



ANNEXURE H: RCEP EIS Chapter 19 – Economic Values



ANNEXURE I: RCEP EIS Appendix D-1: Soil Survey Technical Report



Appendix D-1

Soil Survey Technical Report

EIS



Report

Soil survey technical report Rolleston Coal Expansion Project

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Site	Rolleston
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Executive Summary

Introduction

A soil survey was commenced in June 2011 of MLAs 70415 and 70416 as part of planning for the Rolleston Coal Expansion Project (the 'Project'). The survey was subsequently extended to include a soil survey of MLA 70458 and later to assess the Strategic Cropping Land (SCL) potential and possible impacts of the proposed mine expansion. The soil survey was undertaken prior to release of formal guidelines of specific requirements for SCL assessment, meaning that soil descriptions and analytical data have had to be reinterpreted in light of the guidelines that were given assent on promulgation of the *Strategic Cropping Land Act* in January 2012. The survey did not investigate the existing ML70307 for which a Compliance Certificate (SCLRD2013/000106) was issued on 5 February 2013 for an amended application for further work. No SCL will be affected on ML70307 by the proposed future disturbance.

This revised report focuses on the identification of SCL, likely impacts of the proposed development on SCL lands, potential mitigation measures and advice on the level of compensation that may be required for those areas to be disturbed by mining and associated infrastructure development activities.

This report on the soils of the Project and the SCL assessment will provide input to the Environmental Impact Statement for the mine expansion and also supporting information for use in the formal SCL assessment process to gain the necessary approvals for the Project.

Scope of works

The scope of work undertaken for this commission included:

- a soil map of all MLAs as specified above
- conformance to all relevant matters relating to soils and SCL as set out in the provided Terms of Reference for the Rolleston Coal Expansion Project Environmental Impact Statement January 2012
- an assessment of SCL status of areas identified on the DNR&M SCL Trigger Mapping within the disturbance area (including the proposed road diversion (two options) to the east of Meteor Creek and the potential inundation area on MLA 70458) including mapping
- determination of likely impacts on SCL and particular lands within the wider disturbance area
- development of recommendations for mitigation of the identified impacts
- assessment of the amount payable for mitigation of impacts on land that will be irreversibly lost to agriculture due to permanent impacts
- guidance as to necessary steps to be taken with respect to future management of the approvals process for soil related impacts
- preparation of a single report that documents all the above outputs

Soil and Land Use Assessment

A free soil survey methodology was applied over the mine site. More than 500 sites were variously described at a detailed or check level and representative sites were sampled for chemical analysis for selected attributes important to land use and soil classification.

Twelve soil types were defined for the area surveyed on MLAs 70415, 70416 and 70458. These soils and landscapes were correlated with earlier mapping by Bourne and Tuck (1993) and *Story et al.* (1967), for which a range of supporting descriptive, chemical and physical data were also available. There were some differences between the mapping of Bourne and Tuck (1993), *Story et al.* (1967) (which mapped land resource areas and soil associations respectively but for which soil descriptions were provided that allowed for correlation) and the present survey that resulted in land meeting/not meeting the SCL trigger mapping classification exactly.

It appears that the SCL mapping largely relied on the *Story et al.* (1967) report though, so that to some extent, these differences have been masked by the SCL trigger mapping. Thus, the SCL mapping reflects soil associations and not detailed soil mapping that is at a level suitable for adequate assessment of actual SCL. Clearly, the regulator is of the opinion that this level of soil mapping is consistent with the intent of management in this region. These differences are a consequence of scale of mapping and the differing objectives of the three surveys. Effective correlation was achieved, nevertheless, supported by expert knowledge of the regional soils and land use characteristics, giving an effective SCL assessment of the

proposed area of disturbance. The mapping achieved in the present survey is, therefore, more than appropriate for an SCL assessment.

SCL Assessment

The published SCL trigger mapping indicated that 1,813 ha of SCL potentially existed on MLAs 70416 and 70458. No SCL was identified on the trigger mapping for MLA70415.

The current SCL evaluation found that 296 ha of the trigger mapping did not meet the Western Management Zone criteria for one or more of the slope, depth, and water storage attributes, or could be excluded on dimensional parameters (i.e. residual area <100 ha) for both MLA70416 and MLA70458.

The assessment identified 326 ha of SCL land that would be permanently impacted and thus subject to payment of a contribution to the mitigation fund as per the currently proposed design. Depending on whether the road detour option to the east of MLA70416 and/or the adoption of a recommendation to accept that a parcel of land of 97 ha that would be isolated by the location of the internal road route should be considered as permanently impacted for workability reasons. These two additional options would add a further 208 ha to the compensation calculation if accepted.

Thus the financial contribution is estimated to be \$1,548,500 or, alternatively, \$2,536,500 depending on the approach adopted.

With adoption of a realignment strategy for all proposed infrastructure within both MLA70416 and MLA70458, the permanently impacted area becomes 156 ha, leading to a financial contribution of \$741,000. The implementation of the external road would add a further \$427,500, making a total of \$1,168,500.

These are estimates based on mapping available for this report and are not to be considered the final amounts that may be determined by NRM following a formal assessment.

Recommendations for Managing SCL

The estimated mitigation costs for future mine development have been substantially reduced in this report from those first estimated in initial draft reports (Palaris, 2012) due in part to a revised definition of the disturbance area and a more detailed assessment of the Western Management Zone criteria. Although the initial survey was done prior to release of the final SCL guidelines, it has been possible to reinterpret many of the soils described against the final guidelines criteria.

It is considered that the expansion be considered under the transitional arrangements for SCL as the mine was operating under an ML at the time of the legislation being introduced.

To estimate the likely financial contributions, a decision on the road options is required. Both of these options would have permanent impact on SCL areas but to varying degrees. An allowance has been made in Section 4 for these options as an indicative value in the absence of a detailed design.

Though this report assesses the probable impacts on SCL as a consequence of the planned disturbance area, more accurate definition is required prior to submission of an application for SCL validation and determination of all necessary approvals. This will only be possible when all final mine development designs are to hand and exact affected area calculations can be made.

1 Introduction

Palaris Mining Pty Ltd (Palaris) was engaged originally in June 2011 by Xstrata Coal Queensland (XCQ) to undertake a soil survey of the Rolleston Coal Expansion Project (the Project) area covering MLAs 70415 and 70416. Subsequently, MLA 70458 was added to the study.

This commission later included undertaking a Strategic Cropping Land (SCL) assessment for those areas identified on the Trigger Mapping provided by the Department of Environment and Resource Management (now Department of Natural Resources and Mines – DNRM). An assessment of Good Quality Agricultural Land (GQAL) and Land Suitability (LS) were also included in the expanded scope. The field work, which was well underway at that time, was not based on the specific requirements set out in the *Guidelines for applying the proposed strategic cropping land criteria*, which were only made available in September 2011 and became mandatory in January 2012 when the Strategic Cropping Land Act was implemented. To some extent, therefore, the sampling regime undertaken in this interim period does not exactly reflect the specifications of the Guidelines and extrapolations have been necessary using other published data to underpin this report.

This revised report focuses on the identification of SCL, likely impacts of the proposed development on SCL lands, potential mitigation measures and advice on the level of compensation that may be required.

This report on the soils of the Rolleston mine site and the SCL assessment will provide supporting information for use in the formal SCL assessment process to gain the necessary approvals for the Project. It is based on work conducted previously and reported in August 2012.

1.1 Background

XCQ operates the Rolleston Coal Mine (the mine) on behalf of joint venture partners. The mine commenced operation in 2005 and currently has approved production levels of up to 14 Mtpa including export and domestic use. The Project area is located about 16 km west of Rolleston in the southern part of the Central Highlands. Tenure is contiguous with the existing mining lease ML 70307 and the mine will be operated as a single operation incorporating activities on all MLAs that are the subject of this present study. MLA70418, which is the location of the rail loop for the coal loading facility, has been dropped from the report as this area has already been disturbed and will not be subject to future mining activity.

The Project seeks to expand the existing mine and ultimately increase production up to a maximum of 19 Mtpa. The Project encompasses Mining Lease Applications (MLA) 70415, 70416 and 70458, with a total mapped area of 12,496 ha (Figure 1.1), a small part of ML70307 and a road option off-lease. It is understood that mining within the mining lease application areas will be developed in accordance with existing open cut practices. Surveys were only conducted over MLAs 70415, 70416 and 70458.

1.2 Objectives of Study

This report will provide input to the EIS in compliance with the Final Terms of Reference as set out in DERM (2012). Additionally, the scope of the initial soil survey was broadened to include an assessment of Strategic Cropping Land (SCL) as this component came into force following introduction of the *Strategic Cropping Land Act 2012* during the timeframe in which the EIS was being undertaken. The following list of activities has been developed accordingly to address requirements under s4 - *Environmental values and management of impacts* and specifically relevant parts of s4.2 - *Land* (DERM 2012):

- a soil map of all MLAs as specified above
- conformance to all relevant matters relating to soils and SCL as set out in the Terms of Reference provided
- an assessment of SCL status of areas identified on the DERM Trigger Mapping within the disturbance area (including the proposed road diversion to the east of Meteor Creek and the potential inundation area on MLA 70458) including mapping
- determination of likely impacts on SCL and particular lands within the wider disturbance area
- development of recommendations for mitigation of the identified impacts

- assessment of the amount payable for mitigation of impacts on land that will be irreversibly lost to agriculture due to permanent impacts
- guidance as to necessary steps to be taken with respect to future management of the approvals process for soil related impacts
- preparation of a single report that documents all the above outputs

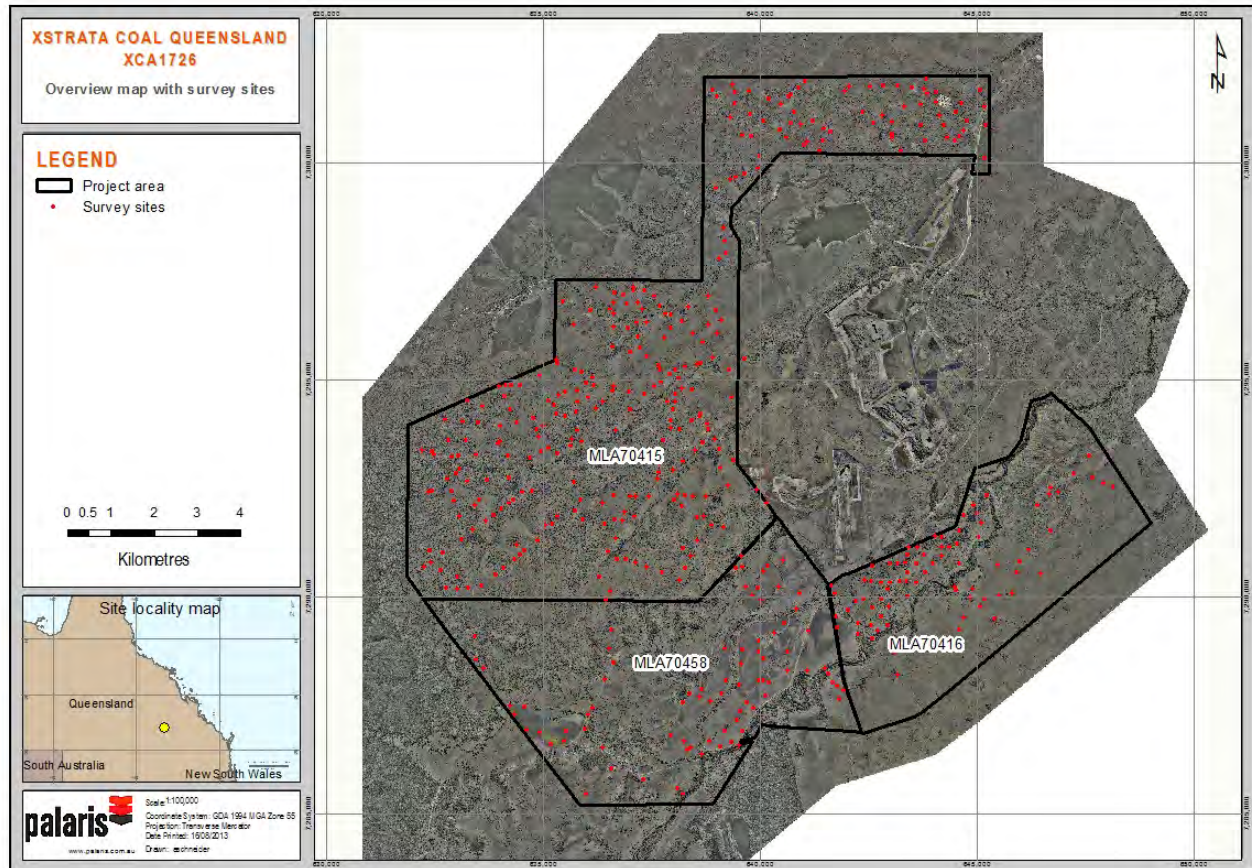


Figure 1.1 Location of the Project showing MLAs 70415, 70416 and 70458

2 Environmental Setting

2.1 Climate

The Rolleston district has a variable climate, characterised by unreliable rainfall, extreme temperatures and high evaporation. Agricultural land use is greatly affected by rainfall and temperature, with rainfall variability being the most limiting factor (Bourne and Tuck, 1993). Land use is predominantly grazing though extensive areas are used for dryland (i.e. rainfed) cropping in suitable seasons. Irrigation is rare in the district though there is a centre pivot irrigator on MLA70458 as shown by a review of satellite imagery of the area.

(i) Rainfall

The mean annual rainfall recorded at Rolleston is 639 mm (BOM, 2011). Whilst rainfall averages are an important indicator for agriculture, it is rainfall variability that has a greater impact on dryland cropping systems in central Queensland (Thomas, Bauer and Short, 2011). According to BOM (2011) the rainfall variability index at Rolleston is moderate to high, i.e. variability from year to year.

The rainfall regime is summer dominated with about 65-70% of rain falling in the summer months. Summer events are typically of high intensity and short duration, i.e. storm events, which create runoff and erosion hazards for crop land.

Cyclones can affect the area, but only as heavy rain depressions, generally in the period from January to March. Most of the rain between September and December is associated with local thunderstorms. The Central Highlands area experiences the highest average number of thunderstorms in Queensland. The average thunderstorm has an 8 km front and a 64 km path. Although thunderstorms are a valuable source of rainfall, their high intensities produce high runoff and associated soil erosion problems, which create problems with land management and in the case of the mine site, with rehabilitation programs as well as daily operations.

Where rainfall is unreliable and highly seasonal, farmers tend to adopt opportunity cropping management practices, planting only if and when rainfall occurs and subsoil moisture is sufficient. Rainfall is characteristically of short duration and high intensity and strongly influences the choice of cropping systems in the region. Spring plantings are rare as soil profile moisture is seldom sufficient as deep wetting does not occur from the high intensity, short duration thunderstorms. The lack of likely follow-up rain can further impact on cropping selection due to rundown of soil moisture and crop death. This creates similar problems for rehabilitation programs and influences the most effective times for establishing vegetation.

As fallow farming systems are important in the region, this moisture limitation is a critical criterion in the assessment of strategic cropping lands under the eight zonal criteria as reported later in this report.

(ii) Temperature

The mean monthly maximum and minimum temperatures at Rolleston are 29.6°C and 14.0°C respectively (BOM, 2011) (Table 2.1). Temperatures can exceed 40°C during the hottest months while frosts are common from June to August. The diurnal temperature range is considerable, particularly in winter.

While temperature plays a less significant role than rainfall it is still an important consideration in cropping systems. For example, low lying areas are affected more by winter frosts than upland areas, and high temperatures over summer can affect crop growth and yield potential. Heatwaves (defined as three consecutive days over 38°C) constitute a real hazard if crops are at a particularly sensitive stage. Heatwaves occur mostly in the months of December and January, but can start as early as late October. There are no heatwaves recorded between the beginning of March and the end of September.

Table 2.1 Mean Maximum and Minimum Daily Temperatures for Rolleston (After BOM)

Temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av
Max °C	34.8	33.7	32.8	29.7	26.1	23.0	22.9	24.8	28.5	31.7	33.0	34.3	29.6
Min °C	21.0	20.8	18.4	14.8	10.6	7.1	5.6	6.8	10.6	15.0	17.7	19.8	14.0

(iii) Evaporation

The long-term average daily evaporation rate at the nearest monitoring station (Emerald) is 5.8 mm/d ranging from 3.1 mm/d (June) to 8 mm/d (December). Evapotranspiration rates can be significantly higher than evaporation due to extra transpiration surfaces provided by plant leaves. These relatively high evaporation rates reinforce the importance of water availability and avoiding moisture stress as the key limiting factor for cropping in the region.

2.2 Agricultural Land Use

Cropping in Central Queensland is significantly affected by the variability of the climate and is considered opportunistic; i.e. sowing when there is sufficient soil moisture to grow a crop (Cox *et al.*, 1998). While the potential for cropping was recognised as early as 1897 with the establishment of the Gindie State Farm, and later with the Queensland British Food Corporation (QBFC - circa 1947-54), uptake was low among the existing graziers due to variability in rainfall and climate which eventually resulted in the collapse of the QBFC (Bourne and Tuck 1993). Nonetheless, the break-up, and restricted selection, of the QBFC lands (1954-56) combined with the Brigalow Scheme in the late 1950s resulted in the expansion of cropping in the Central Highlands with cropping reaching approximately 500,000 ha in the region (Armstrong *et al.*, 2003).

The construction of the Fairbairn Dam forming Lake Maraboon, to assist with the development of agriculture in the region, has resulted in a significant area of irrigated cropping within a defined irrigation area. Irrigated crops include wheat and cotton, as well as fruit trees, vine crops, melons and corn. Limited irrigation from groundwater sources also occurs and the dam now supports mining as well as agriculture.

The most extensive form of cropping in the district is dryland, predominantly of summer crop cereals such as sorghum, sunflower, some winter wheat, and dryland cotton. Irrigated cropping is practised where water supplies are available but all such sites are more than 100 km from the mine site. Legumes are being increasingly grown in rotation with cereals (e.g. chickpeas in winter and mungbeans in summer).

Grain quality and financial returns can vary between seasons due to the variable rainfall. In wetter high-yielding years tonnage is increased but quality can be lower than expected. In drier years the situation is reversed, with lower yields but higher quality. This uncertainty of financial return creates a reluctance to apply fertiliser in dryland cropping resulting in declining soil fertility (Cox *et al.*, 1998, and Armstrong *et al.*, 2003). While cropping with additional fertiliser may be profitable in the short-term, the practice is not sustainable (Armstrong *et al.*, 2003).

The use of legumes in rotation with cereals to counter rundown in soil nitrogen fertility due to cropping offers a potentially cost-effective solution. However, crop yields from legumes are generally low in the Central Highlands and legume crops require careful management to be profitable (Cox *et al.*, 1998). Well managed crops can contribute up to 50 kg N/ha through dry matter with yields around 1.0 t/ha of legume.

Nevertheless, such practices are not a complete solution and are at best only likely to reduce the rate of fertility decline, not reverse it. Armstrong *et al.* (2003) concluded that rotations of legumes had no significant effect on soil fertility and recommended perennial pasture rotations be used instead.

