-60cm, Medium clay, 7.5YR4/6, thick roots 10%, blocky peds, dry moisture content, pH 5.5, clear boundary; B21 60-100cm, Heavy clay, fine, polyhedral peds, black and grey mottles, dry moisture content, pH 7.0, gradual boundary; B22 100-170, Light Medium Clay, soft, 5YR4/6, weak, polyhedral peds, dry/moist moisture content, pH 6.5; B23 170-230cm, Sandy Clay Loam, 7.5YR5/6 apedal, nodules present, moist moisture content, pH 8.0, operate advised on softer conditions. End of borehole at 230cm.	 
TP046	615074	7560608	A3	Detailed pit	Black vertosol	31/10/11	Cleared with strong grass cover 80%.	cracking with minor rock <5% and few small gravels.	A1 0 – 10cm. 10YR3/2, Coarse granular mulch. pH 6.0, light clay, dry, abrupt to; B21 10 – 80cm. 10YR2/1, medium clay, polyhedral, firm, pH7.5, roots common, dry , 10% basalt rocks to 60mm ; C 60cm+ Hard rock / boulders. Basalt.	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP047	613608	7560387	B2	Detailed	Black Vertosol	20/11/20			A1 0-20cm, Light Clay, 10YR2/1, blocky peds with roots, dry moisture content, pH 7.0, clear boundary; B21 20-40cm, Light Medium Clay, 10YR2/2, polyhedral peds, dry/moist moisture content, pH 6.5, gradual boundary; B22 40-90cm, Medium clay, lenticular peds, coarse gravel entering profile, moist moisture content, pH 7.5; C 90-100cm, Weathered rock. End of borehole at 100cm.	 
TP048	608142	7560430	A3	24/11/11	Red/Brown Dermosol	Detailed	Non racking		A11 0-15cm, Silty Clay Loam, 10YR3/3, angular polyhedral peds, stiff, dry moisture content, pH 6.5; clear boundary; B21 15-40cm, Medium clay, angular polyhedral peds with slickensides, 2.5YR3/4, dry/moist moisture, pH 7.0, gradual boundary; B21 40-90cm, Medium Clay, lenticular peds and slickensides, white and grey mottles 10YR3/4, dry/moist moisture content, pH 8.0, clear boundary; B22 90-160cm Light Medium Clay, weak polyhedral peds, 10YR4/4, pH 8.0; C 160-200cm, Weathered rock. End of borehole at 200cm.	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP049	609071	7562038	C2	Detailed, Pit		24/11/20	Mostly clear of original vegetation.	Gently undulating plain, Midslope. Slope 1.5%. Nil surface stone. Surface sandy, firm, weak cracking	A11 0- 30 cm, Silty clay, 10YR5/4, weak subangular blocky, coarse gravel and round quartz 10%, dry, pH 7.0 , sharp boundary; B21 30- 60cm Medium clay 10YR5/6, coarse polyhedral peds, rounded ironstone gravel 10%, dry, pH 8.0, abrupt boundary; B22 60-80cm, Light medium clay, 7.5YR5/8, moderate polyhedral peds, dry, pH 8.0; abrupt boundary; C 80- 110cm. Weathered rock, potentially sandstone, dry . End of borehole at 110cm.	
TP050	607045	7562564	C1	Detailed, pit	Sodosol / chromosol	. 22/11/11	Extensive clearing for pasture.	Firm sandy.	A11 0-20cm, Fine Sandy Loam, 7.5YR3/4, massive with plentiful roots, dry moisture content, pH 5.0, clear boundary; A12 20-60cm, Sandy Gravel, 10YR4/6, very weak structure, coarse gravel 40%, dry moisture content, pH 5.5, clear boundary; B21 60-130cm, Sandy clay, 10% coarse rounded gravel with sand, 5% mottles, dry moisture content, pH 5.5, clear boundary; B22 130-150cm, Medium Clay, 10YR5/4, polyhedral peds, dry moisture content, pH 8.0, clear boundary; C 150-160cm, Weathered rock, dry moisture content. End of borehole at 160cm.	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP051	609607	7563402	C2		chromosol	22/11/11			A11 0-20cm, Sandy Clay Loam, blocky smooth faced peds, 7.5YR3/2, dry moisture content, pH 5.0, clear boundary; A12 20-40cm, Loam Fine Sandy, 10YR3/4 sub-rounded polyhedral peds, dry moisture content, pH 6.0, abrupt boundary; B21 40-80cm, Silty Clay, 10YR5/6, coarse angular sand, angular polyhedral peds, red mottles, Dry moisture content, pH 5.0, gradual boundary; B22 80-150cm, Light Clay, 10YR5/4, platy polyhedral peds and grey mottles, dry/moist moisture content, pH 8.0, clear boundary; B23 150-190cm, Heavy clay, 5YR5/6, white and black mottles from weathered rock, pH 8.5; C 190-200cm, Weathered Rock End of borehole at 200cm.	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP052	607112	7564678	C1		Chromosol	22/11/11	OUT OF SURVEY AREA		A11 0-20cm Fine Sandy Loam, with course gravel (40%), 10YR2/2, dry, pH5, very stiff A1220-60cm Light clay 10YR3/4 w/ angular polyhedral peds w/ black mottles and fine sand (5%), dry, pH5.5, abrupt boundary B21 60-110cm Medium clay, 10YR5/4, w/ angular lenticular peds, stiff, gradual boundary, pH9 110-145cm White weathered rock, 10YR7/1, w/ fine red sand, sharp boundary, pH9 145-190 Clay loam, firm, 2.5Y4/4, pH9 190-220 Medium clay, firm, 2.4Y5/0, clear, very plastic, pH9	
TP053	608606	7564887	B2		Vertosol	22/11/11		Cobbles from surface to 30cm	A11 0-20 cm, 10YR2/4 pH6, light clay with course sand and smooth blocky peds, roots 10%, dry, clear B21 20-60cm, Light medium clay, 10YR2/1 pH5.5, lenticular peds, w/5% red fine sub angular gravel, dry B22 60-90cm Heavy clay, 10YR3/2, lenticular peds, pH8, clear, moisture B23 90-170cm+Heavy clay, 10YR3/4, lense/lenticular peds, black mottles, white weather sandstone 170-200cm, Silty clay, w/5% sand component, 10YR5/6	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP054	610116	7564383	A1		Arenic Rudosol	Detailed, 22/11/11			A11 0-20cm, Loam Fine Sandy, soft, weak blocky peds, 10YR4/4, roots observed 15%, dry moisture content, pH 5.5, clear boundary; A12 20-30cm, Sandy Loam, 10YR3/6, massive structure <10%, dry moisture content, pH 6.0, abrupt boundary; B21 30-100cm, Light Sandy Clay Loam, massive structure, moist moisture content, pH 7.5, abrupt boundary; 100-110cm, Rounded gravel, 10YR5/8, moist moisture content, pH 7.0, abrupt boundary; D1 110-160cm, Silty Clay Loam, 10YR5/6, coarse sand10%, grey and red mottles 10YR6/3 and 10R4/6, moist moisture content, pH 5, gradual boundary; D2 160-200cm, Light Medium Clay, massive structure with coarse sand 5%, red and orange mottles , moist moisture content, pH 5.0. End of borehole at 200cm.	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP055	611119	7564887	C2		Dermosol /Kurosol	Detailed, 21/11/11	-	-	A11 0-20cm, Sandy Loam, weak polyhedral peds, roots (10-20%), dry moisture content, pH 5.0, gradual boundary; A12 20-60cm, Sandy Clay Loam, massive structure, 7.5YR4/4, dry moisture content, pH 5.5, clear boundary; A13 60-90cm, Loam Fine Sandy, 7.5YR5/8, sub-angular polyhedral peds, dry moisture content, pH 5.0, clear boundary; B21 90-120cm, Sandy Clay, 7.5YR4/8, lenticular peds, red mottles, coarse gravels 30%, dry/moist moisture content, pH 5.5 ; B23 120-160cm, as above, red mottles fading out throughout profile, <10% gravel, gradual boundary; C1 160-200cm, weathered rock, 7.5YR6/4, massive structure, white and red mottles 7.5YR4/4, pH 4.5,. End of borehole at 200cm.	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP056	612466	7563706	C1		Chromosol	Detailed, 21/11/11	-	Firm sandy non cracking	A11 0-10cm, Fine Sany Loam, polyhedral peds, roots, 7.5YR4/3, dry moisture content, pH 5.0; clear boundary; A12 10-30cm, Sandy Clay Loam, polyhedral peds, 7.5YR3/2, dry moisture content, pH 5.5, roots common abrupt boundary; B21 30-60cm, Light Medium Clay, 10YR6/6, 5% dark grey mottles, 5% small (<4mm) , coarse hard blocky, ironstone nodules and angular gravel, dry moisture content, pH 8.0, slowly drained, gradual boundary; B22 60-110cm, Sandy Clay with fine gravels 10%, columnar peds, fine roots and black mottles, dry moisture content, pH 9.0, diffure boundary; B23 110-160cm, Sandy Clay, 10YR6/6, angular polyhedral peds, pale yellow and black mottles, dry moisture content, pH 9.0; B24 160-190cm, as above, Heavy Clay, dry/moist moisture content, pH 9.0. End of the borehole at 190cm.	
TP057	613110	7561911	B2		Rudosol/ Vertosol	Detailed, 22/11/11	-	Cracking soils to 40cm	A1 0-30cm, Medium Clay, polyhedral peds, stones and cobbles 20%, dry moisture content, pH 4.5, B1 30-60cm, Heavy Clay, lenticular smooth faced peds, stones and cobbles 40%, dry moisture content, pH 5.0; BC 60-70cm Weathered rock End of the borehole at 70cm.	

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP058	614573	7563434	A1		Kurosol	Detailed, 20/11/11	-	-	A1 0-10cm, Loam, soft polyhedral peds, rocks present, 7.5YR4/4, Dry moisture content, pH 7.5, clear boundary; A21 10-20cm, Silty Loam, very stiff, polyhedral peds, 10YR3/6, dry moisture content, pH 5.5, clear boundary; B1 20-40cm, Light Clay, stiff, 5YR4/6, blocky peds, dry moisture content, pH 4.5, clear boundary; B21 40-60cm, Medium Clay, stiff, blocky peds, 7.5YR4/6, dry/moist moisture content, pH 6.5, gradual boundary; B22 60-150cm, Sandy Clay Loam, polyhedral, sub-angular peds, dry/moist moisture content, pH 7.0; B23 150-200cm, Silty Clay, 10YR4/6, weak angular polyhedral peds, dry/moist moisture content, pH 8.0. End of borehole at 200cm.	 

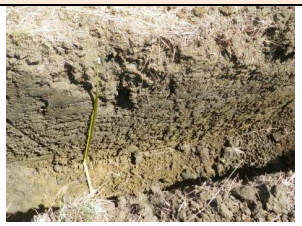
Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP059	615130	7562437	A1		Chromosol	Detailed 20/11/11	-	-	A11 0-20cm, Silty Loam, 10YR3/6, lense peds, stiff, dry moisture content, pH 5.0, gradual boundary; A12 20-50cm, Sandy Loam, fine, 10RY3/4, stiff angular polyhedral peds and roots, dry moisture content, pH 5.5, clear boundary; B21 50-110cm, Silty Clay, 10YR3/6, very firm, rough peds, roots, dry/moist moisture content, pH 7.0, clear boundary; B22 110-160cm, Medium clay, 10YR3/4, very firm blocky peds with rough faces, dry/moist moisture content, pH 7.5, gradual boundary; B23 170-210cm, Light Clay, very plastic, firm, 10YR4/6, angular lenticular peds, moist moisture content, pH 9.0. End of borehole at 210cm.	 

Site no	Location GDA94 zone 55		SMU	Site Type.	AS class	Date	Land use, disturbance,	Landform, surface,	Soil Profile Description Horizon, depth (cm), structure, colour,	Photo (s)
TP060	615612	7564179	A1		Chromosol	Detailed 20/11/2011	-	-	A11 0-20cm, Sandy Loam, 10YR3/4, polyhedral peds (elongated), thick roots observed 10%, dry moisture content, pH 5.0 , clear boundary; B21 20-50cm, Light Clay with minor sand content, 10YR5/8, angular polyhedral peds, dry moisture content, pH 6.5, clear boundary; B22 50-80cm, Medium clay, 10YR6/6, weak polyhedral peds, white mottles and Mn nodules , dry moisture content, pH 7.5, clear boundary; B23 80-170cm, Sandy Clay, 10YR6/4, blocky angular but weak peds, white mottles 10YR7/3, dry moisture content, pH 8.5 gradual boundary; B24 170-200cm Medium clay 10YR6/1, no structure present, white and grey mottles, pH 8.5. End of borehole at 200cm.	 

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP061	No site								
TP062	620080	7547606	A3	Black vertosol	D,B 17/11/11	Cleared for grazing pastures. Sally Wattle regrowth. Thick grass cover (>80%)	Gently undulating plain. Cracking, firm sandy Minor surface gravel <5%, Nil microrelief Slope 2%. ERD > 100cm	A1 0 – 30cm. 10YR3/2, stiff granular , pH 7.5, medium clay, dry, abrupt; B21 30– 110cm. 10YR3/1, medium clay, hard subangular, smooth peds, pH7.5, well drained, roots <2%, dry, gradual to; B23 110- 180cm+ 10YR4/3, light medium clay, moderate lenticular structure, firm ,pH 7.5	 0 – 50cm  120 – 180cm
TP063	No site	-	-	-	-	-	-	-	-
TP064	No site	-	-	-	-	-	-	-	-
TP065	No site	-	-	-	-	-	-	-	-

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP066	611613	7553380	B2	Black vertosol	D,B 15/11/11	Cleared for grazing pastures	Cracking, coarse granular mulch. Surface cobble (>20mm) 20%. Nil microrelief ESD 100cm	A1 0 – 5cm. 10YR3/2, strong granular , pH 7.5, light clay, dry, abrupt to; B21 5- 20cm. 10YR3/1, medium clay, firm subangular blocky, pH7.5, 15% basalt rock to 15cm, well drained, roots common, moist, gradual to; B22 20-100cm. 10YR3/1, medium clay, lenticular firm, pH 9.0, soft carbonate 5-10%, well drained, some cobble (5%), roots common , moist, gradual to; C 100cm weathered bedrock,	
TP067	No site	-	-	-	-	-	-	-	-

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP068	612444	7553727	B2	Black vertosol	D,B 15/11/11	Cleared for improved pastures. Minor regrowth of acacias.	Cracking, coarse granular mulch. Surface cobble (>20mm) 20%. Nil microrelief ESD 90cm	A1 0 – 5cm. 10YR3/2, strong granular , pH 7.5, light clay, dry, abrupt to; B21 5- 30cm. 10YR3/1, medium clay, firm blocky, pH6.0, well drained, roots common, moist, gradual to; B22 30 - 90cm. 10YR3/1, medium clay, lenticular firm, pH7.0, slowly drained,some cobble (5%), roots common , moist, clear to; C 90cm weathered bedrock,	
TP069	No site	-	-	-	-	-	-	-	-
TP070	617800	7584071	A2	Kandosol	D,B 16/11/11	Cleared for improved pastures. Minor regrowth of acacias.	Sandy firm, non-cracking Nil microrelief. ESD restricted to 50cm due to very hard sandy clay and rock content	A1 0-30cm. Light sandy clay, firm granular to weak blocky, roots common,20% small rounded quartz gravels, pH 8.5, abrupt to; B21 30 – 80cm. 5YR5/4, sandy clay, hard weak prismatic, >50% rock & cobble to 40cm diameter, soft lime (10%), fine roots only to 50cm, poor drainage, pH 9.0. B22 80- 140cm. Sandy clay 5YR4/4, massive with 30% soft lime, pH 9.0. C 140cm hard bedrock, sandstone.	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP071	614380	7553277	B2	Black vertosol	D,B 12/11/11	Cleared for improved pastures. Minor regrowth of acacias.	Cracking, self mulching Minor surface gravel <5%, Nil microrelief ERD > 100cm	A1 0 – 3cm. 10YR3/2, Strong granular , pH 7.0, light clay, dry, abrupt; B21 3– 40cm. 10YR3/1, light medium clay, strong subangular blocky, firm, pH7.0, well drained, roots common, moist, gradual to; B22 40– 100cm. 10YR3/1, medium clay, firm lenticular, pH 8.0, well drained, moist. 20% soft lime, clear to; B23 100- 150cm+ 10YR4/3, light clay, weak structure, soft,pH 8.0	
TP072	No site	-	-	-	-	-	-	-	-
TP073	615615	7553380	A3	Black vertosol	D,B 12/11/11	Cleared for improved pastures. Minor regrowth of acacias.	Cracking, coarse granular mulch. Nil microrelief ESD >110cm	A1 0 – 5cm. 10YR3/2, strong granular , pH 7.5, light clay, dry, abrupt to; B21 5- 30cm. 10YR3/1, light clay, firm blocky, pH7.5, well drained, roots common, moist, gradual to; B22 30 - 120cm. 10YR3/1, medium clay, lenticular firm, pH7.5, slowly drained,some small gravel <5mm, roots to 100cm , moist, gradual to; C 120-160cm weathered bedrock, 2.5Y5/4, pH 8.0, 50% gravel <0.5cm diameter	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP074	614943	7554749	B2	Black vertosol	D,B 12/11/11	Open downs, occasional Mountain Coolibah	Cracking, self mulching Nil microrelief 0% slope ESD > 110cm	A1 0 – 5cm. 10YR2/1, Strong granular , pH 7.0, light clay, dry, abrupt; B21 5– 20cm. 10YR2/1, light medium clay, strong subangular blocky, firm, pH9.0, well drained, roots common, moist, gradual to; B22 20– 130cm. 10YR3/1, medium clay, firm lenticular, pH 9.0, well drained, moist. 20% soft lime, clear to; C 130cm+ weathered bedrock.	
TP075	614099	7554416	B2	Black vertosol	D,B 15/11/11	Leucaena crop nearby. Cleared of vegetation.	Cracking, coarse granular mulch. Minor surface basalt stone (20%) to 10mm. Nil microrelief ESD 110cm	A1 0 – 5cm. 10YR3/2, strong granular , pH 7.5, light clay, dry, abrupt to; B21 5- 30cm. 10YR3/2, medium clay, firm blocky, pH8.5, well drained, roots common, moist, trace soft lime,gradual to; B22 30 - 110cm. 10YR3/3, medium heavy clay, lenticular firm, pH7.0, slowly drained,some cobble (5%), roots common , moist, clear to; C 110cm weathered bedrock.	 
TP076	No site	-	-	-	-	-	-	-	-