2.3 Geology and Landform

The Rolleston mine site is dominated by a gently undulating landform formed on Tertiary basalt flows and minor pyroclastics (**Tb** – Minerva Volcanics) with isolated higher residuals associated with shallow and stony soils. The Tertiary landscape includes basalt, acid igneous intrusions, and terrestrial sediments. The basalts are variable and include dense, fine-grained olivine basalt, porphyritic, vesicular, and ashy basalts, and tuffs, with some grading to trachytes. This explains the variability encountered in the soils and prior vegetation communities across the mine site. The geology of the mine and surrounding area is shown in Figure 2.1.

During the Tertiary, weathering and erosion of regional exposed older rocks led to widespread accumulation of clays, sand, and gravels, many of which were extensively lithified to form claystone, quartz sandstone, and conglomerate. These sediments are sometimes interbedded with basalt, particularly in the lower part of the sequence. The conglomerate beds are usually found near the present major rivers, suggesting that these drainage systems are ancestral streams that existed when the Tertiary sediments first formed and received high energy flows capable of transporting coarser material than they do now (after Story *et al.*, 1967).

Extensive erosion in late Tertiary times led to the deposition of gravelly deposits now found as dissected terraces along the major rivers and as fans around some of the higher hills, notably to the south and west of

the mine. These gravelly sediments are often not readily distinguishable from the main body of Tertiary sediments so that the lithological layers and recent alluvium present similar soils and landscapes.

Meteor Creek and its anabranches flow generally north-eastwards through MLA70458 and MLA70416 and are associated with extensive deposits of Quaternary Alluvium, which is characterised by mainly clayey sediments with associated sandy, gravelly and mixed sediments. Spring Creek flows further to the north across MLA70415 and has been captured by a broad shallow earth and rockfill dam and diverted around the mine before re-entering Meteor Creek off the mine site.

To the south-east, areas of Rewan Formation (**Rr** - red and green silty mudstone and lithic quartzose sandstones), Blackwater Group (**Puw** – lithic sandstone, siltstone, shale and coal), and Ingelara Formation (**Pli** which is part of the Back Creek Group – conglomeratic siltstone, sandy mudstone and calcareous shelly beds) occur. These underlie in part the **Qa** alluvial unit that is comprised of mixed clayey and sandy/gravelly mixed sediments. These older sedimentary rocks underlie the Tb unit and in places have influenced the drainage patterns of Meteor Creek through structural controls. The weathering of the Permian rocks also explains the change from clayey soils on basalt over the majority of the mine site and the scattered occurrence of sandy and texture contrast soils in the south-east along the eastern margin of MLA70416.

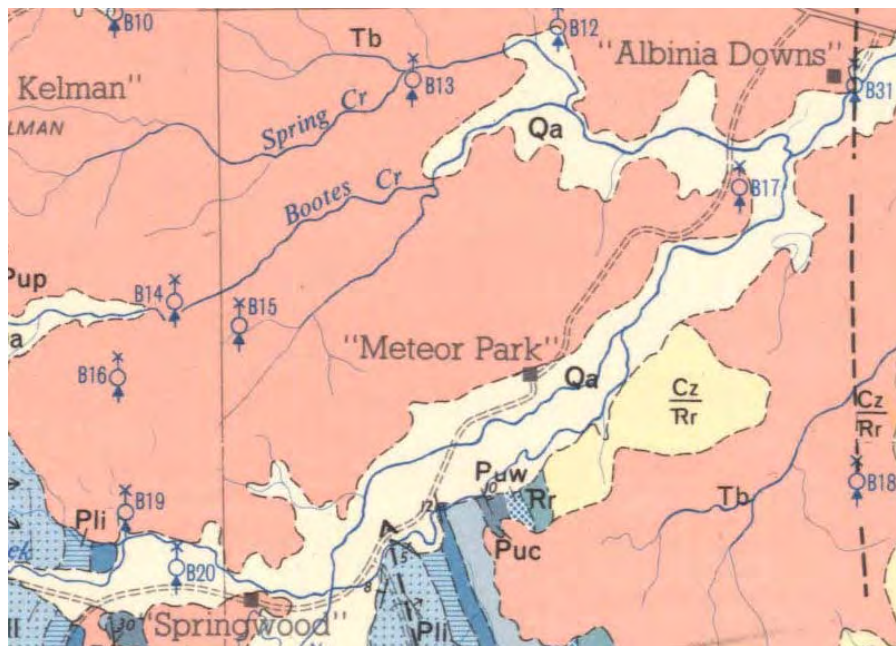


Figure 2.1 Geology of the Rolleston Mine Site and Surrounding Area (after Springsure 1:250,000 Geol Sheet)

3 Soils

3.1 Existing Soils Mapping

Story *et al.* (1967) undertook broad scale reconnaissance (approximately 1:500,000 scale) land systems mapping, which included the Project area. Its purpose was to provide a first-stage, broad inventory of natural features by identifying *land systems* on the basis of topography, soils, vegetation and agricultural potential (Figure 3.1). The direct usefulness of this early work is limited due primarily to scale. Nevertheless, information is presented on the land units which were aggregated subsequently to define the land systems.

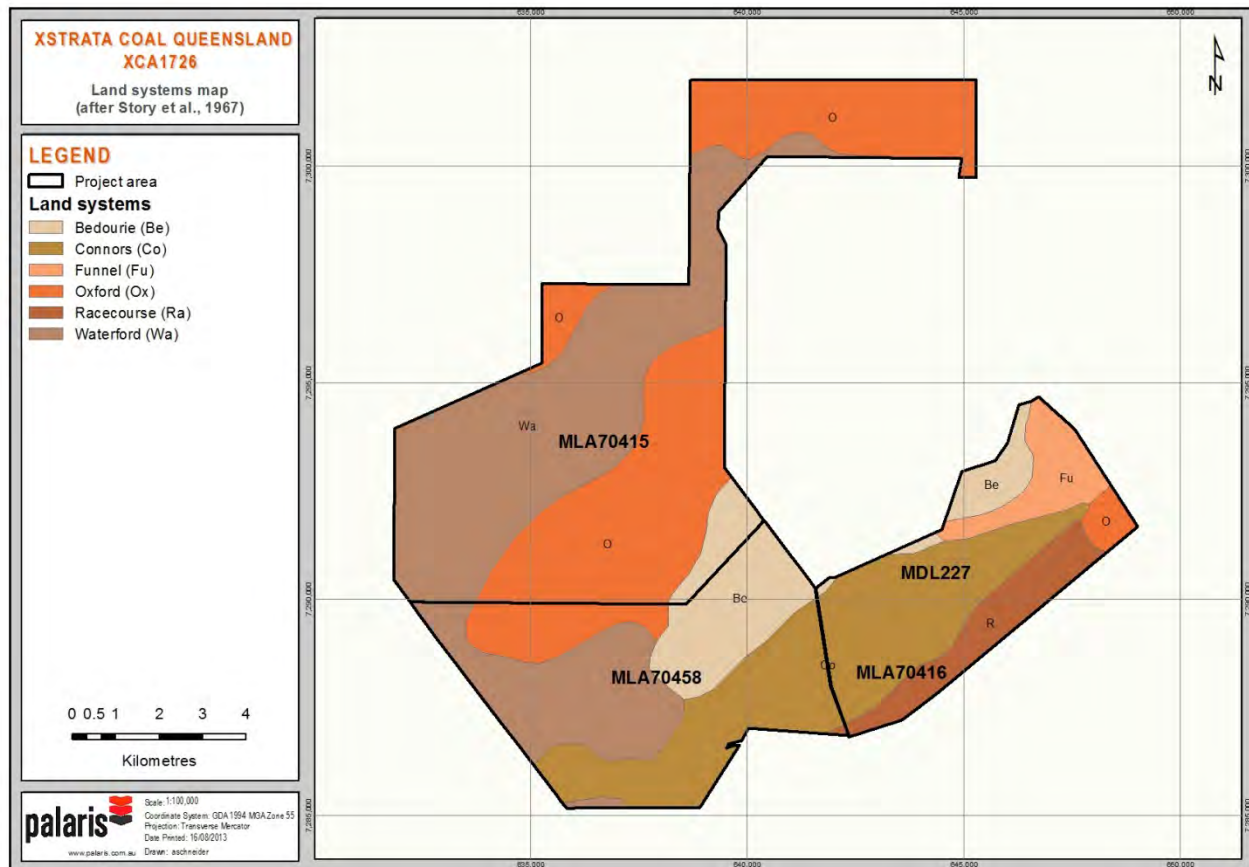


Figure 3.1 Land Systems Relevant to the Project (Adapted from Story *et al.*, 1967)

Soils associated with the six land systems in the area may be summarised as follows (the earlier soil types have been updated to accord with the Australian Soil Classification system Isbell, 1993):

- **Bedourie Land System** – approximately 55% shallow, rocky Tenosols and Rudosols, generally medium-textured, and shallow rocky Vertosols; and approximately 45% shallow Dermosols, and Sodosols, generally approximately 0.6 m deep
- **Connors Land System** – highly variable depending on location within the survey area but approximately 25% medium to fine-textured Rudosols and sandy-surfaced Sodosols; approximately 65% sandy-surfaced Sodosols and Chromosols with some Dermosols; and approximately 10% deep Vertosols, some gilgaied, and stream channels
- **Funnel Land System** – approximately 15% sandy-surfaced Sodosols and Chromosols; approximately 80% Vertosols, some gilgaied; and approximately 5% stream channels and Rudosols
- **Oxford Land System** – approximately 40% shallow Vertosols with some Rudosols; and approximately 60% deep Vertosols
- **Racecourse Land System** – approximately 35% deep Dermosols; approximately 45% deep Vertosols; approximately 20% shallow Vertosols
- **Waterford Land System** – approximately 55% shallow Vertosols and Tenosols; approximately 40% Vertosols 0.6 to 0.9 m deep; and approximately 5% deep Vertosols

Later, Bourne and Tuck (1993) produced a land management manual for the area, classifying land resources at two levels, namely:

- **Land Resource Area (LRA)** – using patterns of vegetation, landform and geology; often similar to the land systems and comprising a defined range of Agricultural Management Units (AMU)
- **Agricultural Management Unit (AMU)** – soil management groups amalgamated on the basis of their similar characteristics for land management

Six LRAs were identified and delineated for the Central Highlands by Bourne and Tuck (1993) and three of these are relevant to the Project area, i.e. LRAs 1, 2, and 4 (*Figure 3.2*). AMUs and associated features for these three LRAs are described in *Table 3.1*.

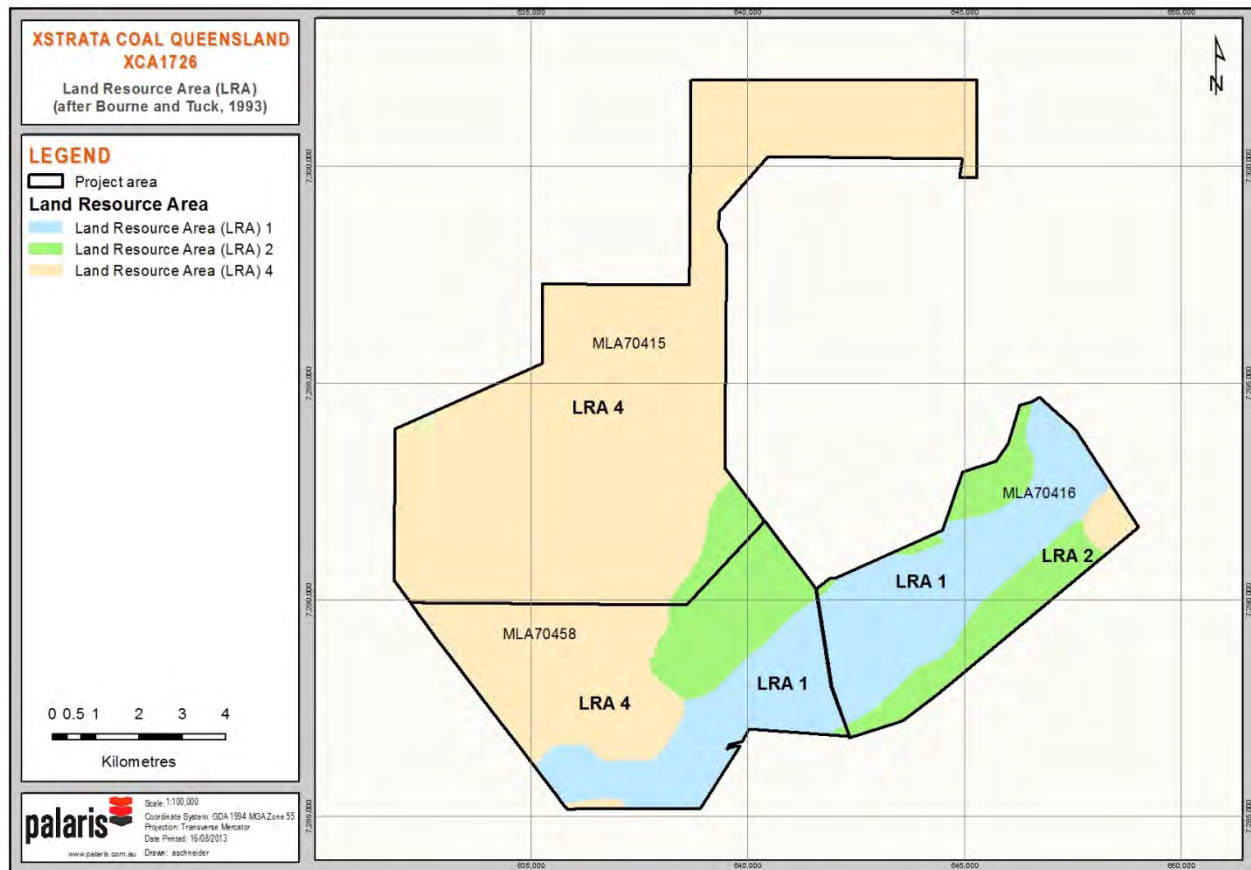


Figure 3.2 LRAs Relevant to the Project (adapted from Bourne and Tuck, 1993)

At a property management level where attributes such as cultivation practices and land use/cropping suitability come into consideration, the Land systems have been grouped as follows to form the three LRAs:

LRA 1 = Funnel and Connors – formed predominantly on Quaternary Alluvium

LRA2 = Bedourie and Racecourse – formed predominantly on sedimentary rocks, Tertiary basalt, and unconsolidated sediments

LRA 4 = Oxford and Waterford – formed predominantly on Tertiary basalt, Permian shales, sandstone, and unconsolidated sediments

Correlations with previous surveys are set out in Appendix B.

Table 3.1 LRAs and Description (Adapted from Bourne and Tuck, 1993)

LRA	Landform	Soils	Major AMU	Vegetation	Potential land use
LRA 1 - Alluvial Plains	Level plains on Quaternary alluvium	Alluvial cracking clays (Vertosols), non-cracking clays (Dermosols) and solodic soils (Sodosols); minor red and yellow earths (Kandosols), loams and sands (Tenosols and Rudosols).	Adelong, Moramana, College	Eucalypt woodland with poplar box and coolibah, minor brigalow	Cropping and improved pasture
LRA 2 - Undulating Scrub Plains	Undulating plains on basalt and sediments	Cracking clays (Vertosols), Solodic soils (Sodosols), red-brown earths (Chromosols), non-cracking clays (Dermosols) and structured earths (Dermosols and Ferrosols)	Rolleston, Picardy, Springton, Turkey Ck, Glengallan, Glen Idol	Brigalow, bonewood, blackwood, and gidgee scrubs	Cropping and improved pasture
LRA 4 - Undulating Downs	Gently undulating plains on basalt and sediments	Black, brown and grey cracking clays (Vertosols)	Orion, Jimbaroo	Grasslands – bluegrass, Mitchell grass, Flinders grass and others	Cropping and grazing on natural pastures

3.2 Soil Survey Methodology

Soil survey methodology included the following components:

- review of existing mapping
- aerial photography interpretation
- on-ground survey
- laboratory analysis
- interpretation of data
- mapping

(i) Review and Data Interpretation

Available aerial photography and soil mapping data (Bourne and Tuck, 1993) were reviewed and interpreted. This allowed targeted planning for on-ground investigation using a *free survey* method.

(i) On-Ground Survey

On-ground soil survey was conducted in June and July 2011 (MLA 70415, 70416 and 70418) and in October 2011 (MLA 70458).

The survey investigated 505 sites within the 12,496 ha Project area as shown in *Figure 3.3* with descriptions provided in Appendix E. This gives approximately one site per 25 ha or four sites per km².

Sites were chosen using a *free survey* methodology based on air photo interpretation and vegetation patterns, subject to accessibility. The number and type of soil descriptions, soil samples taken and analyses were based on the recommended guidelines by McKenzie *et al.* (2008) and DME (1995).

Detailed descriptions were made at 271 of the sites, which included:

- profile description
- field pH using a Manutec field pH kit
- structure by observation, where possible
- soil colour by Munsell Colour Chart
- field texture class

Soil profiles were exposed and sampled using a hand auger to a maximum depth of 1.2 m. Opportunistic observations were made at exploration sumps and other excavations.

Soil samples were collected for laboratory analysis at 16 sites yielding 57 samples.

(ii) Laboratory Analysis

Laboratory analysis was conducted at a NATA accredited facility (SGS Food and Agricultural Laboratory, Toowoomba). Parameters analysed include the following:

- pH (1:5 water), Electrical Conductivity (dS/m), chloride (mg/kg), sodium (mg/kg), organic carbon (%)
- nutrients (mg/kg): nitrogen (nitrate and ammonium), available phosphorus (Colwell), potassium
- exchangeable cations (meq/100g), CEC, Exchange Sodium Percentage (ESP), Exchangeable Aluminium Percentage, Calcium/Magnesium ratio; and
- trace elements (mg/kg): sulphur (KCL), calcium, magnesium, aluminium, zinc, copper, iron, manganese and boron
- Phosphorus Buffer Index (PBI), soil texture, dispersion index
- Field capacity (%), Wilting Point (%)

(iii) Mapping

Following interpretation of field and laboratory data, soil mapping was completed on imagery and compiled using ARCGIS software to produce geo-referenced soil maps.

Twelve different soil types were identified and mapped in the Project area. The distribution of the soil sampling/description sites is shown in (**Figure 3.3**). Sites are described in detail (Appendix A).

3.3 Soils of the Rolleston Mine Site

The mapped soils can generally be grouped into three main soil associations based on parent materials and formation processes. The three main groups of soils are as follows:

Soils Formed on Alluvium

The first group includes soils derived from alluvial deposition occurring adjacent to Meteor and Sandy Creeks in the south of the project area. Areas of lighter textured soils occur along the recent levees, grading into texture contrast soils within the transition zone to the deep cracking clays of the flat alluvial plains. The heavy clay soils are potentially suited to both long-term dry-land and irrigated cropping subject to adequate water supply. Representative soil type descriptions are provided in Appendix A.

Sedentary and Colluvial Soils on Basaltic Undulating Plains

The second group are the soils derived from largely colluvial processes within the basaltic landscape. The weathering of the basaltic parent material has resulted in *in situ* formation of dark, cracking, self-mulching clay soils on undulating plains. Depth and rockiness are variable depending on slope and landscape position, with the deeper soils found on the open downs of the gently undulating plains.

Colluvial, Colluvial / Alluvial, and Sedentary, Soils on Mixed Calcareous Sediments

The third group are colluvial, colluvial / alluvial, and some sedentary soils, formed from mixed calcareous sediments, occurring within the Brigalow scrub soils on gently undulating plains. These soils are found mainly in the south of the Project area. Their suitability for agriculture is generally limited by unfavourable drainage together with some areas of excessive surface rockiness, though some areas of suitable soils exist that are too small to constitute a farmable area.

Wherever possible, the 12 soils mapped on site have been correlated with the work of Bourne and Tuck (1993) (*Appendix B*) and other relevant land resource survey reports in the area (*Appendix B*). Given the differences of scale of the three data sets (i.e. current survey, Bourne and Tuck, 1993 and Story *et al.*, 1967), soil correlations are not always exact though the key soil properties that affect land use and sustainability have been matched as closely as possible. Summarised field observations are provided in *Appendix E*.

Eight of the 12 soils are considered as potentially arable, ranging from cracking clays (A1, A2, B2, B3 and C1) to non-cracking clays (A3, A5 and C2). These soils have also been classified against the Good Quality Agricultural Land (GQAL) mapping for Central Highlands Regional Council (CHRC) GQAL mapping (formerly Bauhinia Shire Planning Scheme) and assessed under the Strategic Cropping Land guidelines that were legislated following completion of the field survey investigations.

For each soil type, selected chemical characteristics (and detailed laboratory analyses (*Appendix C*)) are provided. Additional chemical data for these soils are also provided in *Table 3.4* based on Bourne and Tuck (1993) showing the degree of variability associated with these soils in the wider regional context.

(i) Overview of Key Properties

The project initially focused on a soil survey of MLAs 70415, 70416 and 70458 in line with the ToR established for the Rolleston Coal Expansion Project EIS (DERM, 2012). Subsequently, the project scope was expanded to include an assessment of SCL for the mine expansion area. This was conducted under the interim Guidelines for assessment of SCL as the enabling legislation was not in place at the time. Consequently, the assessment relied on available data and soil descriptions that do not strictly comply with the Guidelines that now apply. Thus, all available data, including that available from other published reports, has been evaluated to undertake the assessment.

The 12 soils mapped at the mine site have been correlated with the AMU/LRA mapping of Bourne and Tuck (1993) and soils and land unit descriptions of Story *et al.* (1967). As the latter study pre-dated the introduction of the Australian Soil Classification (Isbell, 1996), the inter-relationship of the earlier mapping with the ASC has been set out in *Table 3.2*. The AMU/LRA mapping and soil descriptions were defined as a regional concept to promote early moves to improve land use sustainability and, as a consequence, the soil definitions were necessarily broadly based. Thus, within any single AMU there can be a moderate degree of variability that does not significantly impact land use at a property level but that does not accord with the more detailed attribute description required for accurate SCL determination. This present report, therefore, seeks to allocate soils on the mine site into those AMUs with which they share the most properties in common, but may vary in one or more properties.

Thus, the central concept of each soil type (this report) is set out in *Table 3.2* and is also based on landform and other site parameters rather than attempting to develop a more detailed soils map based on subdivision of the existing broad groups of soils.

The key chemical attributes that help differentiate the 12 soil types are set out in *Table 3.3*, supplemented by other chemical data (*Table 3.4*) that has been obtained from Bourne and Tuck (1993). For most soils, sampling and analysis has been undertaken for the same standard depths so that comparisons can be made of the variability that exists regionally for the soil types. Detailed chemical data are provided for all sampled sites in *Appendix C*.

No inland acid sulfate soils were identified during the survey.

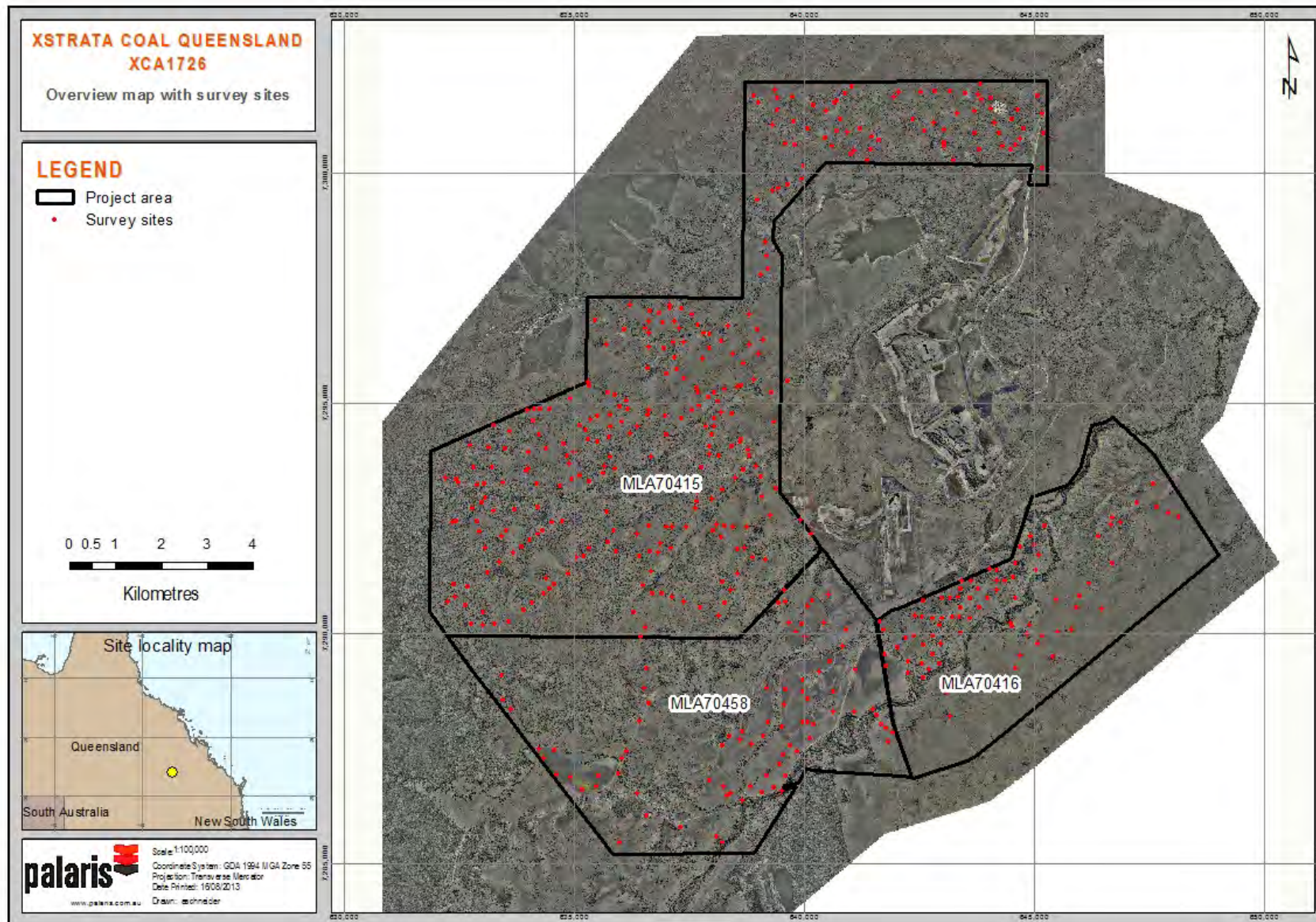


Figure 3.3 Distribution of Soil Survey Sites Across the Project Area

Table 3.2 Soil Type Descriptions and Correlations with Those of Bourne and Tuck (1993)

Soil type (AMU – Bourne and Tuck, 1993)	Concept (Current study)	Soils (Australian Soil Classification)	Concept (Bourne and Tuck (1993), adapted from Table 5.2 in Resource Information volume)
Soils derived from alluvium			
A1 (Adelong)	Broad alluvial plains of deep grey to black cracking clays on flood plains associated with Meteor Creek.	Grey Vertosols - Cracking and self-mulching medium to heavy clays which are well structured and moderately drained	Dark to grey surface over dark to grey subsoil becoming lighter and slightly mottled at depth Uniform medium to heavy clay; >1.5 m Self-mulching and deeply cracking with alkaline reaction trend
A2 (Moramana)	Deep black sandy clay along recent and/or active drainage lines within the basaltic landscape.	Black Vertosols - Deep black cracking clays with coarse granular self-mulch. Deep clay subsoils have sandier and coarser structured subsoil than the surrounding <i>in situ</i> basalt soils.	Brown to red surface over brown, dark or red subsoil Medium clay over medium heavy clay subsoil, >1.5 m Strongly self-mulching surface over alkaline strongly structured subsoil, often forms a gilgai complex
A3 (Glen Idol)	Gently undulating alluvial frontage country of moderately deep clays which are quite hard and coarse structured (clay soils within areas of variable alluvial materials)	Brown Dermosols - Non cracking firm surface which may be sandy overlying dark coloured sandy clays which are very hard and coarse structured	Red to reddish brown surface over red to reddish brown subsoil Clay loam to sandy clay loam over medium to medium heavy clay; generally >0.9 m Generally hard setting surface and no bleach; moderate prismatic structured subsoil; alkaline subsoils; carbonate often present; texture contrast soils.
A4 (Isaac)	Active channels and levees associated with Meteor Creek. Variable soils which are usually sandy and stratified	Brown Chromosols and Dermosols - Alluvial stratified thin texture contrast soils, deep sandy loams and clay loams	Brownish black to brownish grey surface over yellowish brown to brownish grey subsoil Loamy fine sand to sandy clay loam surface over sandy clay subsoil; >1.5 m Neutral reaction trend; few inclusions or coarse fragments; often textural stratification
A5 No similar AMU	Slightly elevated levees along the Meteor Creek floodplain.	Brown Chromosols and Dermosols - A thin silty clay loam overlies hard, coarse structured dark clay which overlies brown sandy clays below 90 cm.	
Mainly colluvial soils on basaltic undulating plains			
B1 (Jimbaroo)	Crests and upper slopes of rises, in the basaltic landscape.	Black Vertosols - Mainly cracking and self-mulching shallow (<50 cm) black clay soils which are well structured and drained	Dark to reddish brown surface over dark to reddish brown subsoil Light medium clay surface over medium to heavy clay subsoil; <0.45 m to bedrock; Neutral to alkaline self-mulching to hard setting surface; often stony throughout
B2 (Orion)	Moderately deep (mainly 60-90 cm) clay soils on basalt or calcareous sediments on undulating plains.	Black Vertosols - Cracking and strong self-mulching black clay soils which are well structured and drained	Grey-brown to dark throughout Uniform medium to heavy clay; 0.45 m to 1.2 m to bedrock Surface stone may be present Coarse, moderately self-mulching surface; neutral to alkaline; and strongly structured subsoils
B3	Open downs of gently undulating plains with deep	Black Vertosols - Soil as for B2 except for greater profile depth	Grey-brown to dark throughout

Soil type (AMU – Bourne and Tuck, 1993)	Concept (Current study)	Soils (Australian Soil Classification)	Concept (Bourne and Tuck (1993), adapted from Table 5.2 in Resource Information volume)
(Orion)	(>90 cm) cracking clay soils.		Uniform medium to heavy clay; 0.45 m to 1.2 m to bedrock Surface stone may be present Coarse, moderately self-mulching surface; neutral to alkaline; and strongly structured subsoils
B4 (Highlands)	Steep and rocky uplands dominated by shallow (<30 cm) clay soils on hard basalt.	Brown Rudosols - Soils are dark medium clays.	Reddish brown to yellowish brown over rock Variable; generally shallow, rocky sandy clay loam to loamy sand; >0.1 m to bedrock Neutral reaction trend; massive structure
B5 (Highlands)	Lighter textured clay than for B4. Shallow (<60 cm) and often rocky	Brown Rudosols/Chromosols - Firm sandy surface over clay loam to light sandy clay reddish brown soils.	Reddish brown to yellowish brown over rock Variable; generally shallow, rocky sandy clay loam to loamy sand; >0.1 m to bedrock Neutral reaction trend; massive structure
Colluvial and sedentary soils on mixed calcareous sediments			
C1 (Rolleston/ Springton)	Brigalow scrub soils along gently undulating plains to the south. Includes areas of normal gilgai.	Brown Vertosols and Dermosols - Cracking and non-cracking grey / brown medium heavy clays with moderately coarse subsoil structure below about 40cm.	Rolleston Grey to dark surface over grey to yellow-brown subsoil; red or yellow mottles at depth Uniform medium to heavy clay; >0.9 m Slight (< 0.4 m vertical interval) linear or normal gilgai may occur; self- mulching surface; soil reaction trend varies from acid to alkaline Springton Red to reddish brown surface over reddish brown to dark reddish brown subsoils often slightly mottled Uniform light to medium heavy Clay; >0.6 m to bedrock Neutral self-mulching to hard setting surface with alkaline reaction trend; often coarse structured subsoils
C2 No similar AMU	Deeper (60-120+ cm) uniform brown clay	Brown Dermosols - Firm, non-cracking light to medium clay surface. Subsoils are not mottled but form moderately hard and coarse structure with impeded drainage.	

Table 3.3 Selected Chemical Data for Representative Sites of Each Soil Type (Sampled in Present Survey) Showing Relationship to Bourne and Tuck (1993) Soils

Soil	Depth	pH _{water}	Cl (mg/kg)	CEC (meq/100g)	ESP (%)
A1 (site 165)	0-10	8.3	11	60.1	1.1
(Adelong)	20-30	8.7	15	59.5	4.8
	60-70	8.7	401	62.1	7.2
	100-110	8.3	2103	63.9	9.2
A2 (site 6)	0-10	7.3	18	55.6	1.1
(Moramana)	20-30	7.6	17	54.8	1.7
	60-70	8.3	33	59.5	2.0
	100-110	8.3	17	41.2	0.8
A4 (site 267)	0-10	7.0	8	38.9	0.8
(Isaac)	20-30	7.5	<0.5	39.5	1.4
	60-70	8.6	2	44.0	8.1
	90-100	8.8	591	46.9	12.8
A5 (site SPR001)	0-15	7.4	10	23.9	1.1
	20-30	7.2	6	29.8	1.4
	50-60	7.8	11	36.6	2.0
	60-100	8.3	<1	40.1	2.7
A5 (site 254)	0-10	6.7	5	21.8	0.7
(No similar AMU)	20-30	7.1	3	26.8	1.1
	60-70	7.8	16	25.1	1.4
	100-110	8.3	7	43.9	3.1
B1 (site 132)	0-10	7.2	11	59.4	1.2
(Jimbaroo)	20-30	7.1	6	56.3	1.2
	60-70	7.5	4	57.4	1.5
	limit	--	--	--	--
B2 (site 79)	0-10	7.0	46	68.5	1.0
(Orion)	20-30	7.7	7	75.2	1.5
	60-70	7.8	4	74.5	1.6
	limit	--	--	--	--
B3 (site 130)	0-10	7.3	8	61.1	1.0
(Orion)	20-30	7.7	5	61.4	1.0
	60-70	7.7	5	62.5	1.1

Soil	Depth	pH _{water}	Cl (mg/kg)	CEC (meq/100g)	ESP (%)
	90-100	8.1	8	66.5	1.4
B4 (site 85)	0-10	7.8	7	41.4	1.0
(Highlands)	20-30	7.7	4	45.3	1.1
	limit	--	--	--	--
	--	--	--	--	--
B5 (site 313)	0-10	6.9	4	13.2	1.8
(Highlands)	20-30	7.1	28	36.2	3.3
	50-70	8.2	108	41.4	5.5
	limit	--	--	--	--
C1 (site 233)	0-10	7.1	11	36.8	1.1
(Rolleston)	20-30	8.0	6	37.7	1.3
	50-60	8.4	2	46.2	2.0
	90-100	8.6	5	48.8	3.5
C1 (site SPR002)	0-10	7.7	10	37.3	2.4
	20-30	8.3	42	37.6	5.3
	30-60	8.8	313	42.8	7.8
C2 (29)	0-10	6.5	8	15.4	1.0
(Springton)	20-30	6.3	13	14.5	2.3
	60-70	8.2	619	38.7	6.2
	100-110	8.4	980	51.8	7.1

Table 3.4 Additional Chemical Data for Similar Soil Types After Bourne and Tuck (1993) Showing Relationship to Current Survey Soil Names

Soil	Depth	pH _{water}	Cl (mg/kg)	CEC (meq/100g)	ESP (%)
Adelong	0-10	8.5	10	54	1.8
(A1)	20-30	8.8	30	52	1.3
	50-60	9.0	140	49	2.4
	80-90	8.8	390	49	11.4
	110-120	8.6	410	-	-
	140-150	8.5	600	-	-
Moramana	0-10	8.0	10	56	1.5
(A2)	20-30	8.8	10	59	5.3
	50-60	8.9	160	56	10.4
	80-90	8.7	690	57	14.4
	110-120	8.4	940	57	16.0
	140-150	8.0	960	59	16.8
Glen Idol	0-10	6.7	10	14	-
(A3)	10-20	6.2	10	-	-
	20-30	6.1	60	21	4.7
	50-60	7.3	200	27	-
	80-90	8.6	320	-	-
Isaac	0-10	6.7	60	9.6 (sum)	-
(A4)	NS				
Jimbaroo	0-10	7.7	20	73	0.5
(B1)	20-30	8.1	10	75	0.5
	45-50	8.6	10	-	-
Orion	0-10	7.4	10	76	<1
(B2/B3)	10-20	7.0	10	-	-
	20-30	7.2	10	78	<1
	50-60	7.9	10	78	1.1
					-
Highlands	0-10	6.1	1	5.5 (sum)	-
(B4/B5)					
Rolleston	0-10	7.0	10	34	2.2
(C1)	10-20	7.3	40	-	-

Soil	Depth	pH _{water}	Cl (mg/kg)	CEC (meq/100g)	ESP (%)
	20-30	7.5	210	33	7.9
	50-60	5.1	1000	29	13.8
	110-120	4.5	1370	27	14.8
Springton	0-10	8.2	20	31	<0.3
(C1)	20-30	8.6	10	33	4
	50-60	8.7	10	32	1
	80-85	8.6	100	59	2

Sampled across A1/B21 horizon boundary with conspicuous bleached A2 (2 mm) horizon

3.4 Land Assessment for Land Use

There are a number of methods for evaluating and ranking the *usefulness* of agricultural land, namely Land Capability, Land Suitability, and Good Quality Agricultural Land (GQAL). Each has been developed for a different purpose and although all result in ranked classes, it is difficult to directly correlate and compare the methods' outcomes. Land Capability is not used these days and has been subsumed by Land Suitability (Land Resources Branch, 1990). GQAL was introduced in 1992 as an output for local government planning purposes as State Planning Policy 1/92. The relationship between Land Suitability and GQAL is provided in Table 3.5.

Strategic Cropping Land (SCL) is a new method introduced in 2011 (legislated in January 2012) and is discussed later in this report. Its purpose was to ensure the retention, to the greatest extent possible, of strategic cropping lands against encroachment by non-agricultural development.