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP077A	612423	7554428	B2	Brown vertosol	D,B 24/11/11	Minor regrowth of Whitewood and Bauhinia.	Weak cracking, coarse granular mulch. Nil microrelief ESD 60-70cm	A1 0 – 5cm. 7.510YR3/4, coarse granular , pH 7.5, light sandy clay, dry, abrupt to; B21 5- 40cm. 10YR4/4, medium clay, hard blocky, pH 6.0, very slowly drained, roots common, moist, gradual to; B22 40 - 90cm. 10YR5/4, medium heavy clay, blocky hard, pH8.0, slowly drained, some cobble (5%), few roots below 50cm, slight mottling increasing below 60cm, moist, clear to; B23 90 -140cm light medium clay, hard, 10YR4/6, poor drainage. C 140cm weathered shale	
TP078	No site	-	-	-	-	-	-	-	-
TP079	615062	7554215	B2	Black vertosol	D,B 12/11/11	Cleared. Leucaena crop nearby.	Cracking, self mulching Nil microrelief ESD > 110cm	A1 0 – 5cm. 10YR2/1, Strong granular , pH 7.0, light clay, dry, abrupt; B21 5– 30cm. 10YR2/1, medium clay, strong subangular blocky, firm, pH8.0, well drained, roots common, moist, gradual to; B22 30– 120cm. 10YR2/1, medium clay, firm lenticular, pH 8.0, well drained, moist. Trace of soft lime, small layer of lateritised rocks at 90cm. clear to; BC 120-140cm sandy clay loam, massive, increasing gravels, 10YR36/1. C 140cm+ weathered bedrock.	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes	
TP080	612112	7556391	A3	Black vertosol	D,B 15/11/11	Cleared for improved pastures. Nil regrowth. Pasture cover >80%	Cracking, coarse granular mulch. Surface cobble (>20mm) 20%. Nil microrelief ESD 100cm	A1 0 – 5cm. 10YR3/2, strong granular , pH 7.5, light clay, dry, abrupt to; B21 5- 20cm. 10YR3/1, medium clay, firm subangular blocky, pH7.0, 15% basalt rock to 15cm, well drained, roots common, moist, gradual to; B22 20-120cm. 10YR3/1, medium clay becoming light clay by 100cm, lenticular firm, pH 7.0, roots common to 90cm, moist, gradual to; B23 120-130 10YR5/2, light medium clay, firm blocky C 130cm weathered bedrock (basalt).		
TP081	No site	-	-	-	-	-	-	-	-	-
TP082	615023	7555281	B2	Brown vertosol	D,B 12/11/11	Cleared. Leucaena crop	Alluvial deposition soil stratified Weak cracking, self mulching – fine sandy. Nil microrelief ESD 90cm	A1 0 – 30cm. 10YR2/1, blocky , pH 6.0, sandy clay, dry, abrupt to; B21 30– 70cm. 10YR2/1, heavy clay, subangular blocky firm, pH6.0, imperfect drainage, roots common, moist, gradual to; B22 70 - 100cm. 10YR3/2, fine sandy clay, lenticular firm, pH 7.0, imperfectly drained, few roots , moist, gradual to; D1 100-160cm sandy clay loam, 10YR3/2, massive, well drained, some roots , pH 7.5 D2 160-200cm heavy clay, very hard and mottled 10YR4/4, pH 8.0		
TP083	No site	-	-	-	-	-	-	-	-	-

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP084	616015	7555065	A3	Brown vertosol	D,B 12/11/11	Regrowth	Weak cracking, coarse granular mulch. Nil microrelief ESD 90cm	A1 0 – 3cm. 10YR3/2, granular , pH 6.0, sandy clay, dry, abrupt to; B21 3– 60cm. 10YR3/3, light sandy clay, blocky hard, pH6.5, poorly drained, roots common, moist, gradual to; B22 60 - 60cm. 10YR4/4, medium clay, coarser subangular blocky firm, peds <2cm, pH 7.0, very slowly drained, few roots , moist, gradual to; B23 60-80cm light clay, 10YR3/3, firm lenticular, well drained, roots common. pH 8.0 BC 80-100cm light clay, lighter colour with increasing PM material. 10YR4/6, pH 8.0 C 100-110cm + weathered bedrock, pH 7.5	
TP085	616114	7556416	A3	Black vertosol	D,B 12/11/11	Downs with occasional Mountain Coolibah and Sally Wattle	cracking, self mulching Nil microrelief ERD 60-70cm due to very hard structure in B23	A1 0 – 4cm. 10YR3/2, Strong granular , light clay, dry, abrupt; B21 4– 30cm. 10YR3/2, medium clay, polyhedral / angular, firm, pH8.5, well drained, roots common, trace soft lime, moist, gradual to; B22 30– 60cm. 10YR2/2, light medium clay, firm polyhedral, pH 7.5, well drained, moist, gradual to; B23 60-80cm 10YR2/1.very stiff heavy clay, hard blocky, few roots past 60cm, 5-10% orange mottles, C 80cm+ weathered bedrock, 7.5YR3/4 with 2.5YR4/6 extensive mottles.	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes	
TP086	No site	-	-	-	-	-	-	-	-	-
TP087	614112	7556392	B2rp	Black vertosol	D,B 12/11/11	Cleared with regrowth of Brigalow and Sally Wattle	Weak cracking, coarse granular mulch. Nil microrelief ESD 90cm	A1 0 – 20cm. 10YR2/1, blocky , pH 6.0, light clay, dry, abrupt to; B21 20– 90cm. 10YR2/1, stiff heavy clay, blocky hard, pH6.5, poorly drained, roots common, moist, gradual to; B22 90 - 150cm. 10YR4/4, medium clay, coarser subangular blocky firm, pH8.0, trace lime, very slowly drained, no roots , moist, gradual to; B23 150-190cm light clay, 10YR3/1, very weak structure, pH 8.0 BC 80-100cm light clay, lighter colour with increasing PM material. 10YR4/6, pH 8.0 C 100-110cm + weathered bedrock, pH 7.5		
TP088	615621	7557390	B1	Dark vertosol	D,B 12/11/11	Cleared for pastures. (80-90% cover. Odd Mountain Coolibah.	Weak crust, coarse granular mulch. Nil microrelief ESD 90cm	A1 0 – 3cm. 10YR3/2, granular , pH 7.0, sandy clay, dry, abrupt to; B21 3– 30cm. 10YR2/1medium clay, blocky hard, pH8.0, very slowly drained, roots common, moist, gradual to; B22 30 - 75cm. 10YR2/1, light medium clay, firm subangular blocky firm, pH 7.0, very slowly drained, common roots , moist, gradual to; B23 75-90cm medium clay, 10YR2/1, moderate lenticular, firm well drained, 5% coarse sand, few roots. pH 7.5 BC 90-100cm+ weathered bedrock, pH 7.5		

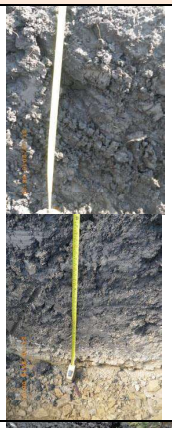
Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP089	615455	7556980	B1	Black vertosol	D,B 5/11/11	Cleared for pastures. (80-90% cover. Odd Mountain Coolibah	cracking, self mulching Nil microrelief ERD > 110cm	A1 0 – 10cm. 10YR2/1, Strong granular , 5% rounded quartz, pH 7.0, light clay, dry, abrupt; B21 10– 70cm. 10YR3/1, medium clay, lenticular, firm, pH8.0, well drained, roots common, moist, gradual to; B22 70– 120cm. 10YR3/2, light clay, soft angular blocky, pH 7.0, well drained, moist, gradual to; B23 120-180cm light medium clay, strong blocky, 5-10% yellow grey mottles, 10YR3/3. C 140cm+ weathered sandstone bedrock, 7.5YR3/4 with 2.5YR4/6 extensive mottles.	
TP090A	612809	7556209	A3	Brown vertosol	D,B 24/11/11	Minor regrowth of Bauhinia, Whitewood and Sally Wattle.	Weak cracking, 60% coarse surface gravel. Nil microrelief ERD 60-70cm	A1 0 – 10cm. 10YR3/6, massive , pH 5.0, light clay, dry, abrupt to; B21 10– 50cm. 10YR4/6, medium clay, weak blocky, firm, pH 8.0, slowly drained, roots common, moist, gradual to; B22 50– 100cm. 5YR4/4, heavy clay, firm blocky, pH8.0, well drained, roots common, moist, gradual to; B23 100-180cm. 5YR4/4 light clay weak to massive, pH 8.0.	

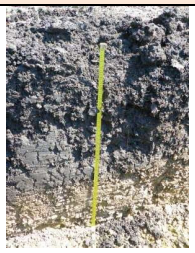
Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP091	613103	7556882	A3	Black vertosol	D,B 29/10/11	Cleared for pastures.	Weak cracking, Minor rock 5-10% mostly < 20mm diameter . Nil microrelief ERD 85cm	A1 0 – 30cm. 10YR3/1, Strong granular , 5% rounded quartz, pH 8.0, light clay, dry, abrupt to; B21 30– 60cm. 10YR4/2, medium clay, lenticular, firm, pH7.0, well drained, roots common, moist, gradual to; B22 60– 85cm. 10YR3/3, light medium clay, firm blocky, pH8.0, well drained, roots common, moist, gradual to; BC 85-140cm light clay with 50% rounded small gravels and angular rock, 10YR4/3. C 140cm+ weathered bedrock,	
TP092	613617	7556893	A3	Grey vertosol	D,B 31/10/11	Some Brigalow regrowth. Melon hole 15m long and 60-70cm deep. Very sparce vegetation in depression.	Drainage line – recent alluvial soil – stratified Non cracking, coarse sandy granular . ESD >110cm	A1 0 – 20cm. 7.5YR3/2, Strong subangular blocky , pH 7.0, medium clay, dry, abrupt to; A2 20-50cm. 7.5YR5/2sandy clay loam, weak to massive, significant coarse white sand component, pH 6.5, well drained, roots common, moist, gradual to; B21 50 - 130cm. 10YR2/1, medium clay, lenticular, firm, pH8.0, well drained, becoming coarser textured with depth with increasing mottles ,gradual to; B22 130-180cm+ soft grey weathered , fine silty loam basalt pH 7.5	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP093	614283	7557351	B2rp	Black vertosol	D,B 5/11/11	Downs with occasional Mountain Coolibah.	Weak cracking, Surface rock 30% gravels and cobble (>20mm diameter). Nil microrelief ERD 70cm	A1 0 – 20cm. 10YR2/1, weak granular , 30% rounded quartz, pH 7.0, medium clay, dry, abrupt to; B21 20– 50cm. 10YR2/1, medium clay, subangular, firm, pH7.0, well drained, roots common, moist, gradual to; C 50– 70cm+. weathered bedrock with gravels and rock.	
TP094	612617	7557348	A3	Brown vertosol	D,B 31/10/11	Cleared with minor regrowth of Sally Wattle and Brigalow.	Cracking, coarse granular mulch. Nil microrelief ESD 75cm	A1 0 – 3cm. 10YR3/2, granular , pH 6.0, sandy clay, dry, abrupt to; B21 3– 40cm. 10YR3/4, light clay, polyhedral firm, peds 5-8mm, pH 5.5, well drained, roots common, moist, gradual to; B22 40 - 60cm. 10YR4/4, medium clay, coarser subangular blocky firm, peds <2cm, pH 7.0, very slowly drained, few roots , moist, gradual to; B23 60-100cm heavy clay, 10YR3/6, hard coarse with 5-10% light mottles and some weathered sandstone. pH 8.0 C 100-110cm + weathered bedrock, pH 7.5	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP095	613625	7557428	B2rp	Black vertosol	D,B 30/10/11	Cleared with minor Sally Wattle regrowth.	Cracking, firm granular mulch Nil microrelief ESD 70cm	A1 0 – 2cm. 10YR3/2, Coarse granular , pH 6.0, light medium clay, dry, abrupt to; B21 2– 70cm. 10YR3/1, medium clay, subangular blocky, firm, pH6.0, well drained, roots common, moist, gradual to; C 70cm+ weathered bedrock – white basaltic material	
TP096	614066	7557826	B2rp	Black vertosol	D,B 30/10/11	Cleared with minor Sally Wattle regrowth.	Cracking, coarse granular mulch. Slope 1.5% Minor rock 5% small gravels. Nil microrelief ESD 95cm	A1 0 – 3cm. 10YR3/2, Strong granular , pH 8.5, light clay, dry, abrupt to; B21 3– 20cm. 10YR3/1, medium clay, subangular blocky firm, pH8.0, well drained, roots common, moist, gradual to; B22 20 - 95cm. 10YR3/1, medium clay, subangular blocky firm, pH8.0, well drained, roots common, moist, trace soft lime,gradual to; C 95-110cm+ weathered basalt bedrock, pH 8.0	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP097	612603	7557878	B2	Brown Vertosol	D,B 28/10/11	Cleared with no regrowth.	Surface firm sandy. Weak cracking No gravels. Slope 1% Nil microrelief ESD >100cm	A1 0-20cm. 10YR3/3, sandy clay , pH6.5, clear; B2120-40cm sandy clay, 10YR3/3, firm subangular blocky, pH 6.5, minor roots, B22 40-80cm. 10YR3/3, very firm subangular blocky, soft lime 5-10%, pH 9.0, 5% subrounded quartz, B23 80-130cm, 10YR4/3, sandy clay, firm subangular blocky, massive, some roots, <5% gravels BC 130- 200cm. Light medium clay, 2.5YR4/2, massive, 5% yellow mottles, no plant roots.	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP098	613114	7557890	B2	Black vertosol	D,B 29/10/11	Cleared, no regrowth.	Strong cracking with fine sandy surface. Nil microrelief Coarse small gravels (5%) with larger (20-30mm cobble (approx. 20%) ESD 50cm	A1 0 – 30cm. 10YR2/1, soft granular. Light clay, pH 6.0, moist, minor quartz small gravel, roots common abrupt to; B21 30 – 70cm. 10YR3/1, medium clay, strong lenticular, firm, pH 6.5, roots common, dry , slow drainage clear to; B22 70 - 110cm. 10YR2/1, heavy clay, firm lenticular, moist, pH7.0, some cobble and gravels up to 30%, slowly drained C 110 – 130 weathered material on hard rock @ 130cm	
TP099	613613	7558391	B2	Black vertosol	D,B 30/10/11	Cleared with minor Sally Wattle regrowth.	Midslope of undulating plain. Slope 1.5%. weak cracking Minor rock <5% gravels. Nil microrelief. Surface basalt cobble 6 – 20cm <2%. ESD >110cm	A1 0 – 20cm. 10YR3/2, Coarse granular , pH 8.5, light clay, dry, abrupt to; B21 20 – 90cm. 10YR3/1, medium clay, lenticular, firm, pH8.5, trace soft lime, well drained, roots common, moist, gradual to; B22 90-130cm. 10YR3/3, medium clay, moderate lenticular 20-30mm, pH 7.5, minor roots, moist, diffuse; C 130+cm weathered bedrock.	