Table 3.5 Comparison of Land Suitability and GQAL Categories

Land suitability (DPI, 1990)		GQAL (DHLGP, 1993)	
Class	Description	Class	Description
1	Suitable with negligible limitations	A	Land that is suitable for current and potential crops with limitations to production which range from none to moderate levels
2	Suitable with minor limitations		
3	Suitable with moderate limitations		
4	Marginal – not suitable	B	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
5	Not suitable	C	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. (
		D	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. Bauhinia SC planning scheme subdivides and maps this as C2 and C3 depending on the ability to introduce improved pasture species without ground disturbance.

The agricultural Land Suitability method classifies land in terms of its suitability for a specific land use, e.g. winter grain cropping. This method not only evaluates soil physical limitations such as, for example, erosion hazard, but also includes a consideration of biophysical, social and economic factors that may affect agricultural production. It classifies land into one of five classes and provides specific rules for cropping systems. Much of the basis of the superseded Land Capability classification still forms part of the categorisation of the five classes.

Queensland's *Good Quality Agricultural Land (GQAL)* method is a simplified four-class system used primarily in land use planning. It was previously supported by legislation and a State Planning Policy (SPP 1/92) which has now been rescinded. GQAL was formerly adopted as a basis for local government planning schemes.

Both GQAL and Land Suitability assessments have been undertaken for the study area (Table 3.6). This was done in accordance with the following guidelines as required by the Terms of Reference:

- Guidelines for Agricultural Land Evaluation in Queensland (DPI 1990)
- Technical Guidelines for Environmental Management of Exploration and Mining in Queensland (DME 1995)
- State Planning Policy 1/92 and the planning guidelines prepared by the Department of Primary Industries and the Queensland Department of Housing Local Government and Planning (DH&LGP 1993)
- Land Suitability Classification for Cropping and Grazing in the Semi-arid Sub-tropics of Queensland (DME 1995) (see Appendix D)

Table 3.6 GQAL and Land Suitability Assessments for the Rolleston Mine Site

Soil Type	Area (ha)	AMU (Bourne and Tuck, 1993)	GQAL	Land suitability			
				Dryland cropping		Grazing	
				Class	Limitations	Class	Limitations
A1	2043	Adelong	A	Class 2	c2, f2, m2	Class 1	
A2	536	Moramana	D	Class 5	c2, f5, m3	Class 4	c2, f5, m3
A3	288	Glen Idol	A	Class 3	n3, m3, k2	Class 2	n2, m2
A4	265	Isaac	D	Class 5	c2, f5, m3	Class 4	f4
A5	1042	NSG	B	Class 4	n4, m4, w4, k4	Class 4	n4, m4, s3
B1	959	Jimbaroo	B	Class 4	n4, m4, k3	Class 3	n4, m4, k3
B2	2105	Orion	A	Class 3	e2, n2, k2, r2, d3, m3	Class 2	n2, d2, m2
B3	1176	Orion	A	Class 2	e2, n2, k2, r2, d2, m2	Class 1	
B4	1408	Highlands	C	Class 5	m5, d5, k3	Class 4	m4, d4
B5	201	Highlands	C	Class 5	m5, d5, k3	Class 4	m4, d4
C1	1751	Rolleston/Springton	A	Class 3	k3	Class 2	w2
C2	541	NSG	A	Class 3	c2, n3, m3, w3, k3	Class 3	n3, m3
Swamp	52	Not described	D	Class 5	f5	Class 5	f5

NSG – No suitable group

3.5 GQAL

GQAL mapping for the mine site based on CHRC data (originally Bauhinia Shire Council Planning Scheme) is presented in Figure 3.4. A review of GQAL following the detailed soil survey led to a slight amendment to mapping of the site based on soil descriptions at a finer scale than the original planning scheme which used map units from Story *et al.* (1967). The amended mapping is shown in Figure 3.5.

CHRC mapping is based on information supplied by the then Department of Natural Resources and Mines, and is presented at 1:850,000 scale (i.e. 1 cm = 850 m). This reconnaissance-scale mapping is far less spatially accurate than the LRA mapping of Bourne and Tuck (1993) and is not comparable with the property-scale mapping (1:25,000 scale) undertaken in this study

The project area has now been classed as follows:

- **Land Class A** - includes soil types A1, A3, B3, B2, C1 and C2 64% or approximately 7,904 ha
- **Land Class B** – includes soil types A5 and B1 – approximately 16%
- **Land Class C** – includes soil types B4 and B5 – approximately 13%
- **Land Class D** – includes soil types A2 and A4 (and a swamp area to the south of MLA70458 – approximately 7%. Soil types A2 and A4 are primarily active drainage lines and, therefore, not able to be cropped or effectively grazed

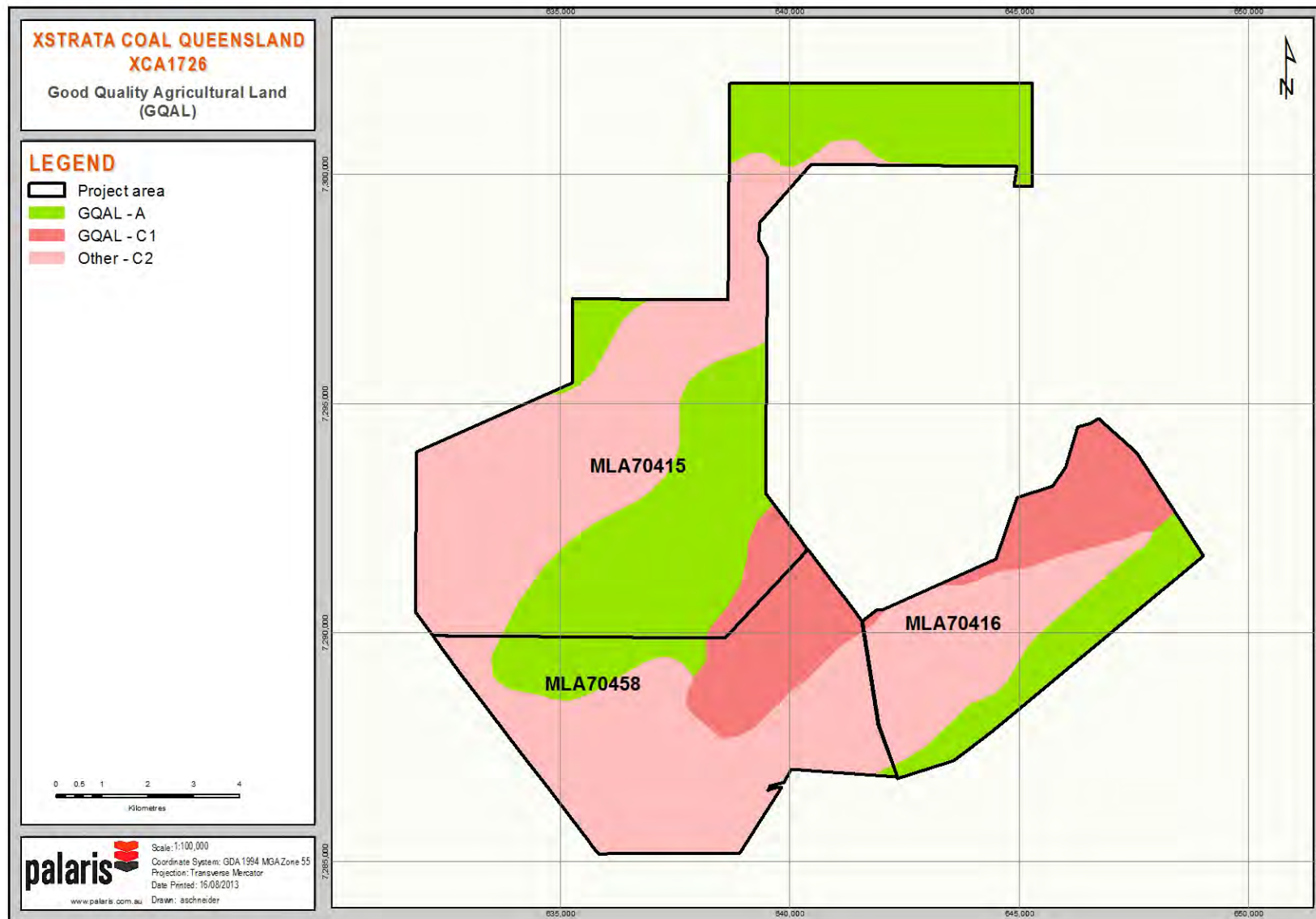


Figure 3.4 Good Quality Agricultural Land after CHRC Mapping

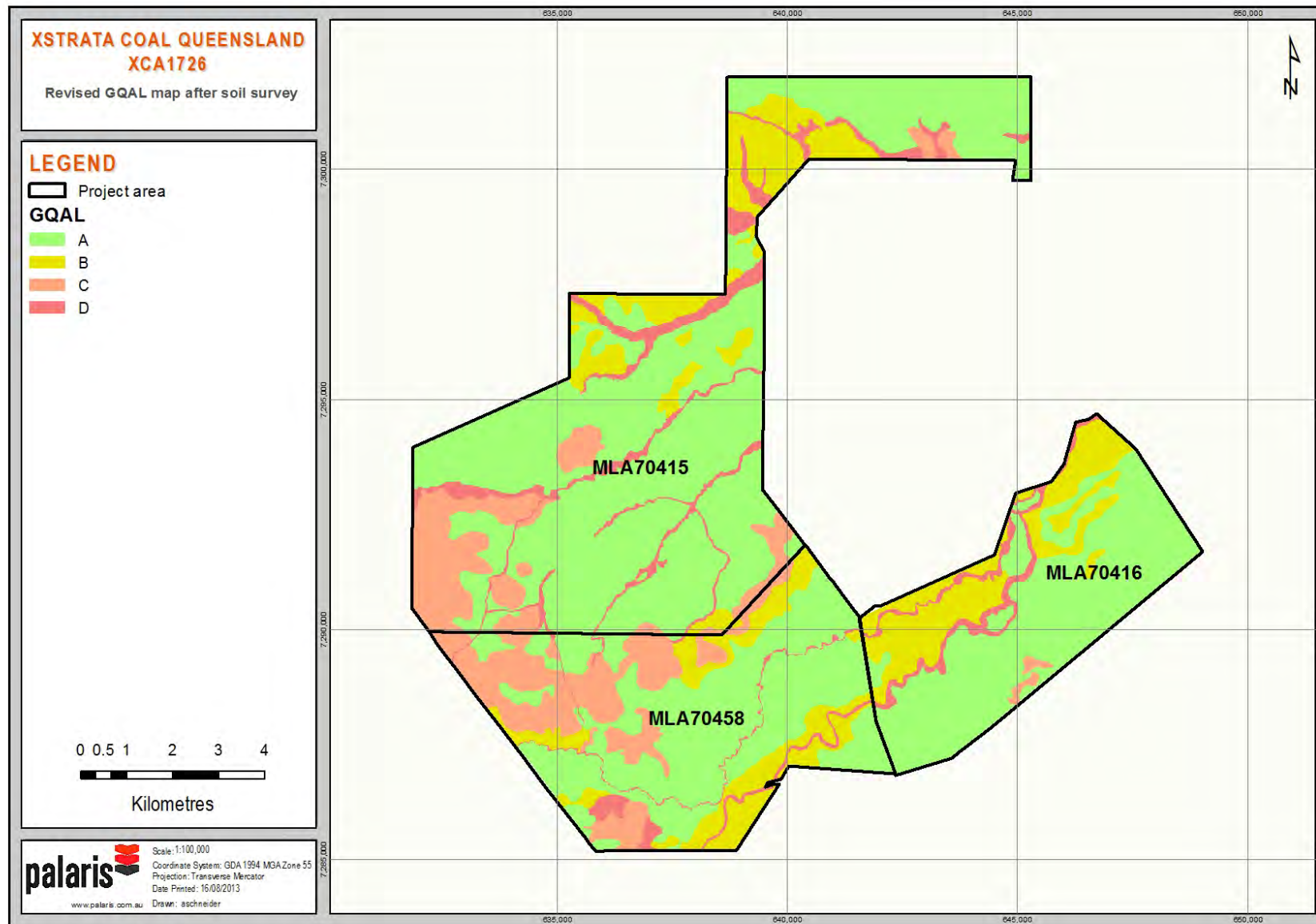


Figure 3.5 Revised GQAL Classification Following Detailed Soil Mapping of the Rolleston Mine Site

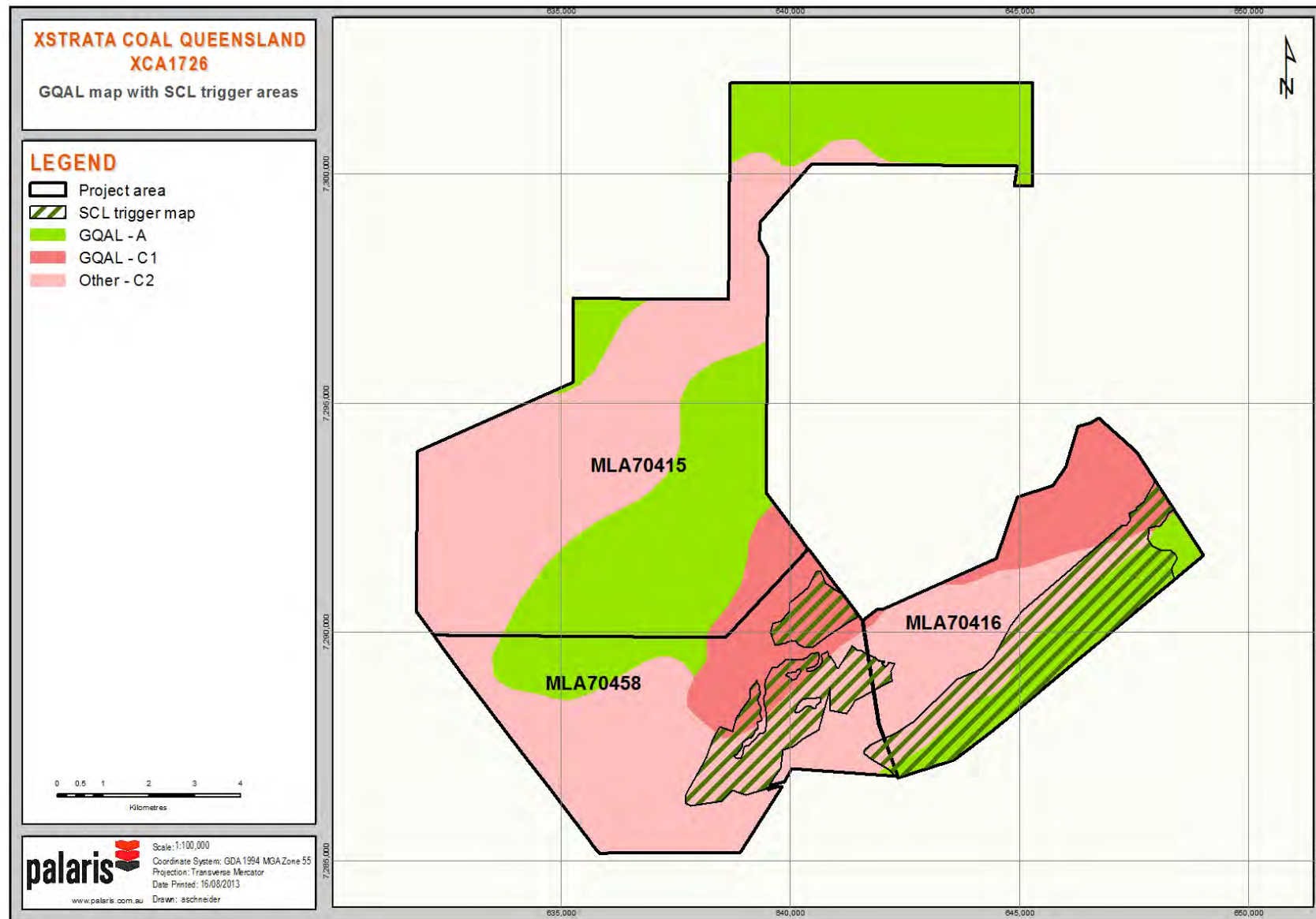


Figure 3.6 Comparison of DERM SCL Mapping with CHRC GQAL Mapping

Key differences between the current land evaluation and the CHRC GQAL evaluation include:

- CHRC appears to incorporate Class D into Class C
- CHRC has considerably less Class A land and no Class B land

The extensive areas of Classes A and B land mapped in the current evaluation reflect the broad definitions within this methodology, i.e. Class A land includes all land that is arable with limitations to crop production ranging from none to moderate, whereas Class B land is defined as being marginal for cropping due to severe limitations (DHLGP, 1993).

The CHRC GQAL mapping, which is apparently based on Story *et al.* (1967), is not reflected in the DERM SCL trigger mapping for the Project area, which shows most SCL as occupying Class C land (Figure 3.6). This contradiction is most probably due to limitations of scale and incorrect assignment of land suitability during map compilation. It is well established that reconnaissance-scale data should not be used for land use planning at a property-scale (McKenzie *et al.*, 2008).

Note: No survey was undertaken for the potential road relocation across land to the south-east of MLA70416 as this was outside the scope of the work initially undertaken. This area is shown as GQAL Class A in the CHRC mapping and based on the recent revision for this report would appear to conform to Class A.

3.6 Land Suitability

The soils identified in this study have been correlated with the earlier work of Bourne and Tuck (1993) for a range of typical land uses (Table 3.7). Predictably, dryland cropping is mainly restricted to the alluvial, medium to heavy cracking clay soils, e.g. Adelong and Moramana, and to the deeper (>60 cm) cracking, self-mulching black Vertosols occurring on basaltic undulating plains, e.g. Orion. The remaining AMUs have only limited or nil suitability for cropping (Bourne and Tuck, 1993). Suitability is confined to those years when soil moisture (both fallow storage and rainfall) is adequate for a rainfed crop.

In land suitability assessment for dryland cropping there are 18 criteria with threshold values used to assess and rank land. These criteria consider a broad range of soil physical and chemical limitations to land use including for example erosion, flood risk, soil depth and other parameters that define the long-term potential of the soil to sustain a cropping or grazing regime. A summary of land suitability for the soils of the Project area is given in Table 3.7

Rainfall variability is an overarching limitation to land suitability for cropping in the Project area. Other than rainfall, soils A1 and B3 within MLA70458 and MLA70416 have only minor limitations to cropping. For example, soil A1 has only minor limitations of climate, flooding and soil water storage (c2, f2, m2) while soil B3 has minor limitations for water erodibility, soil nutrients, workability, rockiness, soil depth, and soil water storage (e2, n2, k2, r2, d2, m2). These limitations are unlikely to affect the cropping performance of these soils. The availability of only limited data on soil types A5 and C1 makes a definitive classification difficult but does suggest that where individual soils lie at the better end of their ranges, they may be considered moderately to marginally suitable (i.e. Class A to B).

Climate variability dominates cropping production in subtropical regions (Littleboy *et al.*, 1990) particularly in the drier SCL Western Cropping Zone and its effects on yield have been studied extensively (e.g. Freebairn *et al.*, 1990; Potgieter *et al.*, 2002). Climate variability, although a synthesis of multiple weather measurements over time, is often reduced to rainfall only in the study of cropping systems (e.g. Biggs 2007). Rainfall variability also provides an overarching limitation to sustainable cropping in the Project area (Bourne and Tuck 1993). This variability reduces landholder confidence to use fertilisers or to spell areas with perennial pastures including legumes; thought to be the only effective means of managing fertility (Armstrong *et al.*, 2003). Without such approaches to the maintenance of soil fertility (especially nitrogen) cropping is not likely to be sustainable.

Table 3.7 Assessment of Land Suitability for Selected Cropping Systems for Soils of the Rolleston Mine Site

Palaris (2012)	Bourne and Tuck (1993)					
Soil type	AMU	Summer crop	Winter crop	Winter forage	Summer forage	Cropping system
A1	Adelong	S	S	S	S	Long-term dryland cropping
A2	Moramana	S	S	S	S	Long-term dryland cropping
A3	Glen Idol	NS	LS	LS	NS	Limited suitability for winter forage and crops
A4	Isaac	NS	NS	NS	NS	Not suitable for development for cropping
A5	No similar AMU	NS	NS	S	S	
B1	Jimbaroo	NS	NS	NS	NS	Not suitable for development for cropping
B2	Orion	S	S	S	S	Long-term dryland cropping
B3	Orion	S	S	S	S	Long-term dryland cropping
B4, B5	Highlands	NS	NS	NS	NS	Not suitable for development for cropping
C1	Rolleston/ Springton	LS	LS	S	S	Suitable for forage cropping
C2	No similar AMU	-	-	-	-	

S: suitable - benefits from land use exceed inputs to initiate and maintain sustainable production

LS: limited suitability- benefits from land use equivalent to inputs; long-term suitability is doubtful

NS: not suitable- benefits from land use less than inputs to initiate and maintain production; limitations are too severe

Cropping systems models such as APSIM (by CSIRO, UQ and Queensland Government) provide a quantitative tool to assess the sustainability of cropping systems. Modelled yield outputs allow comparison with break-even yields for sustainable cropping.

In this sustainable cropping assessment, APSIM has been used to simulate cropping outcomes for more than 100 consecutive years for each of the identified suitable cropping soils, i.e. A1 and B3. Climate data for Springsure were used, with the exception of evaporation data, which was based on that for Emerald. Modelled yields for sorghum and wheat for soil types A1 and B3 are shown in Table 3.8.

The capacity of a soil to store water that is later available to a crop is a fundamental component of successful cropping in Queensland (Freebairn *et al.*, 1990). In this assessment, soil water storage (SWS) values have been determined via each of two methods to enable an assessment of the SCL criteria discussed in Section 4. Methods used included (i) the look-up-table (LUT) in the published SCL criteria application guidelines (DERM, 2011b), and (ii) laboratory data (Lab) using the estimation techniques of Littleboy *et al.* (1989) and Shaw and Yule (1978). These SWS values were also applied to the APSIM modelling to derive the output provided in Table 3.8.

This output along with an assessment of land use attributes for all the twelve identified soils, was then used to define land suitability for both dryland cropping and grazing of beef cattle land uses.

The SWS values for the two soil types were similar, irrespective of method, ranging from 108 to 126 mm/m. DPI (2006) investigated cropping soils within the Western zone in central Queensland and found that soils need to be able to store at least 120 mm of plant available moisture in the effective rooting depth for reliable dryland cropping.

Table 3.8 Modelled Crop Yields for Wheat and Sorghum for Period 1887 – 2010

Soil type	SWS mm/m	Crop	Planting frequency (crops/decade)	Median yield (for crops planted)
A1	108 (LUT)	Winter wheat	6.5	1496
	114 (Lab)	Winter wheat	6.5	1503
	108 (LUT)	Summer sorghum	9.3	3651
	114 (Lab)	Summer sorghum	9.3	3874
B3	120 (LUT)	Winter wheat	6.5	1511
	126 (Lab)	Winter wheat	6.5	1569
	120 (LUT)	Summer sorghum	9.3	3999
	126 (Lab)	Summer sorghum	9.3	4226

Key results of sustainability modelling showed that:

- sowing conditions for wheat were met six years in ten
- sowing conditions for sorghum were met nine years in ten

Modelled yields are known to be overestimates compared to actual yields due to known factors and assumptions in modelling, e.g. nil crop disease or insect damage, no grain losses at harvest, maintenance of soil fertility, and other inputs. Rotations of winter and summer crops were not modelled as the intention was to identify the likelihood of cropping success for either crop within a general opportunistic cropping environment and soil moisture in this area is seldom likely to sustain multiple crops without a substantial fallow period. Notwithstanding, Armstrong *et al.* (2003) concluded that continuous cropping would become unsustainable after 5-6 years without the application of significant fertiliser inputs or long-term pasture leys (crop-pasture rotations).

Sustainable wheat cropping is unlikely in the Project area due to the low reliability of winter rains. Summer cropping of sorghum appears more reliable and potentially sustainable, though returns are lower due to market factors.

The opportunistic nature of cropping in the Central Highlands and concerns over the decline in soil fertility due to cropping are well recognised (Cox *et al.*, 1998, Armstrong *et al.*, 2003). In addition there are limited economically viable options to sustain production (Armstrong *et al.*, 2003). As such it is questionable if these soils offer any real strategic resource for long-term sustainable dryland food production in Queensland

Dryland Cropping

The variability of the rainfall in the Central Highlands region provides the over-riding limitation to dryland cropping. Consequently, there is no Class 1 land within the study area (Bourne and Tuck 1993).

Approximately 26 % (3,219 ha) of the study area was rated as Suitability Class 2 (soils A1, B3). Of all the soils, these two are most suited to long-term dryland cropping and to irrigation where water supplies may be available. Some 38% of the study area is Suitability Class 3 (A3, B2, C1 and C2) and while suitable for dryland cropping has moderate limitations. Suitability Classes 4 and 5 covered 16% and 18% of the study area respectively. The Class 5 areas included areas of swamp, areas of shallow rocky soils, and levees associated with active creeks (e.g. Meteor Creek).

Land suitability classification for dryland cropping of winter crop is shown in *Figure 3.7* based on the current soil survey and reflecting the soil assessments undertaken by Bourne and Tuck (1993).

Grazing

Most of the land within the project area was assessed as suitable for grazing of either improved or native pastures. Nevertheless, sustainable grazing regimes will require varying levels and intensities of management across the different suitability classes.

Approximately 26% (3219 ha) of the mine site was rated as Suitability Class 1 (A1, B3) for grazing, with a further 33% and 21% being Classes 2 and 3 respectively. Most of the remaining area was Suitability Class 4 with the exception of the two large areas of swamp within MLA70458 (52 ha or 0.5% of the study area) which was determined as Suitability Class 5 (Figure 3.8).

Note. Similarly to the GQAL assessment, no survey was undertaken for the potential road relocation onto land to the south-east of MLA70416. As there is evidence that this area has been cropped in the past, it would appear that the area would qualify as Class 2/3 at least. Once a decision has been taken as to the preferred road route, it may be necessary to re-visit the site for a more detailed assessment.

3.7 Impacts on land suitability

The areas to be affected by mining and infrastructure development are shown later in Figure 4.8 and Figure 4.9 which delineate the disturbance areas planned for the next phase of mine development. Some areas such as surface infrastructure, the diversion channel of Meteor Creek and the dam to be constructed along the north-eastern boundary of MLA70458 will permanently affect the utility of those areas. Though such areas may well be rehabilitated to achieve a stable grazing system following reinstatement of a landform after mining, it is unlikely that the pre-existing land suitability would be regained.

Thus, it is likely that the pre-mining grazing land suitability could be restored but that cropping suitability would be Class 4 at best.

Depending on the route selected for the diversion road, impacts would vary. The option across MLA70416 skirts Meteor Creek across the lower colluvial slopes of a basalt undulating plain that drains generally north-westwards and the floodplain of the creek itself. As much of this area is subject to periodic flood impact and a moderate risk to cropping, it is unlikely that land use suitability would be severely impacted. There is no evidence from recent aerial imagery that this area has ever been used for anything other than grazing.

The more easterly road option that lies outside the MLA area traverses other Class A cropping lands, mostly on Meteor Park and partly on the neighbouring property. This option starts off following the Lot boundary before diverging to the north-east and terminating off lease (as shown in Figure 4.8). This would most likely become a permanent road easement so that the impact on both grazing and cropping land suitability would be permanent also. Aerial imagery shows that cropping has occurred in parts of this area at least since 2008. Depending on the exact location of this route option, it could be expected that there would be some impacts on both cropping and grazing land use suitability. More detailed soil investigations would be required to confirm the exact extent of impact should this option be selected as no soil data are currently available and it was assumed that the trigger mapping was correct. This area is included as an additional (optional) input to the financial contribution in Table 4.22.

Following establishment of the stream diversion of Sandy Creek, it is anticipated that there will be increased inundation of part of MLA 70458 during flood events. Modelling has been undertaken for specific AEP events for assessment of the duration of inundation and of likely extent of flooding to determine the degree of impact on this area in terms of changes to land use suitability. Sandy and Meteor Creeks have variable but broad floodplains and a series of meandering incised channels and anastomosing runners. This suggests that flow events regularly break out across the floodplains and that there is a low gradient in these reaches. As aerial imagery of MLA 70458 shows a history of cropping and evidence of at least one centre pivot set up, it is probable that flood impact is tolerated by the landholder under present flood conditions. Modelling shows the extent to which inundation duration, depth, velocity and extent of flooding will be affected by the proposed diversion and mine development. As this flooding is only a temporary impact it will not alter land use suitability in this area to any serious degree. Thus, we consider that there is no permanent impact on SCL in this area of proposed disturbance.

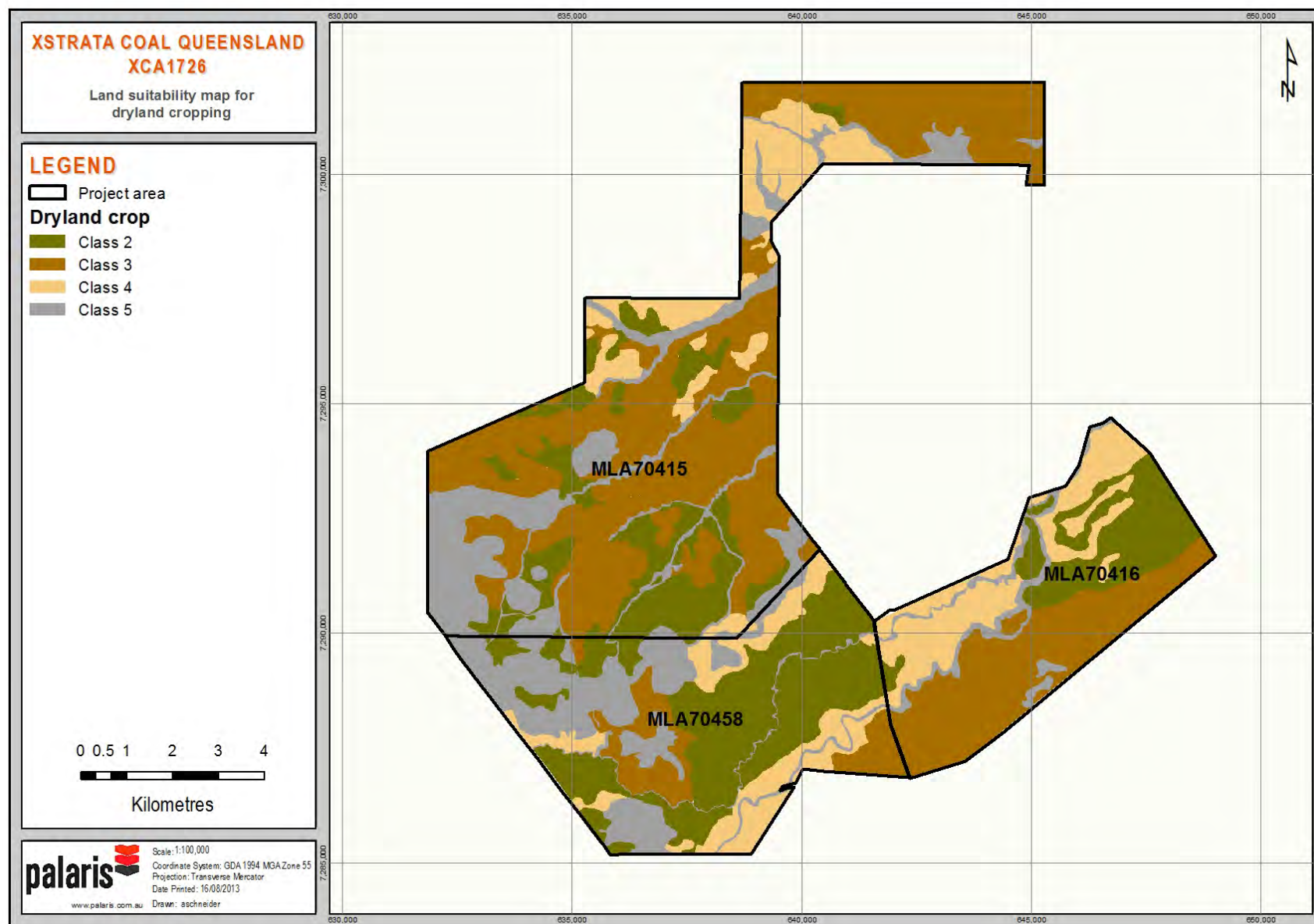


Figure 3.7 Land Suitability for Dryland Cropping at Rolleston Mine Site

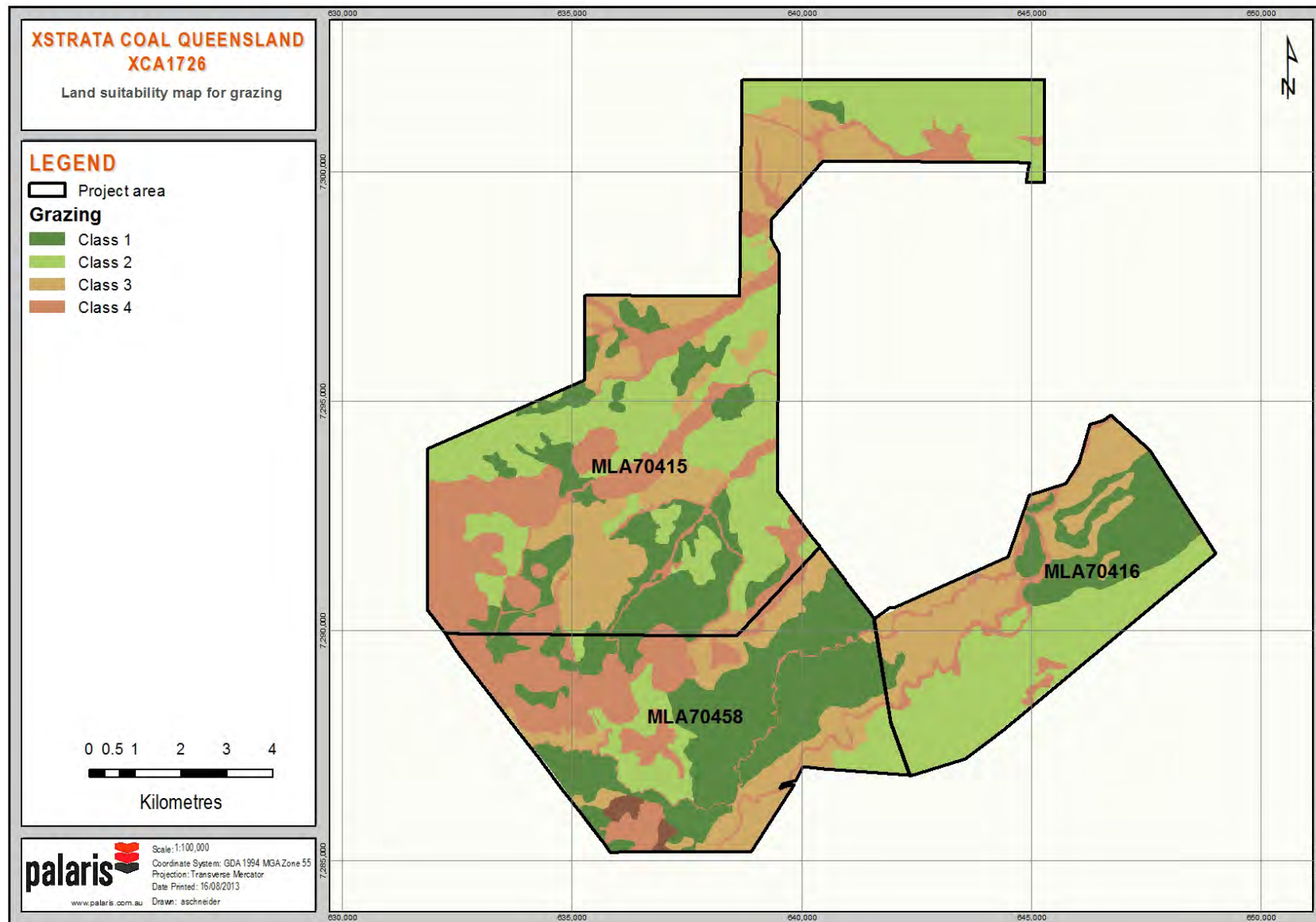


Figure 3.8 Land Suitability for Grazing at Rolleston Mine Site

4 Strategic Cropping Land Assessment

4.1 Introduction

The *Strategic Cropping Land Act 2011* commenced 30 January 2012. This new Act protects land that is *highly suited to cropping* from development that leads to its permanent alienation or diminished productivity.

The Act has implications for mining projects that depend on the status of tenure and environmental approvals at prescribed dates, and the location and the type of proposed mining development.

The SCL assessment process for resource projects is summarised and implications for the Project are identified in Table 4.1.

Table 4.1 SCL Assessment Process Checklist

Step	Action	Application to the Project
1	Is your proposed development on land shown as potential SCL on the trigger map?	Yes
2	Identify the zone the land is in and criteria	Western management zone
3	Are you satisfied that the trigger map is correct and do you accept that the land meets the SCL criteria? Yes – Go to assessment process A No – You will need to conduct an assessment of the land and apply for confirmation of whether it is SCL. Go to assessment process B.	No
4	Conduct an on-ground assessment using the appropriate criteria and guidelines.	Assessed on the basis of the soil survey undertaken by Palaris and documented in this report
5	Different development assessment rules apply in the protection and management areas: Protection area: If the land is within a protection area, submit Part A and C of the SCL validation form to the Department of Environment and Resource Management (DERM) to confirm the status of the land. If DERM decides the land is SCL, you will be required to avoid and minimise to the maximum extent possible, any temporary or permanent impacts on identified SCL. If SCL cannot be avoided, temporary development may proceed if SCL can be restored to its pre-development condition. If SCL cannot be avoided and will be permanently impacted, the development can only proceed in limited exceptional circumstances. Submit an exceptional circumstances application if necessary (you may wish to submit this application before you lodge an SCL protection decision application). If your project is determined to be an 'exceptional circumstance', you will still be required to make all efforts to avoid and minimise any temporary or permanent impacts on SCL and mitigate any permanent impacts.	The Project is within the Central Protection Area
6	Submit an SCL compliance certificate application to comply with the standard conditions code or an SCL protection decision application for resource activities that cannot comply with the standard conditions code.	The Project cannot comply with the standard conditions code
7	If your proposed development is considered to be a transitional project, you will be required to avoid and minimise any temporary or permanent impacts on SCL, and mitigate any permanent impacts.	The Project is a transitional project

The Rolleston Coal Mine and the areas of impact of the Project lie within the SCL Western Cropping Zone. In addition, MLA70415, MLA70416, and the bulk of MLA70458 lie within the Central Queensland Protection Area. A small area in the south-east of MLA70458 lies outside the Protection Area but none of the area outside the Protection Area is shown as SCL in Trigger mapping downloaded 10 July 2013.