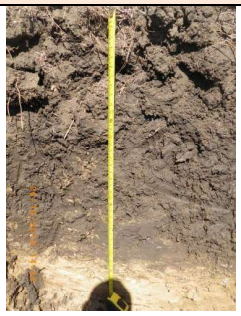
Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP100	614587	7558378	B2rp	Black vertosol	D,B 30/10/11	Cleared with minor Sally Wattle regrowth.	Cracking, coarse granular mulch. Minor rock 5% small gravels. Nil microrelief ESD 75cm	A1 0 – 3cm. 10YR3/2, Strong granular , pH 8.5, light clay, dry, abrupt to; B21 3– 20cm. 10YR3/1, silty clay, subangular blocky firm, pH6.0, well drained, roots common, moist, gradual to; B22 20 - 75cm. 10YR3/1, medium clay, subangular blocky firm, pH8.0, well drained, roots common, moist, trace soft lime,gradual to; C 75-110cm weathered basalt bedrock, pH 8.0	
TP101	615021	7558956	B2rp	Black vertosol	D,B 30/10/11	Cleared with minor Sally Wattle regrowth.	weak cracking, coarse granular mulch Minor rock <5% gravels. Nil microrelief ESD >110cm	A1 0 – 2cm. 10YR3/2, strong granular , pH 8.0, light clay, dry, abrupt to; B21 2– 30cm. 10YR3/1, medium clay, lenticular, firm, pH8.0, well drained, roots common, moist, gradual to; B22 30-70cm. 10YR3/2, medium heavy clay, firm polyhedral, pH 8.5, minor soft lime, minor roots, minor rounded gravels, moist, diffuse; B23 70 – 150cm. 10YR3/1, very firm lenticular 20-50mm, 5% basalt gravels, pH 9.0, 5-10% soft carbonate, C 150cm+ weathered bedrock – white basaltic material	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP102	614610	7558854	A3	Black vertosol	D,B 30/10/11		Cracking, self mulching Minor rock 5% small gravels. Nil microrelief ESD : 60cm	A1 0 – 4cm. 10YR3/2, Strong granular , pH 8.5, light clay, dry, abrupt to; B21 4– 60cm. 10YR3/1, light medium clay, lenticular, firm, pH6.0, well drained, roots common, moist, gradual to; C 60-110cm weathered bedrock, basalt, pH 8.5	
TP103	613937	7558954	A3	Black vertosol	D,B 29/10/11		Cracking, coarse granular mulch. Surface basalt cobble with fine gravels . Nil microrelief ESD – restricted by very hard B22 from 20cm. Estimated at 40-50cm effective depth.	A1 0 – 3cm. 10YR2/2, Strong granular , pH 6.0, light clay, dry, abrupt to; B21 3– 20cm. 10YR2/1,medium clay, subangular blocky, pH 6.0 , gradual to; B22 20 - 60cm. medium heavy clay, coarse and hard structure, poorly drained, very few roots (<5%), pH8.0 B23 60-130cm. 10YR3/1, medium clay, subangular blocky firm, pH8.0, well drained, roots common, moist, trace soft lime, gradual to; C 130-160cm 10YR4/6, soft weathered bedrock (sedimentary), extensive mottling, pH 6.5	 0-40cm 70 – 160cm

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP104	613113	7558889	A3	Black vertosol	D,B 30/10/11		Cacking and self mulching Nil microrelief ESD 100cm	A1 0 – 2cm. 10YR3/2, Coarse granular , pH 6.5, light medium clay, dry, abrupt to; B21 2 – 40cm. 10YR3/1, medium clay, lenticular, firm, pH7.0, well drained, roots common, 2% small gravel, moist, diffuse to; B22 40 – 100cm. 10YR3/1, medium clay, subangular blocky, firm, pH8.0, well drained, roots common, moist, C 100-130cm+. weathered bedrock.	
TP105	612615	7558383	B2	Black vertosol	D,B 30/10/11		weak cacking ESD 100cm Nil microrelief	A1 0 – 4cm. 10YR3/2, Coarse granular , pH 6.5, light clay, dry, abrupt to; B21 4 – 100cm. 10YR3/2, medium clay, subangular blocky, no mottles, firm, pH6.5, well drained, roots common, moist, diffuse to; C 100-130cm. weathered bedrock. pH 7.0	

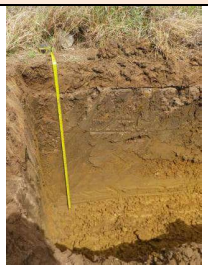
Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP106	611615	7558366	A3	Brown vertosol	D,B 28/10/11		Granular mulch, cracking Minor rock <5% , <10mm, gravels. Nil microrelief Slope 2% ESD 90cm	A1 0 – 10cm. 10YR4/2, granular. pH 6.0, sandy clay, dry, clear to; B21 10 – 40cm. 10YR4/2, sandy clay, granular, firm, pH6.0, roots common, dry , 2% rounded gravels to 1cm, diffuse to; B22 40-90cm. 10YR4/3, sandy clay, moderate lenticular peds (20mm), pH 8.5, minor roots, soft lime trace, <1% rounded sandstone gravel , pH 8.0 moist, gradual; C 90cm+ Weathered rock. Basalt. Whitish yellow with orange / purple granular with carbonate (soft). pH 9.0.	
TP107	611614	7558881	A3	Brown vertosol	D,B 28/10/11		Weak cracking, fine sandy, ESD 110cm Nil microrelief	A1 0 – 10cm. 10YR3/1, granular, pH 6.5, light clay, moderately dry, abrupt to; B21 10 – 110cm. 10YR3/1, Light medium clay, mod lenticular, well drained, pH 7.0, moist , clear to; BC 110-160cm. 2.5Y3/2, massive, increasing gravels, pH 8.0, C 160cm. weathered rock,	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP108	612361	7559138	A3	Brown vertosol	D,B 26/10/11	Mostly clear of vegetation.	Cracking, fine sandy Nil microrelief ESD 100cm	A1 0 – 30cm. 10YR3/1, subangular blocky, pH 7.5, light clay, moderately dry, abrupt to; B21 30 – 60cm. 10YR3/1, Light medium clay, polyhedral, firm, pH 7.0, moist , clear to; B22 60-100cm. 10YR3/1, medium clay, weak structure, pH 7.0, fine white soarse sand throughout, moist, clear; BC 100 -120cm. increasing weathered rock, D 120cm. hard rock	
TP109	613125	7559388	A3	Black vertosol	D,B 29/10/11		Cracking, self mulching Minor rock 5% small gravels. Nil microrelief ESD 70cm	A1 0 – 4cm. 10YR3/2, Strong granular , pH 8.5, light clay, dry, abrupt to; B21 4– 80cm. 10YR3/1, light medium clay, lenticular, firm, pH6.0, well drained, roots common, moist, gradual to; C 80-110cm weathered bedrock, extensive mottling, pH 8.0	
TP110	612116	7559881	B2	Black vertosol	D,B 28/10/11	Mostly clear of vegetation.	weak cacking Minor rock <5% gravels. Nil microrelief ESD >110cm	A1 0 – 30cm. 10YR3/1, Coarse granular mulch. pH 6.0, light clay, dry, abrupt to; B21 30 – 80cm. 10YR2/1, medium clay, lenticular, firm, pH7.0, roots common, dry , rounded gravels to 1cm (<5%), clear to; B22 80-130cm. 10YR2/1, light medium clay, moderate lenticular, pH 7.5, minor roots <1% rounded sandstone gravel , pH 8.0 moist, gradual; B23 130 -150cm. 10YR4/2, fine medium clay, soft lenticular 20-50mm, pH 7.5,	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP111	611612	7559879	A3	Black vertosol	D,B 26/10/11	Mostly clear of vegetation.	Cracking (2mm) self mulching. Minor rock <5%. Nil microrelief ESD 90cm	A1 0 – 2cm. 10YR3/2, Coarse granular mulch. pH 6, light clay, dry, abrupt to; B21 2 – 40cm. 10YR3/1, medium clay, subangular blocky, firm, pH6.5, roots common, dry , clear to; B22 40-90cm. 10YR2/1, silty clay, moderate angular, hard,pH 7, minor roots, 5% rounded sandstone gravel , moist, gradual; BC 90 -110cm. 10YR4/2, fine SCL,weak granular, pH 7.5, BC1 100-140cm. 10YR5/4, deposition layer of medium clay with red ironstone gravel and fine sandstone gravels, weal structure, soft. 140 cm. weathered material	
TP112	613110	7559888	A3	Black vertosol	D,B 30/10/11	Mostly clear of vegetation.	Cacking, coarse granular mulch. Nil microrelief Slope <1% ESD 90cm	A1 0 – 3cm. 10YR3/2, Strong granular , pH 6, light clay, dry, abrupt to; B21 3– 20cm. 10YR3/2sandy clay, prismatic firm, pH8.0, well drained, roots common, moist, gradual to; B22 20 - 90cm. 10YR2/4, medium clay, subangular blocky firm, pH9.0, well drained, roots common, moist, trace soft lime, gradual to; C 90-110cm+ soft weathered , fine silty loam basalt pH 7.5	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP113	612611	7559891	B2	Black vertosol	D,B 26/10/11	Mostly clear of vegetation.	Cracking (2-5 mm) self mulching. Nil microrelief. Slope <1% ESD 105cm	A1 0 – 2cm. 10YR2/1, strong granular mulch. pH 5.5, sandy , dry, abrupt to; B21 2 – 30cm. 10YR2/1, Light clay, strong prismatic, firm, pH 6.0, roots common, dry , clear to; B22 30-60cm. 10YR3/1, silty clay, strong prismatic, moist, impeded drainage, pH 8.0, B23 60-105cm. 10YR3/3, light medium clay, 5% small sandstone gravels, moderate lenticular, moderate drainage, firm, BC 105-160cm+. weathered material increasing	

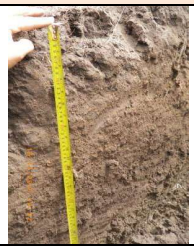
Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP114	612191	7560117	B2	Black vertosol	D,B 26/10/11	Mostly clear of vegetation. Scattered Sally Wattle.	Lower slope of gently undulating plain. Cracking (2mm) self mulching. Nil microrelief. Minor rock <5%. ESD 100cm. Slope 1%.	A1 0 – 2cm. 10YR3/2, Coarse granular mulch. pH 5.5, light clay, dry, abrupt to; B21 2 – 20cm. 10YR2/1, Light medium clay, strong subangular blocky, firm, pH 5.5, roots common, dry , clear to; B22 20-60cm. 10YR3/1, medium clay, strong subangular, hard,pH 5.5, no segregations or mottles, dry, clear; B23 60 -100cm. 10YR2/2, weak subangular blocky, pH 6.0, firm, BC1 100-140cm. 10YR5/4, deposition layer of medium clay with red ironstone gravel and fine sandstone gravels, weal structure, soft. BC2 140 – 160cm. 10YR4/5, sandy clay alluvial material, 10% rounded gravel. Orange mottles. pH 7.0.	 0-60cm 90-140cm

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP115	611096	7560858	A2	Appears to be Sodosol in localised area in the A3 unit	D,B 28/10/11		5% surface coarse fragments, firm, sandy Nil microrelief ESD >110cm	A1 0-20cm. 7.5YR3/4, sandy loam, weak structure, dry, common roots. pH 6.0, abrupt A12 20-22cm sporadic bleach B21 22 – 60cm. 10YR3/2, sandy clay, coarse columnar, very firm, 5% gravel, pH 5.5, roots B22 60 -100cm. 10YR3/3, light medium clay, firm blocky, no roots, 5% soft lime, pH 9.0 B23 100- 150cm. 10YR5/4, light medium clay,coarse blocky, 5% coarse fragments <1cm diameter	
TP116	611605	7560367	A3	Black vertosol	D,B 26/10/11		Cracking (2mm) self mulching. Nil microrelief Coarse small gravels (5%) ESD 120cm	A1 0 – 2cm. 10YR2/1, strong granular mulch. pH 5.5, sandy , dry, abrupt to; B21 2 – 75cm. 10YR2/1, Light medium clay, strong subangular blocky, firm, pH 7.5, roots common, dry , clear to; B22 75 -120cm. 10YR3/1, light clay, strong subangular blocky, dry, pH 7.0, 5% fine sandstone gravel, very firm, moist. B23 120-160cm. 10YR3/3, light clay, pH 7.5, sandstone gravels, moderate lenticular, firm, drainage impeded. C 160cm. weathered sandstone	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP117	612609	7560385	A3	Black vertosol	D,B 29/10/11		Weak cracking and self mulching. Nil microrelief Coarse small gravels (5%) ESD 50cm	A1 0 – 2cm. 10YR2/1, soft granular. pH 7.5, moist, minor quartz small gravel, roots common abrupt to; B21 2 – 45cm. 10YR2/1, medium clay, strong lenticular, firm, pH 7.5, roots common, dry , impeded drainage clear to; B22 45 -80cm. 10YR4/1, light clay, hard angular , dry, pH8.0, 20% orange (10YR5/6 , yellow and black mottling. Very slowly drained C 80cm. hard rock	
TP118	611618	7561424	A3	Black vertosol	D,B 29/10/11		Cracking (3mm) self mulching. Nil microrelief Coarse small gravels (5%) ESD 120cm	A1 0 – 2cm. 10YR2/1, coarse fine sandy mulch, fine sandy clay. pH 7, dry, abrupt to; B21 2 – 30cm. 10YR3/1, medium clay, very firm prismatic, pH 6.0, roots 10% - common, dry , clear to; B22 30 -110cm. 10YR3/1, light clay, strong subangular blocky, dry, pH 7.0, 5% fine sandstone gravel (10%)l, very firm, moist, B23 110-cm. 10YR2/1medium clay moderate lenticular, firm, pH 7.0 D 160cm. weathered sandstone	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP119	612426	7561254	B2	Black vertosol	D,B 29/10/11		Weak cracking (2-5 mm) self mulching. Common surface cobble (20% is 5 – 30cm diameter , basalt) Nil microrelief ESD hard structure & roots indicate 50-60cm	A1 0 – 30cm. 10YR3/1. pH 7.5, sandy , dry, blocky, firmabrupt to; B21 30- 100cm. 7.5YR2/1, medium clay, weak angular to massive, hard, pH 6.0, roots to 50cm, moist, diffuse to; B22 100-180cm. 10YR5/4, silty clay, 5% small sandstone gravels, hard prismatic, trace soft lime, pH 8.0, impeded drainage, B23 180-200cm+. Light clay, soft, massive, 5% soft carbonate, pH 8.0, 10% rounded small gravels.	
TP120	609628	7562067	C2	Dermosol	D,B 22/11/11		Non cracking , firm sandy. Nil microrelief No gravels ESD >110cm	A1 0 – 2cm. 10YR2/1, coarse granular mulch. pH 6.5, sandy light clay , dry, abrupt to; B21 2 – 30cm. 10YR2/1, light medium clay, firm prismatic, pH 7.0, roots common, dry , clear to; B22 30 -70cm. 10YR3/3, medium clay, moderate lenticular, dry, pH 8.5, 5% soft lime, moist. B23 70-110cm+. 10YR5/6, heavy clay, lenticular, pH 8.0. B24 110 – 160cm. Light sandy clay, massive, 10YR4/6. pH 8.0.	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP121	611109	7561887	A3	Black vertosol	D,B 26/10/11		Cracking , firm sandy. Nil microrelief No gravels ESD 120cm	A1 0 – 2cm. 10YR2/1, coarse granular mulch. pH 6.5, sandy light clay , dry, abrupt to; B21 2 – 40cm. 10YR2/1, heavy clay sandy, firm lenticular, pH 8.0, trace soft lime, roots common, dry , clear to; B22 40 -90cm. 10YR3/3, light clay, weak lenticular, dry, pH 7.0, 5% fine sandstone gravel, very firm, moist. D1 90-160cm+. 10YR3/3, sandy clay loam, coarse prismatic, small sandstone gravels (10%), grey mottling 5%, pH 7.0.	
TP122	611165	7562376	B2	Black vertosol	D,B 12/11/11		cracking, self mulching Nil microrelief ESD 60-70cm due to very hard structure in B23	A1 0 – 2cm. 10YR3/2, Strong granular , medium clay, dry, abrupt; B21 2– 80cm. 7.5YR2/1, heavy clay, lenticular firm, pH6.5, well drained, roots common, trace soft lime, moist, gradual to; BC 80-100cm 7.5YR7/2, very gravelly sandy clay, stiff heavy clay, hard blocky, few roots C 100cm+ weathered bedrock (basalt)	

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP123	611113	7562876	A3	Dermosol	D,B 18/11/11		Surface firm sandy non cracking. No gravel. Slope 1% ESD 40cm.	A11 0-20cm. Sandy clay loam, 10YR2/1, weak blocky, pH 5.0, abrupt to; A12 20-30cm Sandy clay loam, 10YR5/8, bleached layer, pH 5.5 B21 30-90cm. Light sandy clay, 10YR2/1, hard prismatic, no roots past 40cm, pH 8.0, D1 90-130cm Sandy clay loam, 10YR3/3,weak blocky, hard, no roots, C Weathered bedrock	
TP124	No site	-	-	-	-	-	-	-	-
TP125	613111	7556390	A3	Grey / brown vertosol	D,B 31/10/11	Cleared Brigalow scrub.	Midslope of gently undulating plain. Slope 0.5%. Cracking, coarse granular mulch. 30% gravel &rock Gilgai 20cm deep, 10% of surface. ESD 80-90cm PAWC est. 95 - 100mm	A1 0 – 4cm. 10YR4/3, Strong granular , pH 7.0, light clay, dry, abrupt to; B21 4 – 40cm. 10YR4/2, medium clay, polyhedral firm, pH8.0, well drained, roots common, moist, gradual to; B22 40 - 60cm. 10YR4/1, heavy clay, angular polyhedral , hard, pH8.0, well drained, roots common, moist, trace soft lime, gradual to; B23 60 - 110cm. 10YR3/3, medium clay, hard coarse polyhedral, hard, pH8.5, slowly drained, 5% red and yellow mottles, roots <10%, moist, trace soft lime, D 110-140cm sandy heavy clay, massive hard structure, mottles common (red) pH 6.0	 0-40cm  80 – 140cm