The SCL Trigger mapping available on the DERM internet site delineates potential SCL. Areas delineated in the Trigger mapping are not classed as SCL until a decision as to their status is recorded in the decision register. Decisions can be made on site-based assessments against the eight specified criteria (Table 4.2) or on acceptance of the validity of the Trigger mapping for the area in question. Areas must meet all of the criteria to be classed as SCL.

Table 4.2 Zonal Assessment Criteria for Western Management Zone

Criteria	Western management zone
Slope	≤ 3%
Rockiness	≤20% for rocks >60 mm diameter
Gilgai microrelief	< 50% of land surface being gilgai micro-relief of >500 mm in depth
Soil depth	≥600 mm
Soil wetness	Has favourable drainage
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
Salinity	Chloride content <800 mg/kg within 600 mm of the soil surface
Soil water storage	≥100 mm to a soil depth or soil physico-chemical limitation of ≤1000 mm

In addition to the criteria in Table 4.2, areas to be considered as SCL in the Western Cropping Zone must be ≥100 ha, and at least 80 m wide. Natural or artificial features that may divide SCL must be greater than 80 m wide as well. The 100 ha minimum area should consider SCL immediately adjacent to the area being evaluated as well.

4.2 Preliminary Assessment

A preliminary assessment of SCL was undertaken by downloading Trigger mapping covering the area from the DNRM internet site. The trigger mapping also including the proposed disturbance area for the mine expansion is shown in Figure 4.1. This shows that potential SCL exists in both MLA70416 and 70458. The total area of SCL delineated in the Trigger mapping is 1,813 ha. None of the SCL shown for ML70307 will be impacted by the proposed additional disturbance.

The approximate relationship between SCL Trigger mapping and previous mapping is set out in Table 4.3. It can be seen that the Trigger mapping bears little relationship to previous regional scale mapping (refer to Figure 3.6), including the land identified as suitable for cropping in GQAL mapping.

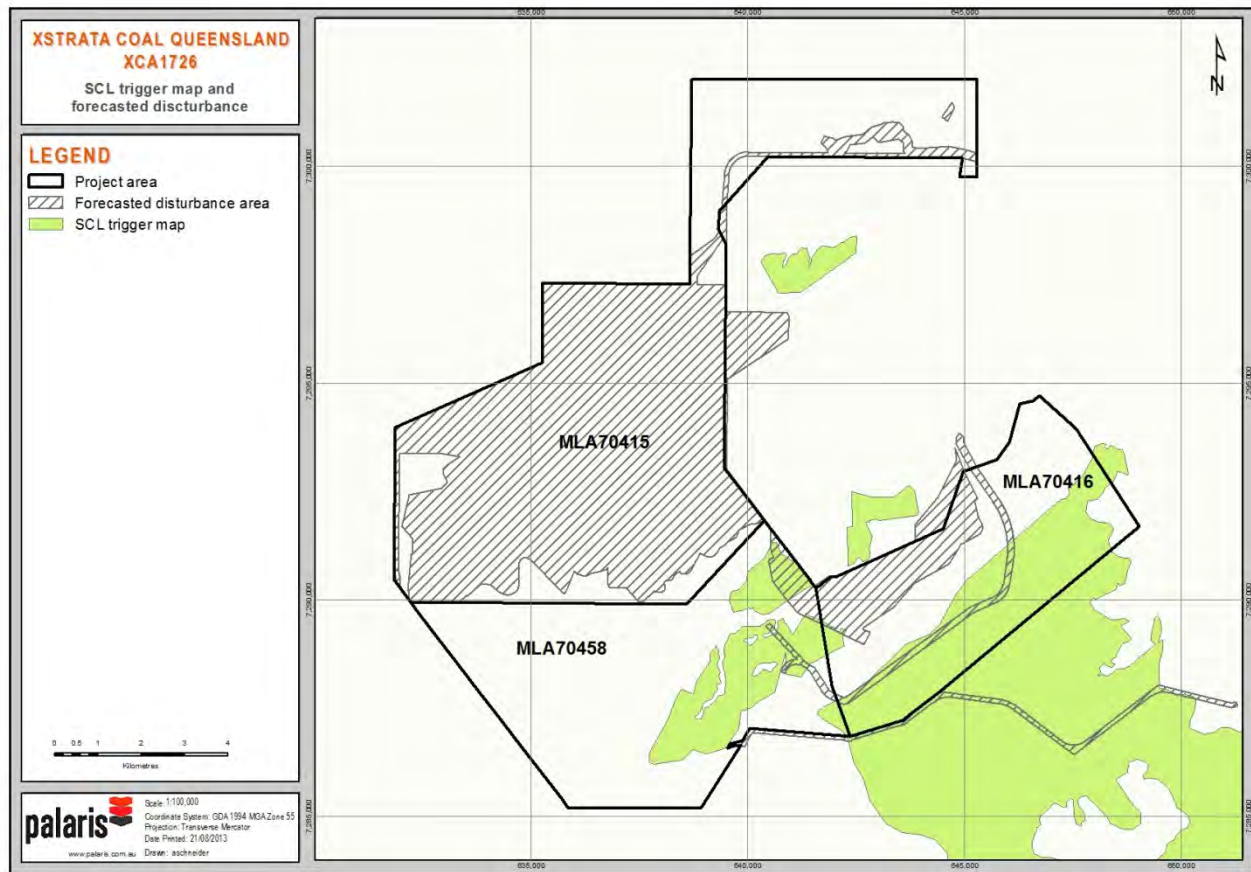


Figure 4.1 DERM SCL Trigger Mapping for the project area (dated 10 July 2013) and forecasted disturbance areas for mine expansion

Table 4.3 Mapping Units from Previous Resource Studies that Contain Appreciable Areas of SCL as Shown in SCL Trigger Mapping (dated 10 July 2013)

Previous mapping	Units containing SCL	Comment
CSIRO Land Systems	<ul style="list-style-type: none"> Bedourie Land System Connors Land System Racecourse Land System Funnel Land System 	Shows SCL as occurring mostly in Racecourse, Bedourie, Funnel and Connors Land Systems
DPI Land Management Manual	<ul style="list-style-type: none"> LRA 1 LRA 2 LRA 4 	Shows SCL as occurring mostly in LRAs 1 and 2 which cover Funnel, Racecourse and Bedourie
Central Highlands Regional Council GOAL (formerly Bauhinia Shire Council Planning Scheme)	<ul style="list-style-type: none"> Class A – Crop land – Suitable for rainfed cropping and broadacre crops with irrigation Class C1 – Pasture Land – Suitable for grazing high quality pastures, either sown pastures where ground disturbance is possible for pasture establishment or native pastures on higher fertility soils Class C2 – Pasture Land – Suitable for grazing native pastures with or without the addition of pasture species introduced without ground disturbance 	Appears to be based on the CSIRO Land System mapping

4.3 Evaluation Methodology

SCL assessments of areas identified as SCL in trigger mapping have been undertaken using:

- slope assessments for areas identified in 1 m contour interval mapping as exceeding 3% slope – slope determinations for SCL purposes were made from a DEM modelled across MLA70416 and MLA70458
- field soil mapping undertaken and soil unit descriptions developed as part of the 2011 soil survey, land suitability and GQAL evaluation
- soil descriptions made during the above survey
- soil analysis data from samples collected during the above field survey
- other land resource information relevant to the area including that from Bourne and Tuck (1993) and ERM (2002)

Trigger mapping identifies SCL in MLA70416 (*Figure 4.2*) and MLA70458 (*Figure 4.3*). No SCL is shown on MLA 70415. Data available from the above sources have been evaluated against the eight zonal criteria shown in Table 4.2 to determine the SCL status of the areas of potential SCL shown in the Trigger mapping. It should be noted that the bulk of the soils and land suitability investigations were concluded prior to publication of the proposed guidelines (DERM, September 2011) published in September 2011 and all of the investigations were concluded before assent was given to the *Strategic Cropping Land Act 2011* and confirmation of the Guidelines and other supporting procedures in January 2012.

While not shown in Figure 4.1, the trigger mapping shows potential SCL continuing immediately to the south-east of that shown in MLA70416 and perusal of imagery and contour information indicates that SCL is highly likely to occur south-east of that in this MLA.

Though this method of assessing SCL does not conform strictly to that set out in the guidelines that now apply the use of existing data, knowledge of the region and experience of the surveyors has enabled an effective assessment of the Project area for the purposes of SCL definition within the proposed disturbance area.

4.4 SCL Assessment

One metre contours across MLAs 70416 and 70485 are presented in Figure 4.4 and Figure 4.5 respectively. In addition, a digital elevation model was used to analyse slopes. Results show that there are appreciable areas of steeper land in the south-west of the trigger mapped potential SCL in MLA70416 and a minor area of steeper land in the south-east of the trigger mapped potential SCL in MLA70458. Appreciable areas exceed 3% slope and fail the slope criterion for SCL.

Slope was determined by measurement over 250 m distances at ten locations in that part of MLA70416 and MLA70458 trigger mapping SCL where slopes appeared steepest. Slopes at the locations checked in the area identified as likely to fail the SCL slope criterion were as follows:

- 642376 E, 7287533 N – 3.6%
- 642541 E, 7287701 N – 3.2%
- 642795 E, 7287987 N – 3.6%
- 643119 E, 7288073 N – 3.2%
- 643309 E, 7287742 N – 4.8%
- 643649 E, 7287888 N – 4.8%
- 643776 E, 7288022 N – 3.6%
- 643770 E, 7288314 N – 4.0%
- 643896 E, 7288685 N – 3.6%
- 643890 E, 7288882 N – 3.2%
- 643757 E, 7288504 N – 2.8%

Slopes in adjacent areas of apparent lower slope were all measured as 2.8%.

Assessments of whether the soils meet SCL criteria within the trigger mapping potential SCL areas based on the zonal soil properties are given in Table 4.4 and Table 4.5 for MLAs 70416 and 70485 respectively while the soil distributions are shown in Figure 4.2 and Figure 4.3.

Areas assessed as SCL and not SCL in the two MLAs are shown in Figure 4.6 and Figure 4.7 where the map legends include the reasons for exclusion for areas not assessed as SCL. The areas assessed as SCL and the areas excluded are given in Table 4.6 and Table 4.7. Polygons that otherwise meet the SCL criteria but are less than the required 100 ha contiguous area needed to qualify as SCL in the Western Cropping Zone are also identified.

Table 4.4 Assessed Status of Soils Mapped Within Areas Shown as SCL in Trigger Mapping Within MLA70416

Soil	Brief soil description	Assessed SCL status
A1	Black and Grey Vertosols formed on alluvium	SCL
A4	Active channels and levees associated with creeks and drainage lines. Variable soils which are usually sandy and stratified	Not SCL – active stream flow areas
A5	Grey and Brown Sodosols, Chromosols and Dermosols usually with thin A horizons	SCL
B5	Shallow (<60 cm) Brown Rudosols	Not SCL – soil depth
C1	Black and Grey Vertosols and Dermosols greater than 600 mm deep	SCL

Table 4.5 Assessed Status of Soils Mapped Within Areas Shown in Trigger Mapping as SCL Within MLA70458

Soil	Brief soil description	Assessed SCL status
A1	Black and Grey Vertosols formed on alluvium	SCL
A4	Active channels and levees associated with creeks and drainage lines. Variable soils which are usually sandy and stratified	Not SCL – active stream flow areas
A5	Grey and Brown Sodosols, Chromosols and Dermosols usually with thin A horizons	SCL
B1	Shallow Black Vertosols, usually <50 cm to weathered basalt	Not SCL – Slope and shallow soils
B3	Black Vertosols usually >900 mm to weathered basalt	SCL
C1	Black and Grey Vertosols and Dermosols greater than 600 mm deep	SCL