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP126	612058	7563228	C2	Kandosol	D,B 18/11/11		Surface firm sandy non cracking. No gravel. ERD 30cm.	A11 0-30cm. Sandy clay loam, 5YR3/3, weak blocky, pH 7.0, abrupt to; B21 30-60cm. Light sandy clay, very gravelly, 5YR4/4, hard massive, no roots past 30cm, pH 6.0, C 60cm. Weathered bedrock	
TP127	613107	7563379	A3	Black vertosol	D,B 21/10/11		Weak cracking, sandy. minor gravel Nil microrelief ERD 80-90cm	A1 0 – 20cm. 10YR2/2, weak polyhedral, pH 6.0, silty clay, dry, abrupt to; B21 20– 80cm. 10YR4/4, light medium clay, lenticular firm, pH 6.5, well drained, roots common, moist, gradual to; B22 80 - 180cm. 10YR5/4, medium heavy clay, hard coarse polyhedral, pH 7.0, poorly drained, no roots, moist,	
TP128	No site	-	-	-	-	-	-	-	-
TP129	No site	-	-	-	-	-	-	-	-

Site no	mE Zone : 55 GHD94	mS	SMU	AS class	Site Type. Date	Land use, disturbance, Major vegetation	Landscape Landform, surface, microrelief, Rock / stone (size, %). Slope (%) Effective soil depth (ESD).	Soil Profile Description Horizon, depth (cm), boundary. Moisture, colour, mottles (colour, %), Field pH, texture, structure, consistence. Inclusions, segregations, roots.	Notes
TP130	616435	7564851	A2	Dermosol	D,B 20/11/11		Surface firm sandy non cracking. No gravel. ERD 60-70cm.	A11 0-20cm. Sandy clay lam, 10YR3/4, weak blocky, pH 5.5, abrupt to; B21 20-70cm. medium clay, 10YR4/6, hard prismatic, roots to 60cm, pH 5.0, B22 70-140cm Sandy light clay, 10YR4/6,weak blocky, hard, some yellow / grey mottles increasing below 140cm, no roots,	

Integrated Isaac Plains Site Descriptions

Source: GTES (2007)

Site	Type*	SMU	mE	mN	Landform, Vegetation, ASG	Soil Profile
1	D, A	A2	621180	7555594	Midslope of undulating plain. Slope <1%. Brigalow regrowth with Blackbutt **Brown vertosol**	**Surface** : Cracking with weak crust. **A1 0-15 cm**. pH 6.5,sandy clay, 5YR4/4, weak blocky, no inclusions. **B21 15-55cm**. pH6.0, medium clay, 2.5YR4/6, strong sub-angular blocky, no bleach or inclusions. **B21 55-100cm**. pH 6.0, Medium clay, 75YR5/5, some grey mottles 100-120+ BC
2	O	C2	621878	7555895	slight ridge, rocky, hard sandy surface **prob. Dermosol**	uniform brown clay. Non cracking
7	O	A1	621676	7553883	low ridge with Silver leaf ironbark, bloodwood and Mountain Coolibah.	sandy surface with termite mounds. **A1** 0 – 35cm sandy loam 7.5yR4/4. pH 6.0. 35cm gravel over hard clay.
8	O	A1	621177	7553646	Silver Leaf Ironbark, Poplar Box ridge.	red sandy duplex 0-40cm 5YR 4/4, sandy loam over yellowish brown clay, mottled.
9	O	A1	620952	7553548	gravelly ridge Brigalow and box.	uniform brown clay. sandy hard set surface.
10	D,A	A2	621680	7554107	Tall open Poplar Box duplex.	**Surface** : loose sandy surface no gravel.

Site	Type*	SMU	mE	mN	Landform, Vegetation, ASG	Soil Profile
					Probably sodosol	**A11** 0-45cm coarse sand, 7.5YR5/4, pH 6.0, massive. **B12** 45-50cm gravelly layer above clay. **B21** 50 – 100+ cm. light sandy clay. pH 7.0, 10YR4/3, 5% mottles , coarse hard blocky, and no inclusions.
11	**D,A**	**A2**	621430	7554212	Low ridge line of E crebra, E populnea, Bloodwood. termite mounds. Slope <0.5% **Chromosol / vertosol**	**Surface** : Surface firm and sandy. few gravels. A12 0-45cm sandy loam, massive, loose, 7.5YR 4/4, B21 45-120+cm light clay, weak polyhedral, firm, no mottles, pH 6.0, 10YR5/6.
12	D,A	C2	622029	7554138	Gently undulating plain. 1% slope. Brigalow and cassia brewerstrii. Gravelly in places **Stratified alluvial**	**Surface** : hardsetting. A11 0-5cm. sandy clay loam , weal blocky, pH 7.0, 5YR4/6 A12 5-10 sandy clay loam, pH 6.5, 75YR4/4, v hard, weak subangular blocky. B21 10- 55cm. Sandy clay, pH 8.5, 7.5YR5/4, v hard, subangular blocky, trace carb nodules. C 55-65+cm. GSA weathered sandstone
13	D,A	C2	622000	7554500	Gently undulating plain. 1% slope. Brigalow and cassia brewerstrii. Gravelly in places	**Surface: cracking, firm weak crust.** **A11** 0-15cm. Sandy clay, pH 6.5, 7YR4/3, weak structure, B21 15-45cm. Medium clay, hard, polyhedral, pH 7.0, 7.5YR4/4, moderate gravel / stone, B22 45-100+cm. pH 8.0, Medium clay, hard , blocky, 7.5YR5/4, grey / yellow mottles 5-10%.

Site	Type*	SMU	mE	mN	Landform, Vegetation, ASG	Soil Profile
					Dermosol / vertosol	
14	O	C2	622207	7554129	Boundary site	
15	D,A	C2	622334	7554557	Midslope of gently undulating plain 1% slope. Minor Brigalow regrowth <1M with mainly open Buffel pasture **Dermosol**	**Surface** : Non cracking sandy clay no gravel. A1 0-20cm. pH 6.0, Sandy clay, 5.5YR4/4, moderate subangular structure . B21 20 - 90+cm. ironstone gravels incorporated with pale and very hard medium clay.
19	D,A	C2	621899	7555003	Slope <1%. Blackbutt, Bauhinia, Currant Bush, Brigalow. **Dermosol**	**Surface** : hard sandy surface. A10-15cm. Sandy loam, pH 6.5,10YR4/3, weak structure B21 15-45cm. Medium clay, hard, subangular blocky, pH 7.0, 7.5YR4/4, moderate gravel / stone, B22 45-100+ cm. pH 8.0, Medium clay hard polyhedral, 7.5YR4/4, 5-10% grey / yellow mottles
20	D,A	C2	621705	75544870	Brigalow **Sodosol / chromosol**	**Surface** : Hard setting sandy surface. Few gravel. A1 0-40cm. sandy clay loam, 7.5YR4/4, 6.0, no bleach B21 10 - 60+ cm. Very hard yellowish brown sandy clay. 7.5YR5/3, some mottles. pH 7.0.
21	O	A2	621112	7554309	sandy poplar box	deep duplex
22	D,A	A2	621533	7555187	Midslope, poplar box. sandy. good pasture. **Sodosol**	**Surface** : Firm to hardest. A1 0-40cm sandy clay loam, pH 6.0, 7.5YR5/4, weak blocky, no mottles or bleach. B21 40 – 70+ CM. medium yellowish brown clay with some mottling, hard blocky.
23	O	A2	621210	7555182	Box duplex slightly shallower A horizon depth	0-25cm sandy loam, 7.5 YR5/4, no bleach 25 – 30 gravelly layer over yellow clay
24	**D,A**	**A2**	621107	7555444	Polpar Box , gently undulating plain. strong	**Surface** : sandy surface with no gravel.

Site	Type*	SMU	mE	mN	Landform, Vegetation, ASG	Soil Profile
					pasture cover. **Sodosol**	A1 0-60cm loamy sand, 7.5YR4/4, pH 6.5, no inclusions or bleach. B21 60-120cm+ sandy clay, heavily mottled (red & grey). Hard blocky, pH 7.0, 7.5YR 5/6.
25	O	A2	621389	7555300	boundary site	
26	D,A	C2	621656	7555489	Midslope of Brigalow undulating plain. **Dermosol**	**Surface** : Sandy non cracking . A1 0-40cm. pH 6.0. 7.5YR4/4 moderate polyhedral structure, Sandy clay, no bleach. B21 40-110 pH 6.5 7.5YR4/4 hard angular blocky, med clay no mottles or inclusions. 110 - 180 pH 7.0 , hard clay with 10% grey mottles and increasing parent material.
27	O	C2	621550	7555879	Flat plain Brigalow, no gravel	uniform clay weak cracking
29	O	C2	622140	7556150	same as 27	
40	O	A1	622532	7558117	mixed poplar box Brigalow alluvia	uniform sandy clay
41	O	A1	622516	7558328	flat sandy mixed veg alluvia	
42 (outside survey area)	D,A	A2	622527	7558353	Alluvia. Cleared flat plain of previous Poplar box and possibly Brigalow. **Dermosol**	**Surface** : Sandy crust surface. No gravel. A1 0-40cm silty clay, 10YR5/4,pH 6.5, no inclusions, weak structure. B21 40-120+cm. silty clay. Firm polyhedral, pH 7.5, 10YR4/4, no inclusions
44 (outside survey area)	D,A	A2	622526	7558611	Isaac river channel. Very sandy surface, no rocks. Poplar Box, River red gum, Casuarina, Bauhinia, Moreton Bay Ash and Brigalow **Dermosol**	**Surface**: Non cracking A1 0-30cm. pH 7.5, Sandy clay,10YR44, strong polyhedral, abrupt to; B21 30-90+ cm. pH7.5 , 10YR54, Medium clay, moderate subangular blocky, no mottle
45	O	A1	622146	7558946	same as 44	

Site	Type*	SMU	mE	mN	Landform, Vegetation, ASG	Soil Profile
46	D,A	A2	621686	7557718	Flat, Blackbutt bauhinia alluvia **Vertosol**	**Surface** : coarse granular, cracking. - A1 0-30cm. sandy clay, pH 6.5, 10YR4/6, moderate subangular blocky, B21 30-90+cm. medium clay , pH 7.5, strong polyhedral, 10YR5/6,
47	D,A	A2	621185	7557583	Poplar box, Flat plain Slope <0.5% **Sodosol**	**Surface** : Sandy duplex. - A1 0-45 sandy loam, weak structure, pH 6.0, 7.5YR5/4, no bleach. B21 45-70+ sandy clay, pH 6.5, whole coloured, very dry and hard , weak S/B structure, 7.5YR 4/4.
48	D,A	A2	620870	7557507	same as 47 **Sodosol**	**Surface** : sandy loose - A1 0 - 35 cm. 7.5YR4/3, sandy loam, no mottles, loose and massive. pH 6.0, B21 35 - 75+ Brown 7.5YR4/3, medium clay (sandy), heavily mottled, no inclusions, field pH 7.0, very hard angular blocky
49	O	A2	620501	7557450	same as 48	
50	O	A2	620863	7557699	same as 48	
51	D,A	A2	620900	7557058	dead cleared Poplar Box. Slope <1% **Sodosol**	**Surface** : Surface sets hard and sandy. No surface gravel. A11 0-55cm. sandy loam, weak structure, pH 6.0, 7.5YR5/4, no bleach. B21 55-100+ cm. sandy clay, pH 6.5, whole coloured, very dry and hard , weak S/B structure, 7.5YR 4/4.
52	O	A2	620650	7557080	as 51	
53	O	A2	620861	7556677	as 51. very thick pasture	
54	O	A2	621116	7557437	midslope. Poplar box duplex	Sandy A horizon 50cm over clay

Site	Type*	SMU	mE	mN	Landform, Vegetation, ASG	Soil Profile
55	O	C2	622161	7558437	Open country with odd Blackbutt	uniform silty clay to 70+ cm
56	O	A1	621364	7558662	Flooded coolabah **Vertosol**	Uniform black clay
57	D,A	A3	621035	7558755	Cleared Brigalow black cracking clay flat alluvia. Thick Parthenium. **Brown vertosol**	**Surface** : Cracking, minor surface crust, sandy. A1 0-45cm medium clay, 10YR3/3, pH 9.0, 5% carb. nodules, sub angular blocky, firm, clear to; B21 45-100+cm. medium heavy clay, 10YR4/2, pH 9.0, 5% carb nodules, lenticular structure.
58	O	C2	620505	7558511	same as 57	uniform dark clay to at least 60cm as 57.
59	D,A	C1	620438	7558921	Midslope above A4 alluvia. Slope 2%. Brigalow regrowth **Brown vertosol.**	**Surface** sandy, cracking, firm no stone. A1 0-30cm . sandy clay, pH 6.5, no inclusions, weak S/B structure, 10YR3/4. B21 30-65cm medium clay sandy, very firm polyhedral, 10YR4/3, pH 6.5, no bleach or inclusions, B22 65-100+cm medium clay, strong polyherral, 10YR5/4, pH 6.5.
60	D,A	C2	619945	7559060	Mid-upper slope 1%, poplar box. sandy. good pasture. **Probable sodosol**	**Surface** : hard, sandy A1 0-45cm sandy clay loam, pH 6.0, 7.5YR5/4, no mottles. B21 45 – 100+ medium yellowish brown clay with red/grey mottling, pH 6.5
64	**D,A,L**	**C2**	621981	7555820	Gently undulating plain. Slope 0.5%. Brigalow carissa regrowth. 50% buffel cover. Land in good condition not eroded. **Dermosol**	**Surface** : Sandy hardsetting surface with 15% ironstone gravel strew. Non cracking. 0-20cm sandy clay, 7.5YR4/4, moderate sub-angular structure, pH 7.0, no bleach or inclusions. 20-65cm 7.5YR3/3, hard with some carbonate nodules, pH 8.0, no bleach. 65-100+cm yellow clay 7.5YR5/4, hard with restricted drainage, pH 8.0.

Site	Type*	SMU	mE	mN	Landform, Vegetation, ASG	Soil Profile
74		A2	620350	7555506	Gently undulating 1% slope, Poplar Box. Flat. **Sodosol / chromosol**	**Surface** : firm sandy A1 0-45cm sandy clay loam, weak blocky, pH 5.5, 7.5YR4/4, no mottles. B21 45 – 90+ cm. medium clay, hard, yellowish brown , pH 6.0
75	O	A2	620751	7556043	same as 74	A horizon 35cm
76	O	A2	620502	7554508	same as 74	A horizon 50cm
77	D,A	C2	620702	7553502	Upper slope position. 2% gradient. Brigalow regrowth **Dermosol**	**Surface** : Sandy N/C clay A1 0-40cm. pH 6.0. 7.5YR4/4 moderate subangular blocky structure, sandy clay, no bleach. B21 40-110cm. pH 6.5 7.5YR4/4 hard angular blocky, no mottles increasing gravels.
78	D,A	A2	620749	7552741	Poplar Box with Brigalow and mixed species. Slope <0.5% **Sodosol**	**Surface** : Sandy duplex. A1 0-30cm. sandy loam, 10YR4/4, 6.0, weak structure, no coarse fragments or inclusions, B21 30-80+cm. very hard weakly structured and dense yellow clay. 10YR5/8. pH 7.0.
79	D,A	A2	620761	7554022	Poplar box undulating plain **Sodosol**	**Surface** : Surface sets hard and sandy. No surface gravel. A1 0-45cm. sandy loam, weak structure, pH 6.0, 7.5YR5/4, no bleach. B21 45-100+cm. sandy clay, pH 6.5, whole coloured, very dry and hard , weak S/B structure, 7.5YR 4/4.
89	D,A	A1	621306	7559322	Deep alluvial sand of River Red Gum, Moreton Bay Ash. Thick buffel with no tree /shrub regrowth. Level and loose sandy surface	**Surface** : Loose sandy A11 0-20cm. Organic stain. Loamy coarse sand, 7.5YR34, 5.5, massive. A12 20-110+cm. LCS 7.5YR5/6, 6.5, massive.
94	O	A2	620704	7558135	poplar box undulating plain	sandy duplex
95	O	A2	621810	7557106	poplar box undulating plain	sandy duplex – A horizon 45cm

Site	Type*	SMU	mE	mN	Landform, Vegetation, ASG	Soil Profile
96	O	A2	621625	7556532	poplar box undulating plain	sandy duplex
97	O	A2	621255	7556223	poplar box undulating plain	sandy duplex – A horizon 50cm

* D – detailed site, O – observation site, A – hand 50mm auger, L – laboratory site.

APPENDIX 2 LABORATORY DATA AND INFORMATION (AVAILABLE ON REQUEST)

APPENDIX 3 OBSERVATIONS SITE DESCRIPTIONS

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S004		611999.15	7551707.43	B2	outside area	black clay		Undulating plain	Mt Coolibah			Cleared grazing		
S005		612387.91	7551737.33	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
S006		611924.39	7551976.57	A3	outside area	black clay		Undulating plain	Brigalow regrowth			Regrowth		
S007		612238.39	7552036.38	B2	black clay	cracking, granular	3.5		buffel		nil	cleared Grazing leucaena	30-50 basalt	<1
S008		611401.06	7552260.66	B2	outside area	black clay			Mt Coolibah					
S009		611700.11	7552245.71	B2	outside area	black clay			Mt Coolibah					
S010		611954.29	7552245.71	B2	Brown clay	cracking , coarse granular	0.5	lowerslope	Buffel	40-50%	5% small gilgai	Cleared brigalow. Grazing leucaena	10-20 mixed laterite	0
S011		611550.58	7552544.76	B2	outside area	black clay						Mt Coolibah		
S012		611894.48	7552514.85	B2	black clay	cracking self mulching	1.5	midslope	buffel	70-80	nil	Cleared Mt Coolibah	20-50	<2
S013		611505.73	7552828.85	B2	black clay	Stable cracking	3.5	midslope.	buffel	60-70	nil	Cleared	10-30 (mostly)	<1

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S014		611849.63	7552828.85	B2	black clay	Stable. cracking coarse self mulching	3.5	midslope low hill	buffel	70-80	nil	Cleared	mostly < 40	<5
S015		612163.62	7552858.75	B2	black clay	cracking, granular	0.5	lower	buffel		nil	cleared Grazing leucaena	30-50 basalt	<1
S016		610967.45	7553053.13	n/a	outside area	black clay						Mt Coolibah		
S017		611475.82	7553097.99	n/a	outside area	brown clay						Brigalow R/G		
S018		611849.63	7553097.99	B2	black clay	cracking	2.5	midslope. Gup	buffel bluegrass	60-70	nil	Cleared	10-30 (mostly)	<1
S019		612208.48	7553142.84	B2	black clay	cracking coarse self mulching	1	midslope	buffel	80-90	nil	Cleared	nil	0
S020		611161.82	7553397.03	n/a	outside area	black clay						Mt Coolibah		
S021		611460.87	7553367.13	C2	brown clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
S022		611879.53	7553426.94	C2	brown light clay	Fine sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S023		612193.53	7553441.89	B2	black clay	cracking coarse self mulching	1.5	midslope gup	buffel bluegrass.	70-80	nil	Cleared Mt Coolibah. Leucaena crop	40-90 basalt rock	<2
S024		612522.48	7553397.03	B2	black clay	cracking, granular coarse	2.5	lower	Sally Wattle	60-70	nil	cleared Leucaena crop	30-50 basalt	<1
S025		612881.33	7553397.03	B2	black clay	self mulching cracking	0.5					cleared Leucaena crop		
S026		614346.65	7552828.85	BDY	Boundary B2-A3									
S027		613823.32	7553023.23	B2	black clay	self mulching cracking no erosion	0.5	midslope Gently undulating plain	Buffel Sally Wattle R/G	70-80	nil	cleared Mt Coolihab	10 - 70mm	<10
S028		614197.13	7553045.07	B2	dark clay	self mulching cracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	slight linear gilgai	extensive clearing	nil	0
S029		613838.27	7553322.27	B2	dark medium clay	self mulching, granular cracking no erosion	0.5	midslope Gently undulating plain	Buffel	>80	nil	cleared	50 -90mm	<5

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S030		614212.08	7553307.32	B2	dark brown clay	self mulching cracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	nil	0
S031		611834.68	7553651.22	BDY	Boundary B2-C2									
S032		612193.53	7553621.32	B2	dark medium clay	cracking no erosion	1.5	midslope Gently undulating plain	Buffel	70	nil	cleared	10 - 70mm	<10
S033		612492.57	7553681.13	B2	same as 32									
S034		612881.33	7553696.08	B2	same as 32									
S035		613210.28	7553696.08	C2	brown light clay	hard sandy, non cracking	1.0	flat plain	Buffel Wilga, Leichardt Bean	60-70	cleared Brigalow, Blackbutt	nil	nil	0
S036		613569.13	7553696.08	B2	dark medium clay	strong granular cracking no erosion	1.5	lower slope Gently undulating plain	Occ Bloodwood , Whitewood Buffel bluegrass	60-70	nil	cleared Mt Coolibah	10 - 70mm	<2
S037		613942.94	7553696.08	B2	dark clay	cracking	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	nil	0
S038		614256.94	7553666.17	B2	same as 37									
S039		614585.89	7553666.17	B2	same as 37									

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S040		614929.79	7553696.08	B2	dark medium clay	self mulching cracking no erosion	0.5	midslope Gently undulating plain	Buffel	70	nil	cleared	10 - 70mm	<2
S041		615258.74	7553666.17	B2	dark clay	cracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	nil	0
S042		615542.83	7553651.22	B2	Same as 41									
S043		611849.63	7553965.22	B2	dark medium clay	Granular cracking no erosion	1.8	midslope Gently undulating plain	Buffel	0.7	nil	cleared	10 - 70mm	<10
S044		612163.62	7553950.27	B2	dark clay	self mulching cracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	nil	0
S045		612492.57	7553965.22	B2	black clay	self mulching cracking no erosion	2.5	lower slope gently undulating plain	bluegrass Buffel	>80%	nil	extens. Clearing	15-30	<5
S046		612821.52	7554039.98	B2	same as 45									
S047		613210.28	7554025.03	C2	brown light silty clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
S048		613584.09	7553995.12	B2	dark heavy clay	self mulching cracking no erosion	1.0	midslope Gently undulating plain	Buffel	0.7	slight linear gilgai	cleared with some Sally Wattle R/G	nil	0
S049		613927.99	7553995.12	B2	same as 48									

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S050		614286.84	7553995.12	B2	dark clay	granular, soft, cracking no erosion	1.5	midslope Gently undulating plain	Buffel	60	nil	cleared	10 - 70mm	<10
S051		614570.93	7553995.12	B2	dark clay	self mulching cracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	nil	0
S052		614899.88	7553995.12	B2	dark clay	self mulching cracking	0.5	midslope Gently undulating plain	Buffel	60	nil	cleared	10 - 70mm	<10
S053		615243.78	7553950.27	B2	dark clay		1.5	upper slope undulating plain		70-80%	nil	extens. Clearing	nil	0
S054		615542.83	7553965.22	B2	same as 53									
S055		612462.67	7554264.26	B2	black clay	cracking coarse granular. no erosion	1.8	footslope	Buffel grass	60-70%	nil	Cleared - old cultivation	15-30	<5
S056		612836.47	7554360.87	B2	black clay	stable.								
S057		613569.13	7554271.16	B2	dark medium clay	self mulchingcracking no erosion	1.8	midslope Gently undulating plain	Buffel	65	nil	cleared	10 - 70mm	<10
S058		613957.89	7554234.36	B2	dark clay	self mulchingcracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	nil	0
S059		614301.79	7554219.41	B2	same as 58									

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S060		614615.79	7554264.26	B2	dark clay	cracking some sheet erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel bluegrass	>80	nil	extens. Clearing	nil	0
S061		614899.88	7554249.31	B2	dark medium clay	self mulchingcracking no erosion	1.8	midslope Gently undulating plain	Buffel	0.7	nil	cleared	10 - 70mm	<5
S062		615243.78	7554279.21	B2 (rp)	dark clay	self mulching cracking, rocky no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	50-250	15-20
S063		612208.48	7554593.21	B2 (rp)	dark medium clay	self mulching, basalt cobble, cracking	1.5	midslope undulating plain	Buffel	50-60	linear gilgai	cleared	10 -130mm	20-25
S064		612896.28	7554593.21	B2	dark clay	self mulching cracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	nil	0
S065		613270.09	7554578.26	B2	black clay	self mulching cracking minor sheet erosion	2	midslope gently undulating plain	bluegrass Buffel	0.6	nil	Cleared.	20-30	<5
S066		613569.13	7554563.31	B2	dark heavy clay	granular cracking no erosion	1.5	midslope Gently undulating plain	Buffel	0.7	nil	cleared Leucaena crop	10 - 70mm	<10
S067		613987.80	7554623.12	B2	dark clay	self mulching cracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	Cleared Leucaena crop	nil	0

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S068		614361.60	7554638.07	B2	dark medium clay	cracking	1.8	midslope Gently undulating plain	Buffel	0.7	nil	cleared	10 - 70mm	<10
S069		614660.65	7554623.12	B2	dark clay	self mulching cracking no erosion	2.5	upper slope undulating plain	Sally Wattle scattered Buffel	40-50%	nil	extens. Clearing	nil	0
S070		614944.74	7554608.16	B2	dark clay		0.5				nil	Cleared Leucaena crop		
S071		615378.35	7554608.16	B2	same as 70									
S072		612283.24	7555101.59	A3	Dark Brown clay	granular, cracking	1.0	midslope	Buffel, bluegrass. Slight woody regrowth	70%	nil	Cleared brigalow. Grazing	5-40. ironstone	0
S073		612836.47	7555101.59	A3	Black clay	non cracking sandy . Firm	3.5	crest	Buffel	60%	nil	Cleared brigalow. Grazing	5-170. basalt	5
S074		613165.42	7554996.92	A3	Brown clay	fine sandy cracking . Firm	1.5	lower	Buffel	70%	nil	Cleared brigalow. Grazing laucaena	5-40. ironstone	0
S075		614316.75	7555086.64	A3	brown clay	sandy weak crust stable	0.9	lower slope alluvial plain	Brigalow wilga Buffel	40-50%	nil	Cleared.	10-30	0

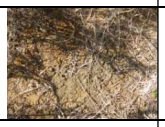
SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S076		614780.27	7555176.35	B2	black clay	self mulching cracking minor erosion	3.0	crest of gup	Sally Wattle regrowth buffel bluegrass	>80	minor linear gilgai	cleared	30-70	<2
S077		615288.64	7555221.21	B2	black clay	self mulching cracking minor erosion	2	upperslope gently undulating plain	Wilga Buffel	0.8	nil	Cleared.	10-30basalt	<0.5
S078		615572.73	7555221.21	B2	black clay	coarse cracking minor sheet erosion	1	midslope gently undulating plain	bluegrass Buffel	0.5	nil	Cleared.	<10	0
S079		615961.49	7555176.35	A3	brown clay	sandy cracking minor erosion	2	lower slope	Buffel	40-50%	nil	Cleared.	10-20	<1
S080		616320.35	7555221.21	A3	Black clay	Cracking crusting	0	Flat relic alluvial plain	buffel	70	nil	Some Brigalow regrowth	Few quartz	0
S081		612268.29	7555490.35	A3	dark clay	coarse crust cracking stable	2	lower slope	Buffel	40-50%	nil	Cleared.	50-70 silcrete, quartz	<5
S082		612567.33	7555445.49	A3	Brown clay	weakly cracking with crust. sandy .	2.5	crest	Buffel	60%	nil	Cleared Brigalow. Grazing	nil	0

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S083		612911.24	7555490.35	A3	same as 82									
S084		613285.04	7555505.30	A3	Brown clay	non cracking sandy . Firm	1.5	midslope	Buffel	60%	nil	Cleared brigalow. Grazing	5-40. ironstone	0
S085		614271.89	7555445.49	B2	black clay	self mulching cracking minor erosion	1.0		Buffel	80	nil	Thinned Mt Coolibah, Bloodwood.	30-80	4-5
S086		614795.22	7555445.49	B2	black clay	self mulching cracking minor erosion	2	upperslope gently undulating plain	Wilga Buffel	70	nil	Cleared.	10-30basalt	<0.5
S087		615303.59	7555460.44	B2	same as 86									
S088		615602.64	7555475.39	B2	black clay	granular cracking minor sheet erosion	1	lowerslope gently undulating plain	Wilga Buffel	40-50	nil	Mostly cleared. Scattered Mt Coolibah	30-70 basalt	5-10
S089		615946.54	7555475.39	B2	as for 88								20-130 basalt	5
S090		616350.25	7555460.44	B2	Black clay	black clay cracking. Prom. Gully erosion	3	Lower slope	Buffel	60-70	nil	cleared	10-250 basalt	<2

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S091		612223.43	7555923.96	A3	Black clay	strong coarse granular cracking sandy . Firm	2	upper slope	Buffel bluegrass	80%	nil	old Mt Coolibah Bloodwood	occasional large floater	5-10
S092		612612.19	7555938.91	A3	brown clay	coarse sandy cracking stable	0.5	lower slope alluvial area	Buffel	60-70%	nil	Cleared.	10-20 mixed	0
S093		612926.19	7555938.91	A3	brown clay	coarse sandy cracking stable	2	lower slope alluvial area	Buffel	40-50%	minor gilgai	Cleared.	10-20	0
S094		613972.84	7555834.25	B2	black clay	cracking minor erosion	2	upperslope gently undulating plain	Wilga Buffel	0.8	nil	Cleared.	10-30 basalt rocks	0
S095		614451.32	7555804.34	B2	dark clay	strong granular cracking stable	1.5	midslope				cleared		<2
S096		614810.17	7555789.39	B2	dark clay	strong granular cracking stable	2.5	midslope						
S097		615587.69	7555879.10	B2 (rp)	dark clay	strong granular cracking stable	<0.5	lower position					30-120 basalt	8-10
S098		615916.64	7555834.25	B2	dark clay	strong granular cracking stable	1.5	midslope					basalt	

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S099		616320.35	7555834.25	B2	black clay	self mulching cracking minor erosion	2	upperslope gently undulating plain	Wilga Buffel	0.8	nil	Cleared. Mt Coolibah	10-30basalt	<0.5
S100		611924.39	7556357.58	A3	brown clay	coarse sandy cracking stable	2	lower slope alluvial area	Buffel	40-50%	5% normal gilgai	Cleared.	10-80 mixed laterite	1-2
S101		612268.29	7556327.67	A3	dark clay	sandy cracking stable	1	lower slope alluvial area	Buffel	60-70%	nil	Cleared. Leucaena crop	10-20	0
S102		612582.29	7556282.81	A3	brown clay	coarse crusty cracking stable	2	midslope	Buffel	70-80%	nil	Cleared. Leucaena crop	10-20	<1
S103		613030.85	7556304.66	A3	Brown clay	non cracking sandy . Firm	2	crest	Buffel	60%	nil	Cleared Grazing	5-40. ironstone	0
S104		613927.99	7556267.86	A3	dark clay	sandy cracking stable	1	lower slope alluvial area	Buffel	60-70%	nil	Cleared.	10-20	0

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S105		614331.70	7556223.01	B2 (rp)	dark clay	strong granular cracking	1	midslope	Sally Wattle regrowth Buffel	70-80%	few linear gilgai	Cleared Mt Coolibah. Grazing	40-90	6-8
S106		615198.93	7556282.81	C2	Sandy	brown duplex	0.5							
S107		615542.83	7556267.86	B2	dark clay	granular cracking stable	1-2	lower	Gently undulating plain	80	nil	Cleared	0	0
S108		615901.68	7556267.86	B2	dark clay	strong granular cracking	1	midslope	Sally Wattle, Bauhinia regrowth Buffel	50-70%	few normal gilgai	Cleared. Grazing		0
S109		616275.49	7556237.96	B2	same as 108	black cracking clay								
S110		612313.15	7556731.38	A3	Brown clay	non cracking sandy . Firm	1.5	Gently undulating	Buffel	60%	nil	Leucaena crop. Cleared brigalow. Grazing	5-40. ironstone	0
S111		612627.14	7556746.33	A3	dark clay	sandy cracking stable	1	lower slope alluvial area	Buffel with odd Blackbutt and Brigalow regrowth	60-70%	10% normal gilgai	Cleared Brigalow Blackbutt	10-20	0
S112		612986.00	7556746.33	A3	same as 111									
S113		613255.14	7556731.38	A3	same as 111									

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S114		613584.09	7556731.38	A3	Brown clay	weakly cracking sandy . Firm	0.5	crest	Odd Brigalow Poplar Box Buffel	70%	nil	Cleared brigalow. Grazing	5-40. ironstone	0
S115		615034.45	7556716.43	C2	brown light clay loam	firm sandy, non cracking	0.5	flat plain	Buffel	60-70	cleared	nil	nil	0
S116		615767.11	7556686.52	B2	dark clay	granular cracking stable	1-2	lower		80	nil	Cleared	0	0
S117		612328.10	7557135.09	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	Cleared Brigalow	5-20mm. Mixed ironstone	0
S118		612642.10	7557120.14	A3	Dark clay	cracking sandy .	0.5	crest	Buffel	70%	nil	Cleared brigalow. Grazing	10-40. ironstone	1-2
S119		612971.05	7557141.99	A3	brown clay	coarse crusty cracking stable	2	midslope	Buffel	70-80%	nil	Cleared. Old cultivation	5-20	0
S120		613285.04	7557105.19	A3	dark clay	sandy cracking stable	1	midslope	Odd Bauhinia Buffel	70-80%	nil	Cleared Brigalow	10-20	0

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S121		613643.90	7557075.28	A3	dark clay	granular cracking stable	2	midslope	Buffel Odd Brigalow	>90%	nil	Cleared.	6-15	<1
S123		612298.19	7557523.85	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
S125		613015.90	7557538.80	B2	brown clay	crusting cracking stable	2	midslope	Buffel	70-80%	nil	Cleared.	5-20	0
S126		613299.99	7557560.65	B2 (rp)	dark clay	weak crust cracking	<3	upperslope	Sally Wattle regrowth Buffel	70-80%	few linearl gilgai	Cleared. Grazing	40-200	20
S127		613628.94	7557523.85	B2 (rp)	dark clay	strong granular cracking minor sheet	2.5	midslope	Sally Wattle regrowth Buffel	70-80%		Cleared. Grazing	40-200	10-15
S128		614092.46	7557500.84	B2 (rp)	dark clay	strong granular cracking	1	midslope	Sally Wattle regrowth Buffel	70-80%		Cleared. Grazing	40-200	20
S129		611879.53	7557987.37	C2	light brown sandy clay	firm non cracking stable	4					mostly cleared		
S130		612328.10	7557979.31	C2	light brown sandy clay	firm non cracking stable	2	midslope	Buffel . Wilga	50-60%	nil	Cleared.	10-15	0