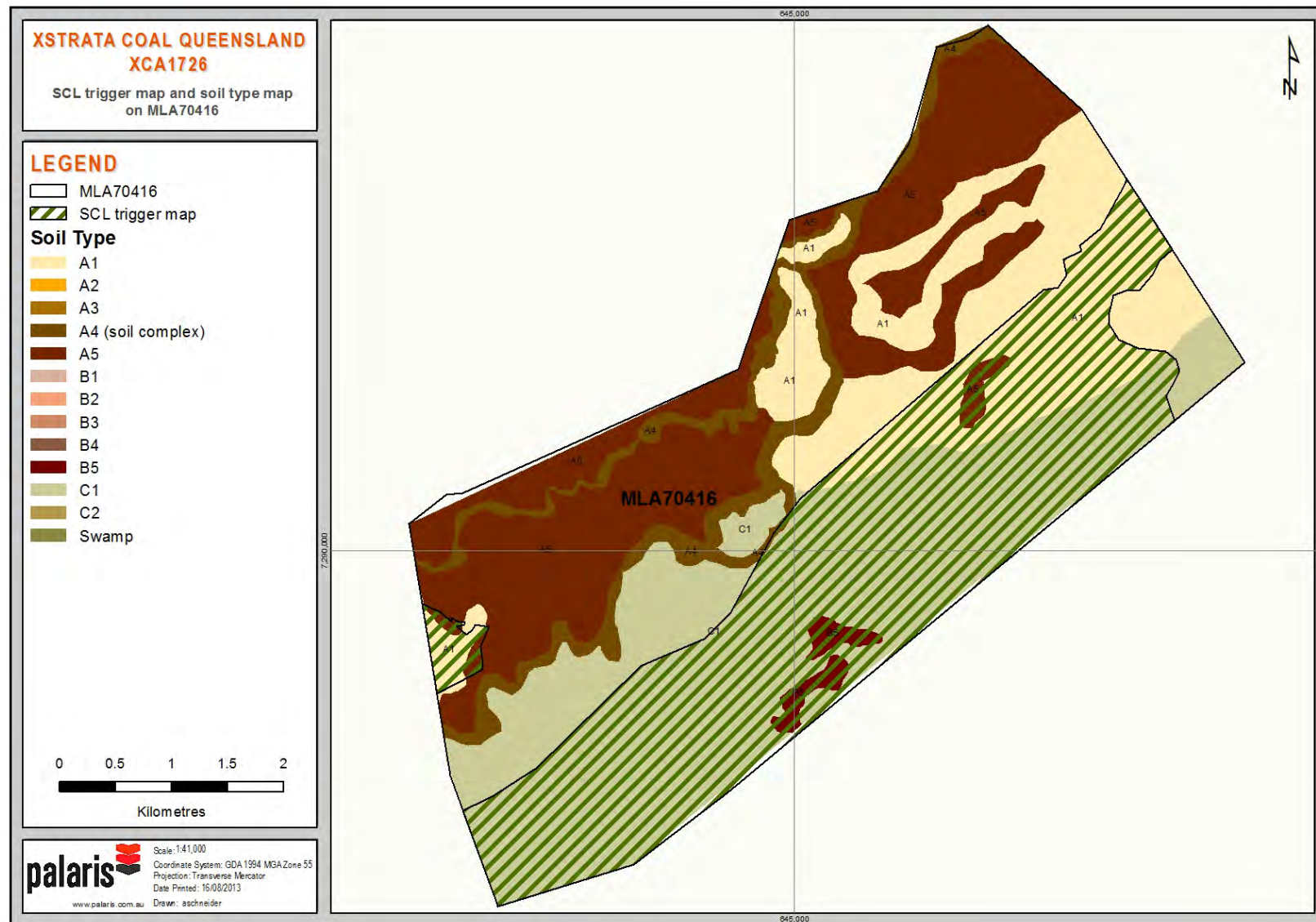


Figure 4.2 Relationship of SCL Trigger Mapping and Soils for MLA70416

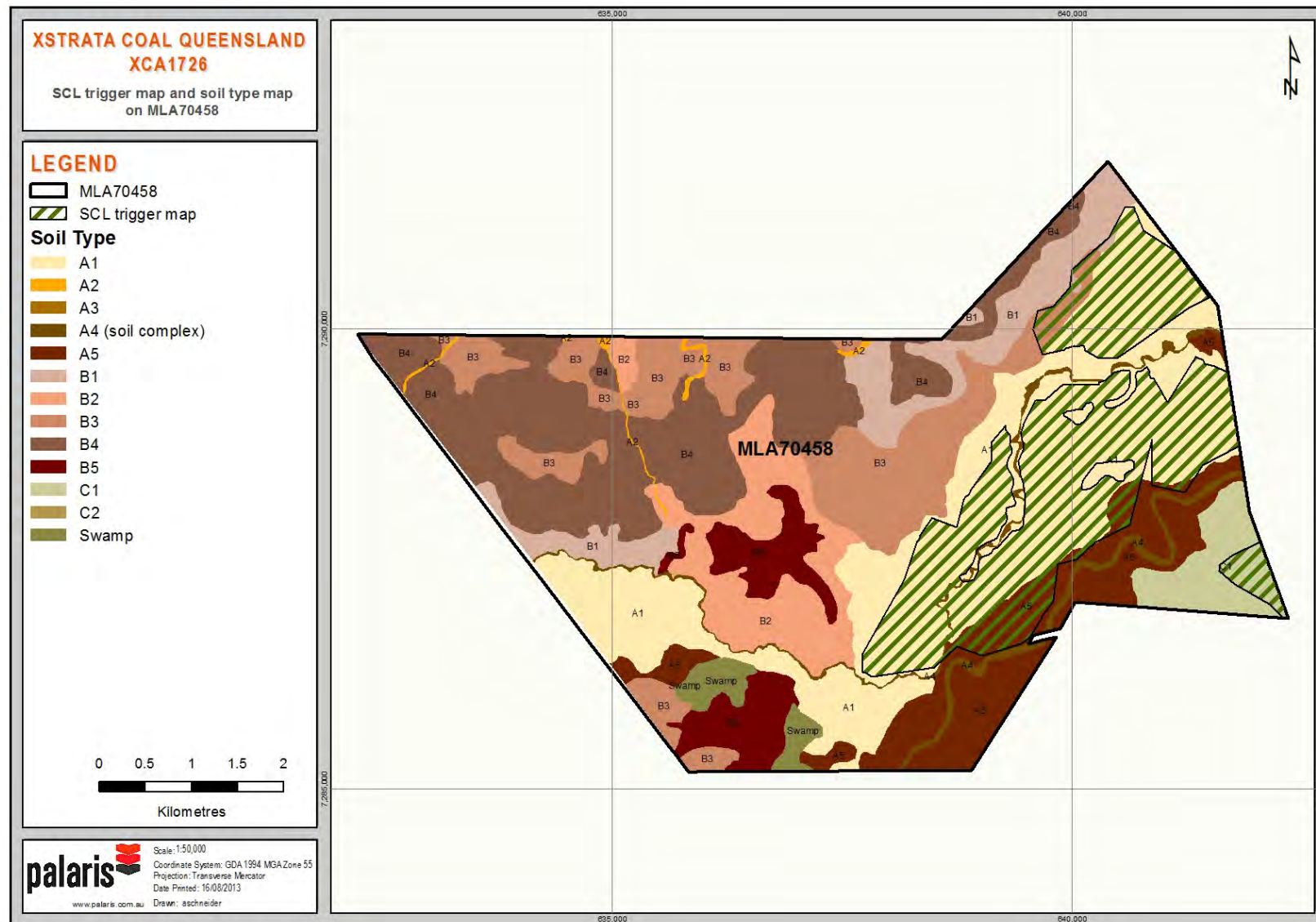


Figure 4.3 Relationship of SCL Trigger Mapping and Soils for MLA70458



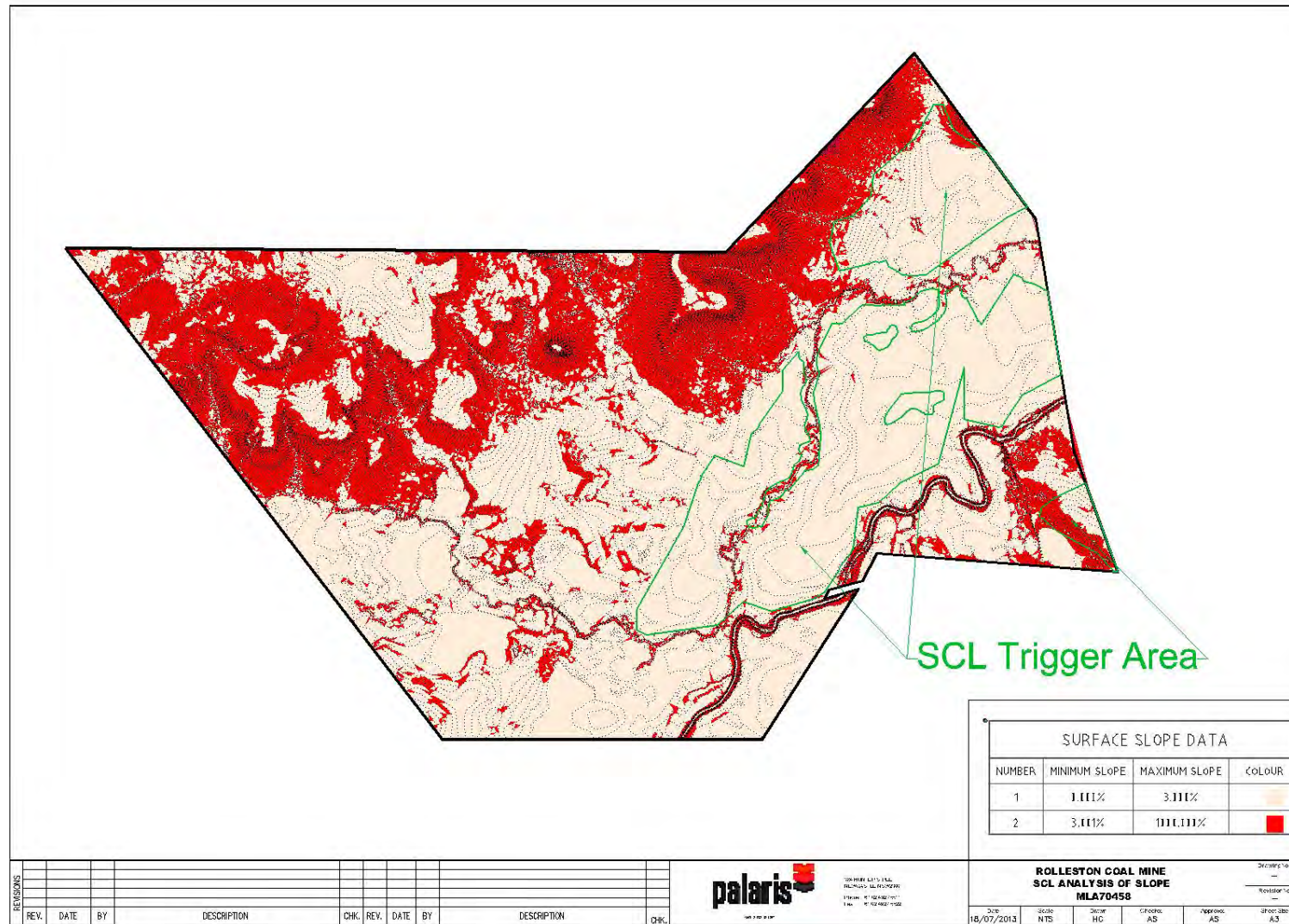


Figure 4.5

in MLA70416 Showing Land >3% slope in red

Topography of SCL Area

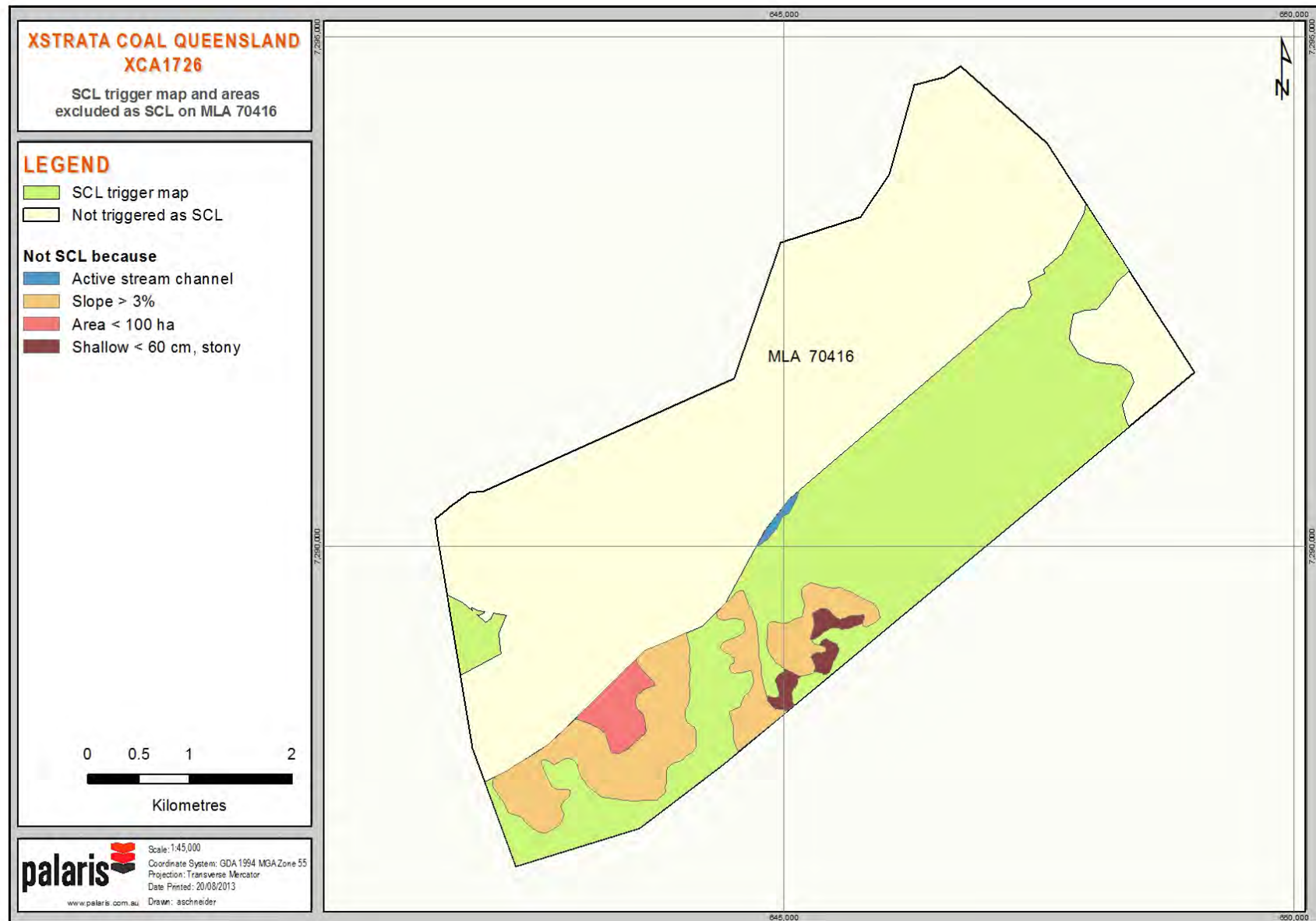


Figure 4.6

Assessed as SCL Showing Areas that Fail the Zonal Criteria on Specific Attributes for MLA70416

Land

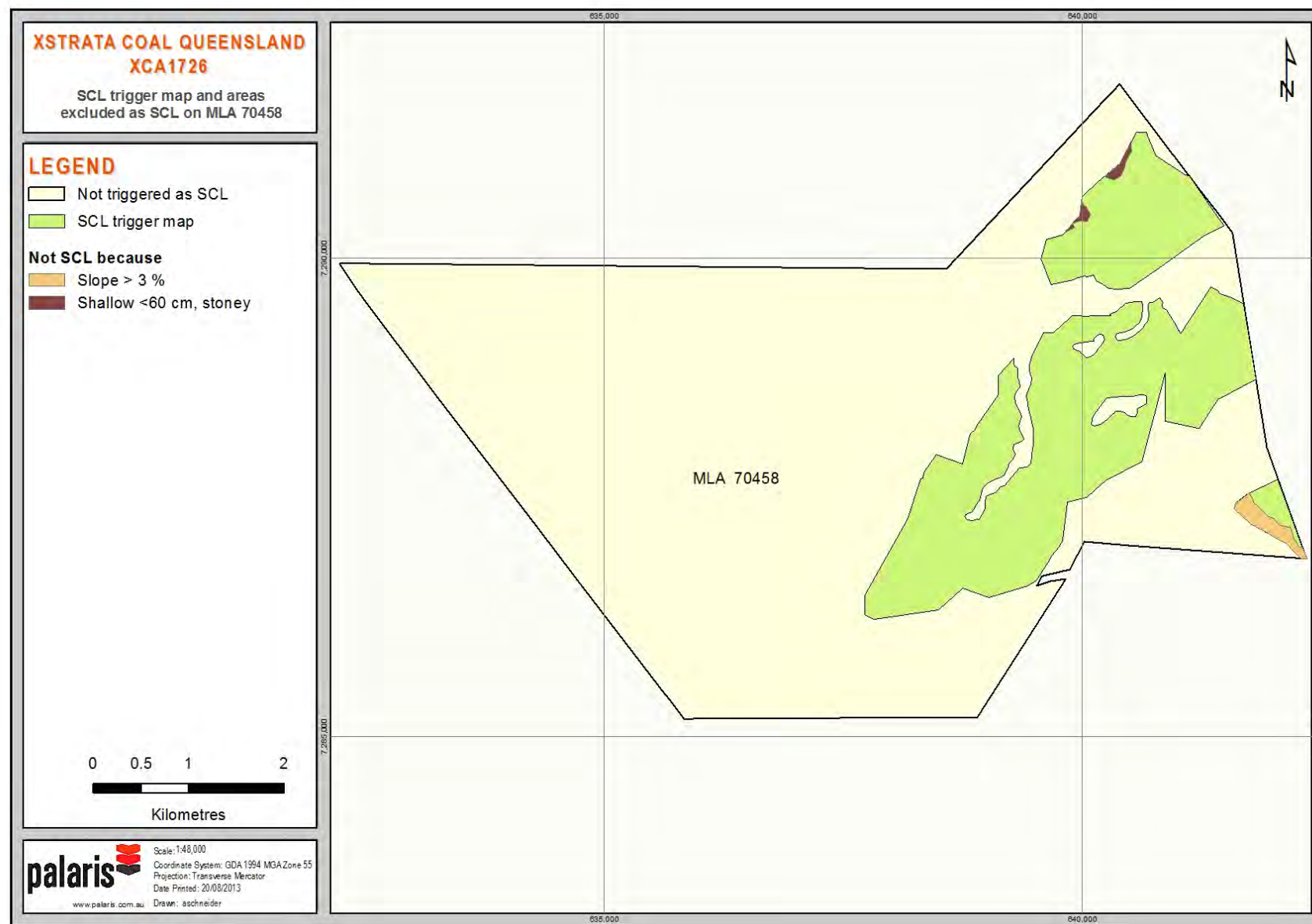


Figure 4.7 Land Assessed as SCL Showing Areas that Fail the Zonal Criteria on Specific Attributes for MLA70458

Table 4.6 SCL Assessment for Areas Shown as SCL in Trigger Mapping in MLA70416

SCL category	Reason for exclusion (where required)
SCL	
Not SCL - slope	Slopes across more than 70% of the area exceed 3%
Not SCL – soil depth	Soils are less than 600 mm to parent material
Not SCL – active stream flow areas	Areas are stream active beds immediately adjacent areas subject to high velocity overbank flow
Not SCL - area	Area assessed as SCL is not part of a land unit of area >100 ha

Table 4.7 SCL Assessment for Areas Shown as SCL in Trigger Mapping in MLA70458

SCL category	Reason for exclusion (where required)
SCL	
Not SCL – soil depth	Soils are less than 600 mm to parent material
Not SCL – active stream flow areas	Areas are stream active beds immediately adjacent areas subject to high velocity overbank flow
Not SCL - area	Area assessed as SCL is not part of a land unit of area >100 ha

Assessments of SCL status at representative soil type description sites within MLA70416 and MLA70458 mapped SCL areas follow (Table 4.8 to Table 4.20 inclusive). All sites are in map zone 55 and were located using GDA 94 and UTM projection.

Table 4.8 Representative Site Description and SCL Assessment for Soil Type A1

PART A – Site and soil data			
Site	258 (MLA70416)		
Land use/cover	Brigalow and Belah		
Location coordinates	647926 E 7292606N		
Soil classification	Black Vertosol		
Soil map unit name	A1		
Soil type correlation (and reference)	Adelong (Bourne and Tuck, 1993)		
Surface rock	Nil		
Gilgai microrelief	Nil		
Slope and landform	1%, Gently undulating plains		
Surface condition	Cracking, self-mulching		
Soil profile description			
0 mm – 50 mm	Dark greyish brown 10YR3/2, medium clay coarse granular structure, field pH 6.5		
50 mm to 450 mm	Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky / prismatic structure, no mottles field pH 8.0		
450 mm to 1000 mm	Yellowish brown 10YR5/3, medium clay, coarse angular blocky, soft and nodular carbonate, field pH 8.5		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	<1%	Clinometer	P
2 – Rockiness	0		P
3 – Gilgai microrelief	0		P
4 – Soil depth	>1000 mm	Hand auger	P
5 - Soil wetness	Imperfect		P
6 – Soil pH	6.5 at 50 mm, 8.0 at 450 mm, 8.5 at 1000 mm	Field	P
7 – Salinity	401 mg/kg (type site) 140 mg/kg (Bourne and Tuck, 1993)	Type site and reference	P
8 – Soil water storage	120 mm	Lookup table	P

Table 4.9 Representative Site Description and SCL Assessment for Soil Type A4

PART A – Site and soil data			
Site	239 (MLA70416)		
Land use/cover	Grazing, Blue gum, casuarina, Moreton Bay Ash; Bank of active drainage line, not available for cropping		
Location coordinates	644496 E 720217 N		
Soil classification	Black Dermosol		
Soil map unit name	A4		
Soil type correlation (and reference)	Isaac (Bourne and Tuck, 1993)		
Surface rock	Nil		
Gilgai microrelief	Nil		
Slope and landform	1%, Recent alluvial plain		
Surface condition	Non-cracking, firm sandy		
Soil profile description			
0 mm to 500 mm	A1 Brown 10YR4/3, silty clay loam, weak granular structure		
500 mm to 1200 mm	B2 Yellowish brown 7.5YR5/3, fine sandy clay, weak sub-angular blocky structure, no mottles, , field pH 7.0		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	Not SCL – Not available for cropping		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	1%	Clinometer	P
2 – Rockiness	0		P
3 – Gilgai microrelief	0		P
4 – Soil depth	>1000 mm	Exposed face	P
5 - Soil wetness	Imperfect drainage		P
6 – Soil pH	7.5 at 1000 mm	Field	P
7 – Salinity	2 mg/kg (this study type site) NA (Bourne and Tuck, 1993)	Type site	P
8 – Soil water storage	90 mm	Lookup table	F

Table 4.10 Representative Site Description and SCL Assessment for Soil Type A5

PART A – Site and soil data			
Site	249 (MLA70416)		
Land use/cover	Grazing, Poplar Box regrowth with Blue Grass and Buffel		
Location coordinates	646401 E 7292082 N		
Soil classification	Brown Dermosol		
Soil map unit name	A5		
Soil type correlation (and reference)			
Surface rock	Nil		
Gilgai microrelief	Nil		
Slope and landform	<1%, Slightly elevated levee on old alluvial plain		
Surface condition	Non-cracking, firm sandy		
Soil profile description			
0 mm to 250 mm	A1 Grey 10YR4/2, clay loam, weak granular structure, no inclusions, field pH 6.5		
250 mm to 1000 mm +	B2 Yellowish brown 7.5YR4/4, light sandy clay, weak blocky structure, 5% yellow and grey mottles, 5% soft carbonate, field pH 8.0		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	Not SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	<1%	Clinometer	P
2 – Rockiness	0		P
3 – Gilgai microrelief	0		P
4 – Soil depth	>1000 mm	Auger	P
5 - Soil wetness	Imperfect drainage		P
6 – Soil pH	6.5 at 250 mm, 8.0 at 1000 mm	Field	P
7 – Salinity	29 mg/kg (this study type site 280) 9 mg/kg (Bourne and Tuck, 1993)	Type site	P
8 – Soil water storage	95 mm	Lookup table	F (Possible pass on field soil water storage measurement for some profiles)

Table 4.11 Representative Site Description and SCL Assessment for Soil Type A5

PART A – Site and soil data			
Site	280 (MLA70416)		
Land use/cover	Grazing, Poplar Box regrowth with Blue Grass, Spear Grass and Buffel		
Location coordinates	643412 E 7289974 N		
Soil classification	Black Vertosol		
Soil map unit name	A5		
Soil type correlation (and reference)			
Surface rock	Nil		
Gilgai microrelief	Nil		
Slope and landform	1%, Slightly elevated ridge on alluvial plain.		
Surface condition	Firm, slight crust, weak cracking		
Soil profile description			
0 mm to 50 mm	A1 Brown 10YR4/3, silty clay, weak blocky structure, nil coarse fragments, no inclusions, field pH 6.5		
50 mm to 300 mm	B21 Very dark grey 10YR3/1, medium heavy clay, moderate sub-angular blocky, no mottles, field pH 7.0		
300 mm to 900 mm	B22 Very dark grey 10YR3/1, medium heavy clay, coarse and hard angular blocky structure, minor grey mottles, trace soft lime, field pH 8.0		
900 mm to 1300 mm	B23 Yellowish brown 10YR4/4, medium heavy clay, coarse weak blocky structure, prominent (10-15%) carbonate nodules and grey mottles		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	1%		P
2 – Rockiness	Nil		P
3 – Gilgai microrelief	0		P
4 – Soil depth	>1000 mm	Auger	P
5 - Soil wetness	Very slow drainage		P
6 – Soil pH	6.5 at 50 mm, 7.0 at 300 mm, 8.0 at 900 mm,	Field	P
7 – Salinity	29 mg/kg (this study type site) 50 mg/kg (Bourne and Tuck, 1993)	Type site	P
8 – Soil water storage	119 mm	Lookup table	P