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S131		612627.14	7557949.41	C2	brown sandy clay	hard non cracking fully erosion	3.5	midslope	Buffel Leichardt Bean	60-70%	nil	Cleared.	20-50	2-3
S132		612986.00	7557904.55	B2	light brown clay	firm cracking stable	0.5	midslope	Buffel and mixed regrowth	60-70%	nil	Cleared.	10-50	<1
S133		613314.95	7557979.31	B2 (rp)	dark clay	granular cracking stable	1-2	lower	Gently undulating plain	80	nil	Cleared	<0.3	10
S134		613733.61	7558017.27	B2 (rp)	dark clay	strong granular cracking	1.5	gup	Bloodwood Buffel bluegrass. Sally wattle 25%	70%	nil	Cleared.	35-340	15-20
S135		614107.41	7558017.27	B2 (rp)	as for 134								50-250	20-25
S136		614526.08	7558002.32	B2	dark clay	granular cracking stable	<1							
S137		611490.77	7558331.27	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
S138		611894.48	7558316.32	C2	Same as 137									
S139		612313.15	7558316.32	C2	Same as 137									

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S140		612642.10	7558331.27	B2	dark clay	strong granular cracking stable	1.5	midslope	Odd Sally Wattle Buffel / bluegrass	70-80%	nil	Cleared. Grazing	40-90	5
S141		612941.14	7558301.37	B2	dark clay	granular cracking stable	<1							
S142		613299.99	7558256.51	B2	dark clay	strong granular cracking	1.5	gup	Buffel bluegrass. Sally wattle Bloodwood	70%	nil	Cleared.	nil	0
S143		613808.37	7558301.37	B2 (rp)	dark clay	strong granular cracking minor sheet	5	midslope	Sally Wattle regrowth Buffel	70-80%	few normal gilgai	Cleared. Grazing	40-200	20
S144		614152.27	7558301.37	B2 (rp)	dark clay	granular cracking stable	3	undulating	Sally Wattle 4-5m Buffel / bluegrass	50-60%	nil	Cleared. Grazing	60-190	15-20
S145		614615.79	7558331.27	B2 (rp)	dark clay	sandy cracking stable	5	midslope low hill	Buffel	70-80%	nil	Cleared. Grazing	40-90	10
S146		611176.78	7558705.08	n/a	brown clay	Stable – minor sheet erosion	1.5	midslope	undulating plain	50	nil	Cleared		0

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S147		611580.49	7558720.03	A3	dark clay	sandy cracking firm.	2	lowerslope	Buffel	60-70	nil	Cleared Brigalow Appears to be previous cultivation. Contour banks	10-40	<1
S148		611909.44	7558705.08	C2	brown light clay	hard sandy, non cracking	2.0	flat plain	Buffel	60-70	cleared	nil	nil	0
S149		612193.53	7558690.12	A3	dark brown clay	granular cracking stable	2	midslope	Buffel	80	nil	Cleared.	10-90	2
S150		612686.95	7558690.12	B2	dark clay	strong ranular cracking	1.5	gup	Buffel bluegrass. Sally wattle 25%	70%	nil	Cleared. Leucaena crop being grazed	30-80 basalt	<5
S151		612986.00	7558720.03	A3	dark clay	strong cracking stable	2	midslope	Buffel	80	nil	Cleared.	6-15	<1
S152		613285.04	7558720.03	B2	dark clay	coarse granular cracking stable erosion	0.5	midslope	Buffel With scattered Sally Wattle	70%	nil	Cleared.	30-80 basalt	<5
S153		613599.04	7558675.17	B2	dark clay	granular cracking sheetwash evident	2	undulating plain	Sally Wattle, r/g Buffel	70-80%	Normal gilgai 40% of surface	Cleared. Grazing	40-100	5

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S154		614241.98	7558630.31	B2 (rp)	dark clay	coarse granular cracking stable erosion	0.5	midslope	Buffel	70%	nil	Cleared.	30-200 basalt	8-12
S155		614675.60	7558690.12	B2 (rp)	dark clay	granular cracking stable	1-2	lower	Gently undulating plain	80	nil	Cleared	<0.3	10
S156		614989.60	7558675.17	B2 (rp)	dark clay	coarse granular cracking stable erosion	0.5	midslope	Buffel Odd Sally Wattle	70%	nil	Cleared.	30-80 basalt	6-8
S157		611266.49	7559123.74	n/a	east of airport outside area	Brigalow clay	1.0							
S158		611595.44	7559153.64	A3	dark brown clay	firm sandy cracking stable	2	midslope	Buffel . Odd Sally Wattle	80	nil	Cleared.	10-20. quartz ironstone	0
S159		611969.25	7559108.79	A3	same as 158									
S160		612253.34	7559093.83	A3	same as 158									
S161		612567.33	7559108.79	B2	dark clay	coarse granular cracking stable erosion	0.5	midslope	Buffel	70%	nil	Cleared.	30-80 basalt	<5

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S162		612911.24	7559093.83	A3	dark clay	granular cracking stable	1-2	lower	Gently undulating plain	80	nil	Cleared - Mt Coolibah Brigalow	nil	0
S163		613210.28	7559063.93	B2	dark clay	cracking stable	2	midslope undulating plain	mixed buffel bluegrass	80	nil	Cleared	cobbles	2-5
S164		613479.42	7559078.88	B2	dark clay	granular cracking stable	<1							
S165		614182.18	7559078.88	A3	dark clay	cracking stable	2	midslope undulating plain	mixed buffel bluegrass	80	nil	Cleared. Sally Wattle regrowth 20%	cobbles	2-5
S166		614585.89	7559063.93	A3	dark brown sandy clay	weak cracking stable	<2.0	midslope Gently undulating plain	pastures - mainly buffel	0.5	Occasional linear gilgai <10cm deep	Extensive clearing	10-70	<5
S167		611266.49	7559362.97	A3	dark brown sandy clay	weak cracking stable	2-3	lower	undulating plain	Grass	nil	Extensive clearing	10-40	<1
S168		611625.34	7559362.97	A3	brown sandy clay	stable - non cracking	1.5	lowerslope	buffel	50-70		Cleared Brigalow		
S169		611894.48	7559452.69	A3	Dark clay	stable - non cracking	1.5	lowerslope	buffel	50-70		Cleared Brigalow		
S170		612358.00	7559407.83	B2	dark clay	granular cracking stable	1-2	midslope	undulating plain	80	nil	Cleared	50-100	5-10

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S171		612761.71	7559362.97	A3	dark brown clay	fine sandy cracking stable	2	lower	alluvial plain	50-60	few shallow gilgai	cleared Brigalow grazing	10-20	0
S172		613030.85	7559362.97	A3	clay cracking		<1		brigalow		nil		nil	0
S173		613359.80	7559333.07	B2	black med clay	cracking granular. stable	<2	midslope	some bloodwood Sally Wattle regrowth (<10%)	80		Cleared	50-90	<5
S174		611146.87	7559676.97	disturbed										
S175		611610.39	7559676.97	A3	dark brown clay	sandy cracking	1.0	lower	Gently undulating plain	50	30-40% normal gilgai	Cleared	<0.3 gravel	<2
S176		611909.44	7559721.83	B2	dark clay	granular cracking stable	1-2	midslope	undulating plain	80	nil	Cleared	50-100	5-10
S177		612313.15	7559736.78	B2	dark clay	cracking stable	2	midslope undulating plain	mixed buffel bluegrass	80	nil	Cleared	cobbles	2-5
S178		612701.90	7559721.83	A3	dark clay	cracking stable	2	midslope undulating plain	mixed buffel bluegrass	80	nil	Cleared	cobbles	2-5
S179		611176.78	7559961.06	disturbed airport										

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S180		611550.58	7559976.02	A3	dark clay	cracking stable	2	midslope undulating plain	mixed buffel bluegrass	80	nil	Cleared	cobbles	2-5
S181		611909.44	7559990.97	B2	dark clay	no erosion	<1	lowerslope	flat plain	60	nil	Cleared Brigalow	nil	0
S182		612298.19	7559961.06	B2	dark clay	granular cracking stable	<1	lowerslope	plain	80	nil	Cleared	40-70	2-3
S183		612686.95	7559976.02	A3	brown clay	cracking - mixed laterite gravels					nil		10-30	0
S184		611116.97	7560334.87	disturbed airport										
S185		611550.58	7560319.92	A3	dark clay	fine sandy cracking stable	3.0	lower	undulating plain	70	nil	cleared	10-70	<5
S186		611864.58	7560319.92	A3	dark brown clay	fine sandy cracking stable	2	lower	alluvial plain	50-60	minor shallow normal gilgai	cleared Brigalow	10-20	0
S187		612193.53	7560304.97	B2	dark clay	granular cracking stable	1-2							

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S188		612657.05	7560304.97	A3	light clay	non cracking sandy	3	upper	plain	70%	Some normal gilgai	cleared	Gravel <30	0
S189		611012.30	7560574.11	disturbed airport										
S190		611520.68	7560708.68	A3	brown clay	sandy cracking stable	<1.5	upper	flat plain	70	Some normal gilgai	cleared Brigalow	Gravel <30	<1
S191		611879.53	7560693.72	B2	dark clay	granular cracking stable	1-2	lower	Gently undulating plain	80	nil	Cleared	<0.3	10
S192		612417.81	7560678.77	B2	dark clay	self mulching cracking	2.5-3.5		odd Bloodwood Sally Wattle			stable		
S193		611027.25	7560903.05	disturbed airport										
S194		611475.82	7560918.01	A3	brown sandy clay	stable - non cracking	1.5	lowerslope	buffel	50-70	nil	Cleared Brigalow	10-20	0
S195		611849.63	7560932.96	A3	brown clay	cracking	1.0	lowerslope	buffel	50-60	nil	Cleared Brigalow	10-20	0
S196		610324.50	7561867.47	Disturbed										
S197		610907.64	7561897.38	A2	sandy loam	firm non cracking stable	0.5	creek line	Mixed trees	40-50	nil	grazing	-	0

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S198		609920.79	7562121.66	Distur bed										
S199		610474.02	7562121.66	Distur bed										
S200		611012.30	7562121.66	A3	sandy clay	sandy crusting cracking	1-2	upper. Colluvial	Buffel - Brig mixed regrowth	60-70	occ normal gilgai	Cleared. Grazing	10-30	0
S201		611296.39	7562480.52	B2	dark clay	cracking stable	1-2	lower	Gently undulating plain	60-70	nil	Cleared	50-70	2-5
S202		611102.02	7562749.66	A1	sandy loam	loose sandy	<0.5	alluvial plain	Poplar Box	30	nil	Little disturbance.	nil	0
S203		611595.44	7562794.51	A3	Brownclay	sandy crusting cracking	1.5	gently UP	Buffel	60-70	nil	Cleared. Grazing	10-30	0
S204		612118.77	7562809.46	A1	Sandy	non cracking, firm	0.5	alluvial plain	Eucalypt, acacia Mixed grasses	30-50	nil	thinning of original	nil	0
S205		612552.38	7562839.37	A1	sandy	creek channel	<0.5							
S206		612941.14	7562839.37	A1	sandy	hard	0.5-1.0	alluvial plain	Poplar Box mixed acacias					
S207		613808.37	7552746.03	B2	dark clay	self mulching cracking stable	1	upper slope flat plain	mixed buffel	80	nil	Cleared - some Sally Wattle	10-60	<2
S208		612148.67	7554301.06	B2	dark brown clay	strong granular cracking	1	upper slope	buffel - 10% Sally Wattle	80	nil	Cleared	10-60	<1

SCL ID	Photo	mE	mN	Soil Type	concept	Surface condition	Slope %	Landform	major vegetation	Ground cover %	Microrelief	Disturbance land use	predom. Rock diam (mm), type	%surface rock cover >6cm
S209		612537.43	7554719.72	B2 (rp)	dark clay	cracking stable	2	midslope undulating plain	mixed buffel bluegrass	80	nil	Cleared	cobbles	5 - 7
S210		613180.38	7554316.01	B2	dark clay	granular cracking stable	1-2	lower	Gently undulating plain	80	nil	Cleared	<0.3	10
S211		614570.93	7555123.43	A3	Brown clay	weak cracking sandy	1.5	upper	und. plain	70	occ. normal gilgai	cleared Brigalow	10-20 ironstone	0
S212		614555.98	7555422.48	B2	Dark brown clay	granular cracking stable	1.5	midslope	Buffel and mixed regrowth	60-70%	nil	Cleared.	10-70	1-2

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
General Moranbah North Project Area OBSERVATION Sites													
m001	620150.08	7546418.92	C1	sandy loam	hard fine sandy. No erosion	0.5	flat plain	extensive clearing odd eupop whitewood .	20-30	grazing native pastures	nil	5 - 20 mixed lateritic	0
m002	619505.34	7546943.56	C1	sandy loam	Firm sandy good condition	0.5 - 1	flat plain	eupop with narrow leaf ironbark, wilga, whitewood .	20-30	grazing native pastures	nil	5 - 10 mixed lateritic, quartz	0
m003	618677.30	7547518.76	C1	outside survey area	poplar box sandy duplex								
m004	619404.21	7547455.55	C1	sandy duplex	Firm sandy	0.5 - 1	flat plain	eupop with narrow leaf ironbark, wilga, whitewood .					
m006	617514.26	7548150.85	A1	coarse sandy	firm, sandy minor sheet wash	0.5	recent alluvia	mixed grasses (aristida spp)	40	cleared for grazing	absent	nil	0
m007	618658.34	7548056.04	A3	dark clay	coarse cracking stable erosion	2	lower slope	Buffel	40-50%	Cleared.	nil	10-40 ironstone	<1

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m008	619315.72	7548049.72	A3	Brown clay	cracking with weak crust. Nil erosion	1.5	gently undulating plain	Buffel bluegrass	70-80%	Cleared Brigalow	nil	5 -40 quartz, ironstone	0
m009	620074.23	7547980.19	A3	Black clay	cracking with weak crust	3	gently undulating plain	Buffel bluegrass	70-80%	Cleared Brigalow	few normal gilgai	5 - 25 quartz	0
m013	617609.07	7548542.75	A1	sandy loam	wet, sandy, loose some erosion evident	<0.5	recent alluvial drainage line	Poplar Box, mixed acacia	30-40	Extensive clearing grazing	absent	10-20 quartz	0
m014	618519.28	7548574.35	A1	sandy loam	coarse sandy, loose	<0.5	active alluvial drainage line	Poplar Box, mixed acacia	30-40	Extensive clearing grazing	absent	nil	0
m015	619404.21	7548523.78	A2	clay loam	firm sandy	0.5	alluvial plain	Open Poplar Box Narrow leaf ironbark.	30-40	partial clearing. Natural pastures	absent	nil	0
m016	620112.15	7548403.69	A3	dark clay	cracking, sandy veneer stable erosion	1.0	midslope colluvial	Buffel improved	70-80%	Cleared.	nil	10-40 ironstone	0
m021	617577.47	7548978.89	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m022	618500.32	7548959.93	A1	loamy sand	firm, coarse sandy	1	recent alluvial plain	mixed grasses . Odd polpar	40	cleared for grazing	absent	nil	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
								box, wilga					
m023	619353.64	7548934.64	A3	dark brown clay	cracking with weak crust stable	1.5	mid slope gently undulating plain	Buffel bluegrass	40-50%	Cleared. Prob previous Brigalow	5% surface normal gilgai	10-40 lateritic mixed gravel	<1
m024	620137.43	7548915.68	B1	grey clay	cracking with weak crust	2.0	gently undulating plain	bluegrass buffel	50-60	cleared Brigalow	nil	10-20. mixed	0
m025	613765.96	7549629.94	A2	outside survey area				Poplar Box					
m030	617684.92	7549541.45	A1	sandy loam	coarse sandy,firm	<0.5	active alluvial drainage line	Poplar Box, mixed acacia	30-40	Extensive clearing grazing	absent	nil	0
m031	618500.32	7549535.13	C1	sandy loam	Firm sandy	0.5	flat plain	eupop with whitewood .	40-50	grazing native pastures	nil	5 - 10 mixed lateritic, quartz	0
m032	619410.53	7549440.31	BDY	Boundary C1 - B1									
m033	620257.53	7549421.35	A2	sandy clay loam	no stone, hardsetting	<0.5	flat plain	mixed native and buffel grass	30-40	grazing native pastures. Cleared	nil	nil	0
m034	613102.27	7550293.64	A1	sandy loam	outside area		alluvial plain						

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m040	617628.03	7550091.37	A1	pale loamy sand	sandy, loose	0.5	adj. to alluvial drainage line	Poplar Box, ironbark mixed acacia	30-40	Extensive clearing grazing	absent	nil	0
m041	618519.28	7550072.41	A3	brown clay	cracking with weak crust	1.5 - 2.0	lowerslope gently undulating plain	Buffel bluegrass	60-70%	Cleared. Regrowth wilga, whitewood. previous Brigalow	nil	10-40 lateritic gravel	0
m042	619442.13	7550059.76	A3	same as m041									
m043	620131.11	7550072.41	B1	grey brown clay	cracking with weak crust	1.0	gently undulating plain	buffel	50-60	cleared Mt Coolibah	nil	nil	0
m044	613039.06	7550818.27	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m050	617596.43	7550653.93	A1	coarse sand	coarse sandy, loose	<0.5	active alluvial drainage line	Poplar Box, mixed acacia	30-40	Extensive clearing grazing	absent	10-20 quartz	0
m051	618500.32	7550666.57	A1	same as m050									
m052	619499.02	7550578.08	A3	brown clay	cracking with weak self mulch	2	crest of gently undulating plain	Buffel bluegrass	70-80%	Cleared Brigalow	minor normal gilgai	nil	0
m053	620320.74	7550546.47	BDY	boundary B1-A2									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m055	621802.99	7550463.25	A3	Black clay	cracking with weak crust	3	gently undulating plain	Buffel bluegrass	70-80%	Cleared Brigalow	few normal gilgai	5 - 25 quartz	0
m056	612523.90	7551339.75	C2	brown light clay	fine sandy, non cracking	0.5	flat plain	Buffel with regrowth of wilga, Leichardt Bean	50	cleared Brigalow	nil	5-20 mixed gravels	0
m057	613097.00	7551322.89	A1		firm, coarse sandy	1	recent alluvial plain	mixed grasses . polpar box, cassia regrowth	40	cleared for grazing	absent	nil	0
m058	613703.81	7551297.61	A1	same as m058									
m062	616805.26	7551196.47	A1	coarse sand	coarse sandy, loose	<0.5	active alluvial drainage line	Poplar Box, mixed acacia	30-40	Extensive clearing grazing	absent	10-20 quartz	0
m063	617639.62	7551154.33	A1		coarse sandy, loose	<0.5	active alluvial drainage line	Poplar Box, mixed acacia	30-40	Extensive clearing grazing	absent	10-20 quartz	0
m064	618600.40	7551171.19	A1		hard fine sandy	1.0	alluvial plain	mixed grasses.	30-40	cleared for grazing	absent	nil	0
m065	619468.47	7551103.77	BDY	bound. A2-C1									
m066	620176.41	7551103.77	B1	dark brown	cracking with	1.5	gently undulating	buffel	50-60	cleared Mt	nil	20-70	1-2

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
				clay	crust		plain			Coolibah			
m069	613004.29	7551820.14	C2										
m070	613678.52	7551811.71	A1	sand	coarse sandy, loose	<0.5	active alluvial drainage line	Poplar Box, mixed acacia	30-40	grazing	absent	nil	0
m071	614319.04	7551803.28	A2	sandy loam	firm sandy ,	0	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	some silcrete quartz	0
m072	615178.68	7551786.42	A1	sandy creek line									
m073	615945.62	7551769.57	A2	sandy loam	firm,	0.5	flat plain	Poplar Box, acacias	30-40	grazing native pastures. Cleared	nil	nil	0
m074	616855.83	7551719.00	A2	same as 73									
m075	617690.19	7551634.72	A2	sandy loam	fine sandy , hardsetting	1	flat plain	regrowth of Poplar Box	50	grazing native pastures. Cleared	nil	5% quartz	0
m076	618575.12	7551592.58	A2	sandy loam	firm,	0.5	flat plain	Poplar Box, acacias	20-30	grazing native pastures. Cleared	nil	nil	0
m077	619417.90	7551550.44	A2	sandy clay loam	sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m078	620218.55	7551508.30	BDY	Boundary									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
				A2-B1									
m081	612254.21	7552346.88	B2	black clay	granular cracking minor sheet erosion	1	lowerslope gently undulating plain	Wilga Buffel	0.5	Cleared.	nil	nil	nil
m082	613021.15	7552321.59	C2	brown sandy clay	sandy,firm non cracking	0.5	flat plain	Buffel	50	cleared Brigalow	nil	5-20 mixed gravels	0
m083	613720.66	7552262.60	C2	same as 82									
m084	614335.90	7552228.89	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
m085	615212.39	7552228.89	A2	brown sandy loam	firm,	0.5	flat plain	Poplar Box, acacias	30-40	grazing native pastures. Cleared	nil	nil	0
m086	615945.62	7552203.60	A2	sandy loam	sandy , hardsetting	1	flat plain	regrowth of Poplar Box	40-50	grazing native pastures. Cleared	nil	nil	0
m088	617648.05	7552161.47	A2	sandy light clay	firm, sandy minor sheet wash	0.5	flat plain	Wilga, Sandalwood Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m089	618423.42	7552169.89	A2	pale brown sandy loam	fine sandy , hardsetting	<0.5	flat plain	regrowth of Poplar Box	50-60	grazing native pastures. Cleared	nil	nil	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m090	619299.91	7552085.61	A1		coarse sandy, loose	1.0	alluvial plain	Poplar Box, wilga, ironbark mixed acacia	30	standing scrub-grazing	absent	10-20 lateritic	0
m091	620176.41	7552051.90	A2	sandy loam	firm,	0.5	flat plain	Poplar Box, acacias	30-40	grazing native pastures. Cleared	nil	nil	0
m094	612372.20	7552911.55	B2	black clay	granular cracking minor sheet erosion	1	lowerslope gently undulating plain	Wilga Buffel	0.5	Cleared.	nil	30-70	5-10
m096	615237.68	7552785.13	A3	Black clay	cracking with weak crust	2	gently undulating plain	Buffel bluegrass	70-80%	Cleared Brigalow	few normal gilgai	5 - 25 quartz	0
m097	615996.19	7552742.99	A2	sandy loam	firm,	0.5	flat plain	Poplar Box, acacias	30-40	grazing native pastures. Cleared	nil	nil	0
m098	616847.40	7552709.28	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m099	617589.06	7552683.99	A2	same as 98									
m100	618431.84	7552650.28	A2	sandy light clay	firm, sandy minor sheet wash	0.5	flat plain	Wilga, Sandalwood Poplar Box	60-70	grazing native pastures. Cleared	nil	nil	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m101	619367.34	7552616.57	A1	sandy coarse	hard fine sandy	1.0	alluvial plain	mixed grasses.	30-40	cleared for grazing	absent	nil	0
m102	620151.13	7552692.42	A1	same as m101									
m105	614689.87	7553349.80	BDY	boundary B2-A3									
m106	615852.91	7553299.23	BDY	boundary A3-A2									
m107	616779.98	7553307.66	A2	sandy loam	A horizon 20cm to brown hard clay	0.5	rold alluvial plain	Poplar Box Ironbark and other acacias, Wilga,	50-60	thinned original veg	odd sink hole	few ironstone small	0
m108	617681.76	7553290.80	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m109	618448.70	7553231.81	A2	same as 108									
m110	619401.05	7553231.81	A2	same as 108									
m111	620260.69	7553214.95	A2	sandy coarse	hard fine sandy	1.0	alluvial plain	mixed grasses.	30-40	cleared for grazing	absent	nil	0
m112	621010.77	7553189.67	BDY	bound. A1-A2									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m114	615945.62	7553956.60	A3	dark brown clay	cracking	1.0	gently undulating plain	Buffel bluegrass	70-80	Cleared Brigalow	nil	some small mixed gravel	<1
m115	616720.98	7553914.46	A2	clay loam	sandy , hardsetting	0.5	flat relic alluvial plain	some Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m116	617462.64	7553863.90	A2	sandy loam	firm sandy ,	<0.5	flat plain	regrowth of Poplar Box vcassia	30-40	grazing native pastures. Cleared	nil	nil	0
m117	618465.55	7553838.61	A2	sandy loam	hard	0	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m118	619358.91	7553788.05	A2	same as 117									
m119	620201.70	7553788.05	A2	pale brown sandy loam	fine sandy , hardsetting	<0.5	flat plain	Poplar Box	50-60	grazing native pastures. Cleared	nil	nil	0
m120	621069.77	7553729.05	A2	same as 117									
m121	621802.99	7553729.05	A1	sandy loam	firm sandy	0	adj. to creek line. alluvial plain	mixed grasses.	30-40	cleared for gpoplar box mixed	absent	nil	0
m122	615911.91	7554453.85	A3	dark clay	cracking with weak crust some sheet wash	2.5	mid slope gently undulating plain	Buffel bluegrass	40-50%	Cleared. Prob previous Brigalow	nil	10-40 quartz mixed gravel	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m123	616628.28	7554453.85	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	mixed grasses	30-40	grazing native pastures. Cleared	nil	nil	0
m124	617513.20	7554453.85	A2	pale brown sandy loam	fine sandy , hardsetting	<0.5	flat plain	regrowth of Poplar Box	50-60	grazing native pastures. Cleared	nil	nil	0
m125	618406.56	7554403.28	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box	50-60	grazing native pastures. Cleared	nil	nil	0
m126	619207.21	7554361.14	A2	light clay sandy	fine sandy , hardsetting	0.5	flat plain	mixed native grass	60-70	grazing native pastures. Cleared	nil	few rounded quartz <10mm	0
m127	620167.99	7554319.00	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box & grass	30-40	grazing native pastures. Cleared	nil	nil	0
m130	613501.54	7554900.52	B2	dark clay	cracking with strong granular mulch some sheet wash	1.5	mid slope gently undulating plain	Buffel bluegrass	40-50%	Cleared. Prob previous Mt Coolibah Bloodwood	nil	10-70 basalt	<2
m131	614605.59	7554917.38	B2	dark clay	cracking with strong granular mulch	<1						few basalt floaters	<5

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m132	615793.92	7554892.10	A3	brown clay	cracking with weak self mulch	0.5	flat plain	Buffel bluegrass	60-70%	Cleared Brigalow	minor normal gilgai	5-20. laterite gravels	0
m133	616619.85	7554883.67	A2	sandy loam	firm,	0.5	flat plain	Poplar Box, acacias	30-40	grazing native pastures. Cleared	nil	nil	0
m134	617487.92	7554951.09	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m135	618339.14	7554934.24	A2	same as 134									
m136	619097.65	7554934.24	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m137	619932.00	7554917.38	A2	same as 136									
m140	613762.80	7555330.35	A3	dark clay	cracking with weak crust some sheet wash	2.5	mid slope gently undulating plain	Buffel bluegrass	40-50%	Cleared. Prob previous Brigalow	nil	10-40 quartz mixed gravel	0
m141	616687.27	7555473.62	A3	Black clay	cracking with weak crust	2	gently undulating plain	Buffel bluegrass	70-80%	Cleared Brigalow	nil	10-30 quartz, laterite	0
m142	617403.64	7555473.62	A3	same as m141									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m143	618330.71	7555482.05	A1		firm, coarse sandy	<0.5	creel line in recent alluvial plain	mixed grasses . poplar box, cassia regrowth	40-50	grazing	absent	nil	0
m144	619055.51	7555515.76	A2	clay loam	sandy , hardsetting	0.5	flat relic alluvial plain	some Poplar Box	30-40	grazing native pastures. Cleared	nil	nil	0
m145	619991.00	7555498.90	A2	sandy loam	firm sandy ,	<0.5	flat plain	regrowth of Poplar Box vcassia	30-40	grazing native pastures. Cleared	nil	nil	0
m148	613455.18	7556046.72	A3	dark clay	coarse cracking stable erosion	2.5	lower slope	Buffel	40-50%	Cleared.	nil	10-70 ironstone silcrete	<1
m149	614702.51	7556257.41	B2 (rp)	black clay	granular cracking minor sheet erosion	1	lowerslope gently undulating plain	Wilga Buffel	0.5	Cleared.	nil	30-70	5-10
m150	616725.20	7556122.57	BDY	boundary A3-B2									
m151	617483.71	7556156.28	A3	dark brown clay	weak cracking	1.5 - 2	lower slope	Buffel bluegrass	40-50%	Cleared. Previous Brigalow	nil	10-20 ironstone quartz / silcrete	0
m152	618292.78	7556164.71	A3	same as m151									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m153	619152.43	7556181.56	C2	Thin sandy duplex, brown	non cracking , hard	1.0	gently undulating plain	Buffel whitewood wilga regrowth	40-50	Cleared Brigalow	nil	some small mixed gravel	0
m154	619969.93	7556088.86	A1	same as m143	creek channel								
m157	614129.41	7557007.49	B2 (rp)	black clay	granular cracking	0.5	lowerslope gently undulating plain	Buffel	0.5	Cleared Mt Coolibah.	nil	30-90	10
m158	615250.32	7556990.64	B2	black clay	strong granular cracking	0.5	lowerslope gently undulating plain	Wilga Buffel	>80	Cleared.	nil	30-70	<5
m160	617593.27	7556881.08	B2	black clay	granular cracking minor sheet erosion	1	lowerslope gently undulating plain	Wilga Buffel	60-70	Cleared.	nil	30-70	<2
m161	618318.07	7556847.36	A3	Brown clay	coarse weak cracking no erosion	0.5	upperslope	Buffel bluegrass	60-70%	Cleared brigalow. Grazing	nil	10-30 ironstone silcrete. Occasional cobble	2-4

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m162	619169.28	7556779.94	C2	brown clay	non cracking , hard	1.0	gently undulating plain	Buffel	40-50	Cleared Brigalow	nil	some small mixed gravel	0
m163	619969.93	7556737.80	A2	brown sandy loam	texture conrtrast A horizon 25cm over mottled yellow clay	1.0				cleared	nil	0	0
m166	614483.38	7557648.01	B2	black clay	cracking	1.5	gently undulating plain	Buffel bluegrass	70-80	Cleared.	nil	30-70	<5
m167	615275.60	7557631.16	B1	black clay	granular cracking minor sheet erosion	1	lowerslope gently undulating plain	sally wattle regrowth Buffel	>80	Cleared.	nil	nil	0
m168	616050.97	7557597.44	A3	same as m161									
m169	616733.63	7557614.30	A3	Brown clay	cracking weak crust, no erosion	0.5	upperslope	Buffel bluegrass	60-70%	Cleared brigalow. Grazing			
m170	617626.98	7557580.59	A3	same as m169									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m171	618334.92	7557580.59	A3	same as m169									
m172	619101.86	7557437.32	C2	palke brown sandy clay	weak cracking	1	lower slope	Buffel bluegrass	40-50%	Cleared. Previous Brigalow	nil	10-20 ironstone quartz / silcrete	0
m173	619860.37	7557420.46	C2	same as 172									
m174	620787.43	7557369.89	A2	light clay sandy	fine sandy , hardsetting	1	flat plain	mixed native grass	60-70	grazing native pastures. Cleared	nil	few rounded quartz <10mm	0
m175	621883.06	7557344.61	A2	sandy loam	fine sandy , hardsetting	0.5	flat plain	regrowth of Poplar Box & grass	30-40	Cleared	nil	few rounded quartz <10mm	0
m176	615267.18	7558339.10	A3	Black clay	cracking with weak crust	2	gently undulating plain	Buffel bluegrass	70-80%	Cleared Brigalow	nil	10-70 quartz, laterite	3-5
m177	616093.11	7558313.81	B2	dark clay	coarse cracking stable erosion	2.5	lower slope	Buffel	40-50%	Cleared.	nil		
m179	617685.98	7558263.25	A3	Dark clay	cracking with silty crust	0.5	flat plain	Buffel with leichardt bean whitewood regrowth	70-80%	Cleared Brigalow	nil	10-60 quartz, laterite	2

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m180	618469.77	7558263.25	A3	same as m179									0
m181	619228.28	7558263.25	BDY	boundary A3-C1									0
m182	620028.93	7558246.39	C1		Firm sandy	0.5 - 1	flat plain	eupop with narrow leaf ironbark, wilga, whitewood .	20-30	grazing native pastures	nil	5 - 10 mixed lateritic, quartz	0
m183	620930.71	7558204.25	A2	sandy loam	fine sandy , hardsetting								
m185	616008.83	7558988.04	A3	dark brown clay	weak cracking	1.5 - 2	lower slope	Buffel bluegrass	40-50%	Cleared Brigalow	nil	10-20 ironstone quartz / silcrete	0
m186	616767.34	7558962.76	A3	same as m185									
m187	617652.26	7558929.05	A3	black clay	strong cracking	0.5	lower slope	Buffel. Some whitewood regrowth	40-50%	Cleared. Previous Brigalow	nil	10-20 ironstone quartz / silcrete	0
m188	618469.77	7558870.05	A3	dark clay	cracking		lower slope			old Brigalow			
m189	619127.14	7558819.49	C1		Hard sandy	1	flat plain	mostly cleared	20-30	grazing native pastures	nil	5 - 10 mixed lateritic, quartz	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m190	619776.09	7558836.34	C1	clay loam brown	hardsetting	1	flat plain		30-40		nil	nil	
m191	620728.44	7558785.78	A3	Brown clay	cracking weak crust, no erosion	0.5	midslope	Buffel bluegrass	60-70%	Cleared brigalow. Grazing	occasional normal gilgai	few small ironstone and quartz	0
m193	613800.73	7559451.58	A3	dark brown clay	weak cracking	1.5 - 2	lower slope	Buffel bluegrass	40-50%	Cleared Brigalow	nil	10-20 ironstone quartz / silcrete	0
m194	614432.82	7559451.58	B2	dark clay	self mulching cracking stable erosion	1.5	lower slope	Buffel	40-50%	Cleared for grazing. Odd Bloodwood	linear gilgai	occasion. Basalt floater	<2
m195	615351.45	7559426.29	A3	brown clay	crusting and cracking	0.5	lower slope	Buffel. Regrowth wilga,whitewood	40-50%	Cleared Brigalow	nil	few small ironstone and quartz	0
m196	616093.11	7559409.44	A3	same as m195								same	0
m197	616851.62	7559434.72	C1	sandy clay loam	brown hard setting	1.0	flat plain	buffel spear grass	60	Cleared Brigalow	few sink holes	few small ironstone	0
m198	617652.26	7559358.87	C1	same as 197		1.0	flat plain	buffel	50-60	Cleared Brigalow	nil		0
m199	618452.91	7559333.59	C1	sandy loam	pale, sandy	1.0	flat plain		40	Cleared Brigalow	nil		0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m200	619059.72	7559316.73	C1	sandy loam	pale hard sandy	0.5	flat plain		40	Cleared Brigalow	nil		0
m202	620905.42	7559266.16	A3	Brown clay	cracking weak crust, no erosion	0.5	midslope	Buffel	60-70%	Cleared brigalow. Grazing	occasional normal gilgai	few small ironstone and quartz	0
m203	613008.51	7559944.61	A3	Brown clay	cracking fine sandy veneer, no erosion	1	upperslope	Buffel	40-50%	Cleared brigalow. Grazing	nil	5-20. quartz silcrete	0
m204	613901.86	7559919.32	B2	dark clay	coarse granular cracking stable erosion	0.5	midslope	Buffel	40-50%	Cleared.	nil	30-80 basalt	<5
m205	614559.23	7559927.75	B2	dark clay	strong granular cracking	2.5	lower slope	Buffel	40-50%	Cleared.	nil		0
m206	615435.73	7559902.47	A3	black clay			lower area			old Brigalow scrub		nil	0
m207	616042.54	7559902.47	BDY		Boundary A3 - C1								
m208	616834.76	7559902.47	C1	sandy	duplex								
m209	617702.83	7559927.75	C1	sandy loam	pale, sandy	1.0	flat plain		40	Cleared Brigalow	nil		0
m210	618461.34	7559902.47	C1	sandy loam	pale hard sandy	0.5	flat plain		40	Cleared Brigalow	nil		0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m211	619068.15	7559919.32	C1	same as 210									
m213	613008.51	7560660.98	B2	dark clay	coarse cracking stable erosion	2.5	lower slope	Buffel	40-50%	Cleared.	nil		
m214	613876.58	7560660.98	B2	Dark clay	cracking with weak silty crust	0.5	flat plain	Buffel with leichardt bean whitewood regrowth	70-80%	Cleared Mt Coolibah Bloodwood	nil	10-60 quartz, laterite	
m215	614592.95	7560601.98	B2	same as 213									
m216	615402.02	7560551.41	BDY		Boundary A3 - B2								
m217	616008.83	7560534.56	A3	Brown clay	cracking weak crust, no erosion	0.5	midslope	Buffel	60-70%	Cleared brigalow. Grazing	occasional normal gilgai	few small ironstone and quartz	0
m218	616843.19	7560483.99	A3	Brown clay	cracking	1.0	midslope	Buffel	60-70%	Cleared brigalow. Grazing	occasional normal gilgai	few small ironstone and quartz	0
m219	617744.97	7560517.70	C1	sandy loam	pale, sandy	1.0	flat plain		40	Cleared Brigalow	nil		0
m220	618646.75	7560483.99	C1	sandy loam	pale, sandy	1.0	flat plain		40	Cleared Brigalow	nil		0
m222	608007.27	7559970.33	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed	60-70	cleared Brigalow	nil	nil	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
								regrowth					
m223	608808.42	7560212.54	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
m224	607858.22	7560603.79	A3	Brown clay	non cracking with crust, no erosion	2.0	upperslope	Buffel	30-40%	Cleared brigalow. Grazing	nil	few small ironstone and quartz	0
m225	609879.72	7560622.43	C2	light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
m227	607154.89	7561283.84	C2	same as 225									
m228	607862.88	7561237.26	C2	sandy clay	firm non cracking	0	flat plain	Buffel	60-70	cleared Brigalow	nil	nil	0
m229	608729.23	7561218.63	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel	60-70	cleared Brigalow	nil	nil	0
m230	609828.48	7561153.42	C2	same as 229									
m231	610750.73	7561237.26	A2	sandy loam	firm sandy,	<0.5	old alluvial plain	Mixed spear grasses, buffel	50-60	Poplar Box mixed woodland	absent	10-20 mixed	0
m232	611365.56	7561265.21	A3	Black clay	cracking self mulching, some sheet	2.5	midslope	Buffel bluegrass	80%	Cleared Mt Coolibah Grazing	nil	40-170	8

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
					erosion								
m233	612231.92	7561237.26	B2	dark clay	coarse granular cracking stable erosion	0.5	midslope	Buffel	70%	Cleared.	nil	30-80 basalt	<5
m234	612939.91	7561181.37	B2	same as 233								30-80 basalt	<2
m235	613843.53	7561181.37	A3	Brown clay	cracking weak crust, no erosion	0.5	midslope	Buffel	60-70%	Cleared brigalow. Grazing	occasional normal gilgai	few small ironstone and quartz	0
m236	614560.84	7561172.05	A3	Brown clay	cracking sandy	1	upperslope	Buffel	40-50%	Cleared brigalow. Grazing	nil	5-20. ironstone	0
m237	615361.98	7561153.42	A3	same as 236									
m238	616116.55	7561116.16	A1		firm sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	Extensive clearing grazing	absent	10-20 mixed	0
m239	616805.91	7561125.47	A1		coarse sandy, loose	<0.5	active alluvial drainage line	Poplar Box, mixed acacia	30-40	standing scrub-grazing	absent	nil	0
m240	617709.53	7561088.21	A1	same as m239									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m241	618436.15	7561032.32	C1	sandy loam	pale, sandy	1.0	flat plain		40	Cleared Brigalow	nil		0
m242	607052.41	7561898.67	C2	brown clay loam	hard sandy, non cracking. Thin duplex	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
m243	607900.14	7561870.72	A3	Brown clay	non cracking with crust, no erosion	1.5	upperslope	Buffel	30-40%	Cleared brigalow. Grazing	nil	few small ironstone and quartz	0
m244	608859.65	7561907.99	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
m245	609781.90	7561852.09	BDY	boundary C2-A3									
m246	611440.09	7561786.88	A3	Dark clay	cracking weak crust, no erosion	0.5	midslope	Buffel	60-70%	Cleared brigalow. Grazing	occasional normal gilgai	few small ironstone and quartz	0
m247	612334.39	7561786.88	A3	Brown clay	cracking sandy . Firm	3.5	crest	Buffel	40-50%	Cleared brigalow. Grazing	nil	5-40. ironstone	1
m248	613088.96	7561758.94	A3	same as 247									
m249B	614029.84	7561796.20	A3	Dark clay	cracking weak crust, no	0.5	lower			old Brigalow			

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
					erosion								
m250	614663.31	7561777.57	A1		creek channel - sandy deep			riverine veg.					
m251	615399.24	7561740.31	A1		creek channel. Sandy			riverine veg.					
m252	616237.65	7561721.67	A1		firm sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	Extensive clearing grazing	absent	10-20 mixed	0
m253	617029.48	7561721.67	BDY	boundary A1-A2									
m254	617877.21	7561675.10	A3	Brown clay	non cracking with crust, no erosion	1.5	upperslope	Buffel	30-40%	Cleared brigalow. Grazing	nil	few small ironstone and quartz. Larger silcrete	4-5
m255	605929.88	7562690.50	C2	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
m256	606982.55	7562634.61	C2	same as 255									
m257	607737.12	7562634.61	C2	brown sandy clay	non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
m258	608715.26	7562597.35	C2	same as 257									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m259	609684.09	7562485.56	BDY C2-A2-Disturbed										
m260	610559.76	7562588.03	Disturbed										
m261	612236.58	7562299.24	B2	dark clay	coarse granular cracking stable erosion	0.5	midslope	Buffel	70%	Cleared.	nil	30-80 basalt	<5
m262	613214.72	7562383.09	B2	dark clay	cracking	0.5						occasion. Basalt floater	1-2
m263	613969.29	7562317.88	A1	sandy loam	loose sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	Poplar Box woodland	absent	nil	0
m264	614677.28	7562345.82	C1	sandy loam	firm sandy,	1.0	flat plain	Mixed spear grasses, buffel					
m265	615450.48	7562308.56	A1	loose sand	loose sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	Extensive clearing grazing	absent	10-20 mixed	0
m266	616130.52	7562178.14	A1	sandy loam	firm sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	some clearing	absent	nil	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m267	616996.88	7562122.25	A2	sandy clay loam	Hard sandy	0.5	old alluvial plain			Poplar Box			
m268	617877.21	7562150.19	A3	Brown clay	cracking with weak crust, no erosion	1.5	upperslope	Buffel	70-80%	Cleared brigalow. Grazing	few small normal gilgai	few small ironstone and quartz	0
m269	612129.45	7563063.13	A3	Brown sandy clay	non cracking with some sheet erosion	3.0	upperslope	Buffel	30-40%	Cleared brigalow. Grazing	nil	10-30 mixed quartz ironstone	0
m270	613228.70	7563025.87	A1		active creek channel.		sandy, deep profile	riverine veg.				nil	0
m271	614020.53	7562942.03	BDY	boundary A3-C1									
m272	614700.57	7562876.82	A1	sand	firm sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	Extensive clearing grazing	absent	10-20 mixed	0
m273	615445.82	7562811.61	A1	sandy loam	firm sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	Extensive clearing	absent	nil	0
m274	616116.55	7562811.61	A3	Brown clay	cracking	1.5	midslope	Buffel	60-70%	Cleared brigalow. Grazing	nil	nil	0
m275	617010.85	7562653.24	BDY	boundary A3-A2									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m276	617877.21	7562690.50	A2	sandy loam	firm sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	some clearing	absent	nil	0
m278	606097.56	7563491.65	BDY	boundary A3-A2	outside survey boundary								
m279	606796.23	7563463.70	A3	Brown clay	cracking weak crust, no erosion	0.5	midslope	Buffel	60-70%	Cleared brigalow. Grazing	occasional normal gilgai	few small ironstone and quartz	0
m280	607606.70	7563426.44	A3	Brown clay	cracking fine sandy veneer, no erosion	1	upperslope	Buffel	40-50%	Cleared brigalow. Grazing	nil	5-20. quartz silcrete	0
m281	608333.32	7563398.49	C1	sandy clay loam	pale, sandy. Duplex 20cm A horizon	1.0	flat plain	some mixed regrowth	40-50	Cleared Brigalow	nil	few quartz <10mm	0
m282	609106.52	7563361.23	C1	sandy loam	pale, sandy	1.0	flat plain		40	Cleared Brigalow	nil		0
m283	609963.56	7563473.02	A1		active creek channel.		sandy, deep profile	riverine veg.					
m284	610774.02	7563491.65	B2	black clay	weak crusting and cracking	2.5	gup	sally wattle odd bloodwood. Bluegrass	70+	grazing improved pastures	slight linear gilgai	few basalt cobble	3-5

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m285	611649.69	7563640.70	A3	brown clay	sandy weak cracking					old Brigalow	nil		0
m286	612450.84	7563612.75	C1	sandy loam	pale, sandy, hard	1.0	flat plain		40	Cleared Brigalow	nil		0
m287	613214.72	7563538.23	A3	Brown clay	cracking sandy . Firm	3.5	crest	Buffel	60%	Cleared brigalow. Grazing	nil	5-40. ironstone	0
m288	614015.87	7563482.33	A3	same as 287									
m289	614919.49	7563454.39	A1		active creek channel.		sandy, deep profile	riverine veg.					
m290	615729.95	7563417.12	A1		active creek channel.		sandy, deep profile	riverine veg.					
m292	605315.04	7564069.22	n/a		outside area								
m294	606917.34	7564115.80	n/a		outside area								
m295	607625.33	7564106.48	n/a		outside area								
m296	608240.16	7564022.64	C1	sandy loam	pale, sandy, firm	0.5	flat plain	sparse buffel	30	Cleared Brigalow	nil		0
m297	608901.57	7564022.64	C1	sandy loam	pale, sandy	1.0	flat plain	buffel	40	Cleared Brigalow	nil		0
m298	609702.72	7564041.27	BDY	Boundary C1-A1									

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m299	610624.97	7564181.01	C1	sandy loam	pale, sandy	1.0	flat plain		40	Cleared Brigalow	nil		0
m300	611603.11	7564171.69	C1	brown light clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	60-70	cleared Brigalow	nil	nil	0
m301	612432.21	7564171.69	C1	same as 300									
m302	613298.56	7564227.59	C1	sandy loam	pale, sandy	1.0	flat plain		40-50	Cleared Brigalow	nil	few quartz <20mm	0
m303	614015.87	7564153.06	A1	creek channel				Riverine vegetation					
m304	614854.28	7564190.32	A1	creek channel				Riverine vegetation					
m305	615832.42	7564013.33	A3	dark clay	strong cracking, granular	2	upper slope - edge of Basalt	previous Mt Coolibah Bloodwood	70	extensive clearing	linear gilgai	occasional basalt floater	<5
m306	616614.94	7564134.43	A2	sandy loam	firm sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	some clearing	absent	nil	0
m308	no site												
m309	no site												
m310	608147.00	7564795.84	B2	dark clay	strong cracking, granular	1	lower slope	bluegrass buffel	>90	extensive clearing	nil	occasional basalt floater	<2

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m311	608873.63	7564777.21	BDY	B2-C2									
m312	609777.24	7564721.32	A1	sandy loam	loose sandy,	0	drainage line	Blue gum, Casuarina, Ironbark	20-30	natural	nil	nil	0
m313	610708.81	7564758.58	C1	sandy loam	pale, sandy, duplex	1.0	flat plain		40	Cleared Brigalow	nil		0
m314	611742.85	7564758.58	C1	same as 313									
m315	612544.00	7564758.58	C1	same as 313									
m316	613261.30	7564758.58	A1		active river channel.		deep sandy						
m317	614155.60	7564674.74	A1		active river channel.		deep sandy						
m318	614826.33	7564730.63	A1		firm sandy,	<0.5	recent alluvial plain	Mixed spear grasses, buffel	50-60	some clearing	absent	nil	0
m319	615888.32	7564739.95	C1										
m320	616586.99	7564786.53	A2	sandy clay loam	firm and quite bare	<0.5	old alluvial plain	Mixed grasses, buffel	50-60	cleared	absent	nil	0
m321	611547.22	7557618.13	C2	brown sandy clay	hard sandy, non cracking	0.5	flat plain	Buffel with mixed regrowth	30-40	cleared Brigalow	nil	nil	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m322	611910.53	7557543.60	C2	brown light clay	firm sandy, non cracking	1.0	flat plain	Buffel	60-70	cleared Brigalow	nil	nil	0
m323	611211.86	7557133.71	A3	Brown clay	cracking sandy . Firm	3.5	crest	Buffel	60%	Cleared brigalow. Grazing	nil	5-40. ironstone	0
m324	612013.00	7557124.40	BDY	boundary C2-A3									
m325	611016.23	7556742.45	A3	Brown clay	non cracking sandy . Firm	3.5	crest	Buffel	60%	Cleared brigalow. Grazing	nil	5-40. ironstone	0
m326	611873.27	7556770.40	A3	same as 326									
m327	610829.91	7556258.04	A3	same as 326									
m328	611314.33	7556220.78	A3	Brown clay	cracking with weak sandy - Firm	1.5	midslope	Buffel	70%	Cleared brigalow. Grazing	nil	nil	0
m329	611770.80	7556183.51	A3	same as 328									
m330	610764.70	7555736.36	A3	outside area									
m331	611174.59	7555708.42	A3	Dark clay	cracking with weak sandy - Firm	2	midslope	Buffel	70%	Cleared brigalow. Grazing	nil	nil	0

ID	mE	mN	Soil Type	Concept	Surface condition	Slope %	Landform	Major vegetation	Ground cover %	Disturbance land use	Microrelief	predom. Rock dia (mm), type	%surface rock cover >6cm
m332	611836.01	7555671.15	A3	Dark Brown clay	cracking sandy .	1.5	lower	Buffel	60%	Cleared brigalow. Grazing	nil	few small ironstone	0
m333	610876.49	7555140.16	A3	outside area	brown clay					Brigalow R/G			
m334	611416.80	7555074.95	A3	Brown clay	cracking , coarse granular	0.5	lowerslope	Buffel	40-50%	Cleared brigalow. Grazing	5% small gilgai	10-20 mixed laterite	3
m335	612003.69	7555028.37	A3	same as 334									
m336	611034.86	7554590.54	A3	outside area									
m337	611575.17	7554543.96	A3	Brown clay	cracking with weak sandy - Firm	1.5	midslope	Buffel	70%	Cleared brigalow. Grazing	nil	nil	0
m338	611985.06	7554525.33	A3	same as 337									
m339	611267.75	7554050.23	A3	Brown clay	weak cracking sandy - Firm	2.5		Buffel regrowth Brigalow whitewood	30-40%	Cleared brigalow. Grazing	occasional small gilgai	few quartz	0
m340	611649.69	7554050.23	A3	same as 339									

APPENDIX 4 ROCKINESS EVALUATION OF THE SCL AREA (AVAILABLE ON REQUEST)