Table 4.12 Representative Site Description and SCL Assessment for Soil Type B5

PART A – Site and soil data			
Site	235 (MLA70416)		
Land use/cover	Grazing, Grey Gum, Dead Finish, Buffel		
Location coordinates	645417 E 645417 N		
Soil classification	Red Rudosol		
Soil map unit name	B5		
Soil type correlation (and reference)	Highlands (Bourne and Tuck, 1993)		
Surface rock	30% gravel – margins of tableland very rocky		
Gilgai microrelief	Nil		
Slope and landform	Small elevated tableland		
Surface condition	Hard		
Soil profile description			
0 mm to 300 mm	A1 Reddish brown 5YR4/4, light sandy clay		
300 mm +	C Rock		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	Not Specified		P
2 – Rockiness	30% Gravel		P
3 – Gilgai microrelief	0		P
4 – Soil depth	300 mm	Auger	F
5 - Soil wetness	Not specified		P
6 – Soil pH	Not specified		P
7 – Salinity	108 mg/kg (this study type site)	Type site	P
8 – Soil water storage	30 mm	Lookup table	F

Table 4.13 Representative Site Description and SCL Assessment for Soil Type C1

PART A – Site and soil data			
Site	229 (MLA70416)		
Land use/cover	Grazing, Brigalow regrowth, Yellowwood, Beefwood, Wilga, Emu Apple, dense Buffel. Moreton Bay Ash		
Location coordinates	643175 E 7288178 N		
Soil classification	Black Vertosol		
Soil map unit name	C1		
Soil type correlation (and reference)	Springton (Bourne and Tuck, 1993)		
Surface rock	Nil		
Gilgai microrelief	Occasional normal gilgai		
Slope and landform	2-3%, Gently undulating plains		
Surface condition	Coarse mulch, weak cracking		
Soil profile description			
0 mm – 50 mm	A1 Dark greyish brown 10YR3/2, medium clay, coarse angular blocky structure, few Qz coarse fragments, field pH 7.0		
50 mm to 400 mm	B21 Dark greyish brown 10YR3/2, medium heavy clay		
400 mm to 750 mm	B22 Dark greyish brown 10YR3/2, medium clay, coarse angular blocky, few yellow mottles, 5% nodular carbonate, field pH 8.5		
750 mm to 1200 mm	B/C Mixture of pale silty sediments and brown light clay		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	3%	Clinometer	P
2 – Rockiness	0		P
3 – Gilgai microrelief	Occasional		P
4 – Soil depth	>750 mm	Hand auger	P
5 - Soil wetness	Imperfect drainage		P
6 – Soil pH	7.0 at 50 mm, 8.5 at 750 mm,	Field	P
7 – Salinity	313 mg/kg (300 to 600 mm this study type site SPR002) 10 mg/kg (Bourne and Tuck, 1993)	Type site and reference	P
8 – Soil water storage	90 mm to 750 mm	Lookup table	F ((Possible pass on field soil water storage measurement – check sites in unit frequently deeper than 800 mm)

Table 4.14 Representative Site Description and SCL Assessment for Soil Type C1

PART A – Site and soil data			
Site	233 (MLA70416)		
Land use/cover	Grazing, cleared		
Location coordinates	644720E 7289509 N		
Soil classification	Black Vertosol		
Soil map unit name	C1		
Soil type correlation (and reference)	Rolleston (Bourne and Tuck, 1993)		
Surface rock	20% mixed surface coarse fragments		
Gilgai microrelief	Occasional normal gilgai		
Slope and landform	2-3%, Lower slope of gently undulating plains		
Surface condition	Weak cracking, slight sandy crust		
Soil profile description			
0 mm – 300 mm	A1 Very dark greyish brown 10YR3/2, medium clay, strong angular blocky structure, few Qz coarse fragments, 5% carbonate nodules field pH 8.5		
300 mm to 650 mm	Dark greyish brown 10YR3/2, medium heavy clay		
650 mm to 1100 mm	Brown 10YR4/3, medium clay, moderate sub-angular blocky, few yellow, grey mottles, coarse and hard angular blocky 10% rounded gravels, 5% nodular carbonate, field pH 9.0		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	2-3%	Clinometer	P
2 – Rockiness	20		P
3 – Gilgai microrelief	Occasional		P
4 – Soil depth	>1100 mm	Hand auger	P
5 - Soil wetness	Imperfect drainage		P
6 – Soil pH	7.0 at 50 mm, 8.5 at 750 mm,	Field	P
7 – Salinity	2 mg/kg (type site this survey) 1000 mg/kg (Bourne and Tuck, 1993)	Type site and reference	P (Type site)
8 – Soil water storage	>120 mm	Lookup table	P

Table 4.15 Representative Site Description and SCL Assessment for Soil Type A5

PART A – Site and soil data			
Site	SPR001 (MLA70458)		
Land use/cover	Grazing, Poplar Box		
Location coordinates	641094E 7288071 N		
Soil classification	Black Chromosol		
Soil map unit name	A5		
Soil type correlation (and reference)			
Surface rock	Nil		
Gilgai microrelief	Nil		
Slope and landform	<1%		
Surface condition	Hard setting		
Soil profile description			
0 mm – 150 mm	A1 Brown 7.5YR3/2, fine sandy loam, massive structure, field pH 5.5		
150 mm to 500 mm	B21 Brown, 7.5YR3/2, medium coarse sub angular blocky, light clay		
500 mm to 1000 mm	B22 Brown 10YR 3/1 subangular blocky medium clay		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	Not SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	<1%	Clinometer	P
2 – Rockiness	Nil		P
3 – Gilgai microrelief	Nil		P
4 – Soil depth	>1000 mm	Hand auger	P
5 - Soil wetness	Imperfect drainage		P
6 – Soil pH	7.4 at 150 mm, 7.2 at 300 mm, 7.8 at 600 mm, 8.3 at 1000 mm	Laboratory	P
7 – Salinity	11 mg/kg (300 – 600 mm) type site) 50 mg/kg (Bourne and Tuck, 1993)	Type site and reference	P (Type site)
8 – Soil water storage	104 mm	Lookup table	P

Table 4.16 Representative Site Description and SCL Assessment for Soil Type A1

PART A – Site and soil data			
Site	SPR023		
Land use/cover	Cleared cultivation		
Location coordinates	640025 E, 7289908 N		
Soil classification	Black Vertosol		
Soil map unit name	A1		
Soil type correlation (and reference)	Adelong (Bourne and Tuck, 1993)		
Surface rock	Nil		
Gilgai microrelief	Nil		
Slope and landform	<1% Level plain		
Surface condition	Cracking, medium coarse self-mulching		
Soil profile description			
0 mm – 100 mm	A1 Dark greyish brown 10 YR 3/1, medium clay, medium sub angular blocky, pH 6.5		
100 mm to 1000 mm +	B21 Very dark grey 10 YR 3/1, medium heavy clay, very hard angular blocky. pH 8.0		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	<1%	Clinometer	P
2 – Rockiness	Nil		P
3 – Gilgai microrelief	Nil		P
4 – Soil depth	>1000 mm	Auger	P
5 - Soil wetness	Imperfect		P
6 – Soil pH	6.5 at 100 mm, 8.0 at 100 mm	Field	P
7 – Salinity	401 mg/kg (type site) 140 mg/kg (Bourne and Tuck, 1993)	Laboratory	P
8 – Soil water storage	>100 mm		P

Table 4.17 Representative Site Description and SCL Assessment for Soil Type B1

PART A – Site and soil data			
Site	SPR031		
Land use/cover	Grazing, Mountain Coolibah, Silver Leaved Ironbark		
Location coordinates	639596 E, 7290665 N		
Soil classification	Black Vertosol		
Soil map unit name	B1		
Soil type correlation (and reference)	Jimbaroo (Bourne and Tuck, 1993)		
Surface rock	Nil		
Gilgai microrelief	Nil		
Slope and landform	4-5% Undulating rises		
Surface condition	Cracking		
Soil profile description			
0 mm – 40 mm	A1 Dark Brown 10YR3/2, medium clay, strong granular structure, nil coarse fragments, field pH 7.5		
40 mm to 400 mm	B21 Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5		
400 mm +	C Weathered basalt		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	Not SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	4-5%%	Clinometer	F
2 – Rockiness	Nil		P
3 – Gilgai microrelief	Nil		P
4 – Soil depth	400 mm	Auger	F
5 - Soil wetness	Imperfect		P
6 – Soil pH	7.5 at 40 mm, 7.5 at 400 mm	Field	P
7 – Salinity	4 mg/kg (deeper type site)	Laboratory	P
8 – Soil water storage	48 mm	Lookup table	F

Table 4.18 Representative Site Description and SCL Assessment for Soil Type A4

PART A – Site and soil data			
Site	267		
Land use/cover	Grazing, Flooded Coolibah, Wilga, Moreton Bay Ash. Blue grass and Buffel; Not available for cropping , bank of active drainage line		
Location coordinates	644195 E, 7291132 N		
Soil classification	Brown Dermosol		
Soil map unit name	A4		
Soil type correlation (and reference)	Isaac (Bourne and Tuck, 1993)		
Surface rock	Nil		
Gilgai microrelief	Nil		
Slope and landform	1% Alluvial plain		
Surface condition	Hard setting, sandy		
Soil profile description			
0 mm – 200 mm	A1 Greyish brown 10YR4/2, silty clay loam, weak granular structure, nil coarse fragments, no inclusions, field pH 6.5		
200 mm to 500 mm	B21 Dark brown 10YR3/3, sandy clay, moderate sub-angular blocky structure, no mottles, field pH 7.0		
500 mm to 950 mm	B22 Dark brown 10YR3/2, sandy clay, coarse and hard angular blocky structure, minor grey mottles, few plant roots, 5% soft carbonate, field pH 9.0		
950 mm to 130 mm	B23 Yellowish brown 10YR4/4, light sandy clay, coarse weak blocky structure, prominent (10-15%) soft carbonate and grey mottles		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	Not SCL – Not available for cropping , bank of active drainage line		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	1%	Clinometer	P
2 – Rockiness	Nil		P
3 – Gilgai microrelief	Nil		P
4 – Soil depth	>1000 mm	Gully face	P
5 - Soil wetness	Imperfect		P
6 – Soil pH	6.5 at 200 mm, 7.0 at 500 mm, 9.0 at 950 mm	Field	P
7 – Salinity	2 mg/kg (type site)	Laboratory	P
8 – Soil water storage	96 mm	Lookup table	F

Table 4.19 Representative Site Description and SCL Assessment for Soil Type B3

PART A – Site and soil data			
Site	130		
Land use/cover	Grazing, old cultivation		
Location coordinates	637796 E, 7295950 N		
Soil classification	Black Vertosol		
Soil map unit name	B3		
Soil type correlation (and reference)	Orion (Bourne and Tuck, 1993)		
Surface rock	Occasional basalt floater		
Gilgai microrelief	Nil		
Slope and landform	2% Gently undulating plain		
Surface condition	Strongly self-mulching, cracking		
Soil profile description			
0 mm – 30 mm	A1 Very dark greyish brown 10YR3/2, medium clay, strong granular structure, field pH 6.5		
30 mm to 750 mm	B21 Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky, no mottles, field pH 7.5		
750 mm to 1000 mm	B3 Dark greyish brown 10YR4/2, medium heavy clay, strong angular blocky, 5% carbonate nodules, field pH 8.0		
1000 mm +	C Weathered basalt		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	Not SCL		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	2%	Clinometer	P
2 – Rockiness	Occasional		P
3 – Gilgai microrelief	Nil		P
4 – Soil depth	1000 mm	Auger	P
5 - Soil wetness	Imperfect		P
6 – Soil pH	6.5 at 30 mm, 7.5 at 750 mm, 8.0 at 1000 mm	Field	P
7 – Salinity	5 mg/kg (type site)	Laboratory	P
8 – Soil water storage	120 mm	Lookup table	P

Table 4.20 Representative Site Description and SCL Assessment for Soil Type C1

PART A – Site and soil data			
Site	SPR002		
Land use/cover	Grazing, Brigalow, Wilga, Bottle trees		
Location coordinates	641948 E, 7287877 N		
Soil classification	Black Dermosol		
Soil map unit name	C1		
Soil type correlation (and reference)	Springton (Bourne and Tuck, 1993)		
Surface rock	15% 6 to 10 mm		
Gilgai microrelief	Nil		
Slope and landform	2-3% Undulating plain		
Surface condition	Non-cracking		
Soil profile description			
0 mm – 100 mm	A1 Very dark greyish brown 10YR3/1,medium clay, med subangular blocky structure, field pH 6.5		
100 mm to 600 mm	B21 Dark brown 10YR2/1, medium clay, coarse angular blocky, few grey and orange mottles, some Mn nodules , field pH 8		
600 mm +	C		
PART B – SCL Assessment			
SCL zone	Western Cropping		
SCL status as shown on trigger map	Not SCL (Within a few metres of SCL)		
SCL Criteria	Threshold assessed	Assessment method	Pass (P) or Fail (F)
1 – Slope	2-3%	Clinometer	P
2 – Rockiness	15% gravel		P
3 – Gilgai microrelief	Nil		P
4 – Soil depth	600 mm	Auger	P
5 - Soil wetness	Imperfect		P
6 – Soil pH	6.5 at 100 mm, 8.0 at 600 mm	Field	P
7 – Salinity	313 mg/kg (type site)	Laboratory	P
8 – Soil water storage	72 mm	Lookup table	F

4.5 Implications of SCL for Rolleston Coal Project Expansion

The area of SCL identified in the trigger maps for the Project has been assessed against the Western Management zonal criteria and found to be an overestimation of what actually exists based on a more detailed assessment at field level. A summary of the findings of the assessment is provided in **Table 4.21**.

The areas of SCL that will actually be impacted by the proposed mine and associated infrastructure development are shown in Figure 4.8 and Figure 4.9 for MLA70416 and MLA70458 respectively.

Table 4.21 Summary of SCL Assessment for MLA 70416 and MLA 70458

Item	Area (ha)
SCL trigger mapping	
▪ MLA70416	1,052
▪ MLA70458	761
Total area	1,813
Area assessed as excluded from SCL on zonal criteria	
MLA70416	
▪ Slope >3%	221
▪ Dimension <100 ha	0
▪ Soil depth; stony	20
▪ Active stream channel	4
Sub-total	245
MLA70458	
▪ Slope >3%	13
▪ Dimension <100 ha	0
▪ Soil depth	5
Sub-total	18
Total area excluded from SCL	263
Total residual SCL	1,550
Area of SCL affected by disturbance area	
▪ MLA70416 (includes internal road option)	52
▪ MLA70458 (includes dam, water diversion to Meteor Creek, and internal road)	86
Total area of SCL within disturbance area	138

(i) Summary of SCL Impacts – MLA70416

The following comments relate to probable SCL impacts for MLA70416.

- The area of SCL likely to be impacted for the road option that lies south-east of the current MLA70416 based on mapping provided by Xstrata Coal Queensland is approximately 90 ha. As no decision has been taken on the preferred road diversion at this stage, this area is indicative. The area of SCL mapped outside MLA70416 is sufficiently large that the imposition of the proposed eastern road route will not leave a residual isolated area of <100 ha as a consequence should this option be adopted
- An area of 245 ha has been assessed as failing SCL criteria due to slope, soil depth and/or residual size
- Approximately 173 ha of SCL will be impacted within MLA70416 by the road and the creation of three isolated areas generally north of the internal road option that, although they total 120 ha and

the larger part (i.e. 97 ha) is theoretically workable, they are not contiguous and would be difficult to manage in any farming enterprise due to imposition of the road. As these areas have been estimated from mapping, it is possible that an accurate ground survey would show that the total of the larger area is close to or greater than 100 ha and therefore, not subject to a financial contribution. Alternatively, a slight realignment of the proposed road would ensure that this residual area becomes >100 ha and thus definitively not subject to compensation. For the purposes of this reporting though, we have treated it as impacted in estimating costs. The western parcel (21 ha) that lies south-east of the dam though within MLA70416, is contiguous with SCL in the adjacent MLA70458 and forms an area of 95 ha. Similarly, a realignment of the proposed works in this area could ensure that the residual area remains >100 ha and not subject to compensation.

Thus, the area of SCL subject to compensation is approximately 52 ha should the internal road option be adopted plus 2 ha of the small SCL parcel, and the residual larger areas of SCL (i.e. the 97 ha and 21 ha parcels) be accepted as continuing SCL. The Project may elect to nominate the whole 173 ha as subject to compensation for ease of operations and the maintenance of a clear working area without risk to the landholder. This means a definite contribution for 54 ha plus the optional 118 ha (i.e. 97 + 21 ha) should the internal road not be re-aligned to avoid this consequence.

An additional 90 ha would be impacted if the road option external to MLA70416 is selected as the preferred route.

(ii) Summary of SCL Impacts – MLA70458

Three areas mapped as SCL on MLA70458 are affected by the proposed development to some degree.

- The disturbed SCL area in that part associated with the dam and other infrastructure in the northern most part of MLA70458 is approximately 66 ha. As this effectively reduces the remaining SCL to an unusable dimension (i.e. 93.7 ha), the whole area of approximately 160 ha would be subject to compensation. An option here would be to reduce the area associated with disturbance of the dam leaving >100 ha not subject to compensation.
- The area of the SCL affected by the loss of land for the internal road and diversion channel (i.e. 20 ha) results in multiple isolated parcels of land that are less than 100 ha individually in the larger central SCL mapping unit. The directly impacted disturbance area requires a compensation payment for a total of 112 ha to the east of the proposed internal road/stream diversion. The largest isolated parcel (74 ha) is contiguous with the 21 ha parcel in the adjacent MLA70416 (discussed above) and forms a parcel of 95 ha. As discussed above, a slight realignment would make this area >100 ha and avoid the need for a financial compensation. Nevertheless, as this is a decision for management and design to suit mine operations, the financial calculations assume that the area is subject to compensation at this stage.
- The SCL that lies in the most south-eastern corner of MLA70458 has 13 ha assessed as failing SCL criteria on the basis of slopes >3%, leaving a residual area of approximately 12 ha. This 12 ha is contiguous with SCL in the adjacent MLA70416 and is not subject to compensation.

Thus, a cumulative total of 272 ha of SCL in MLA70458 will be permanently impacted unless the proposed disturbance areas are realigned to avoid leaving residual areas <100 ha.

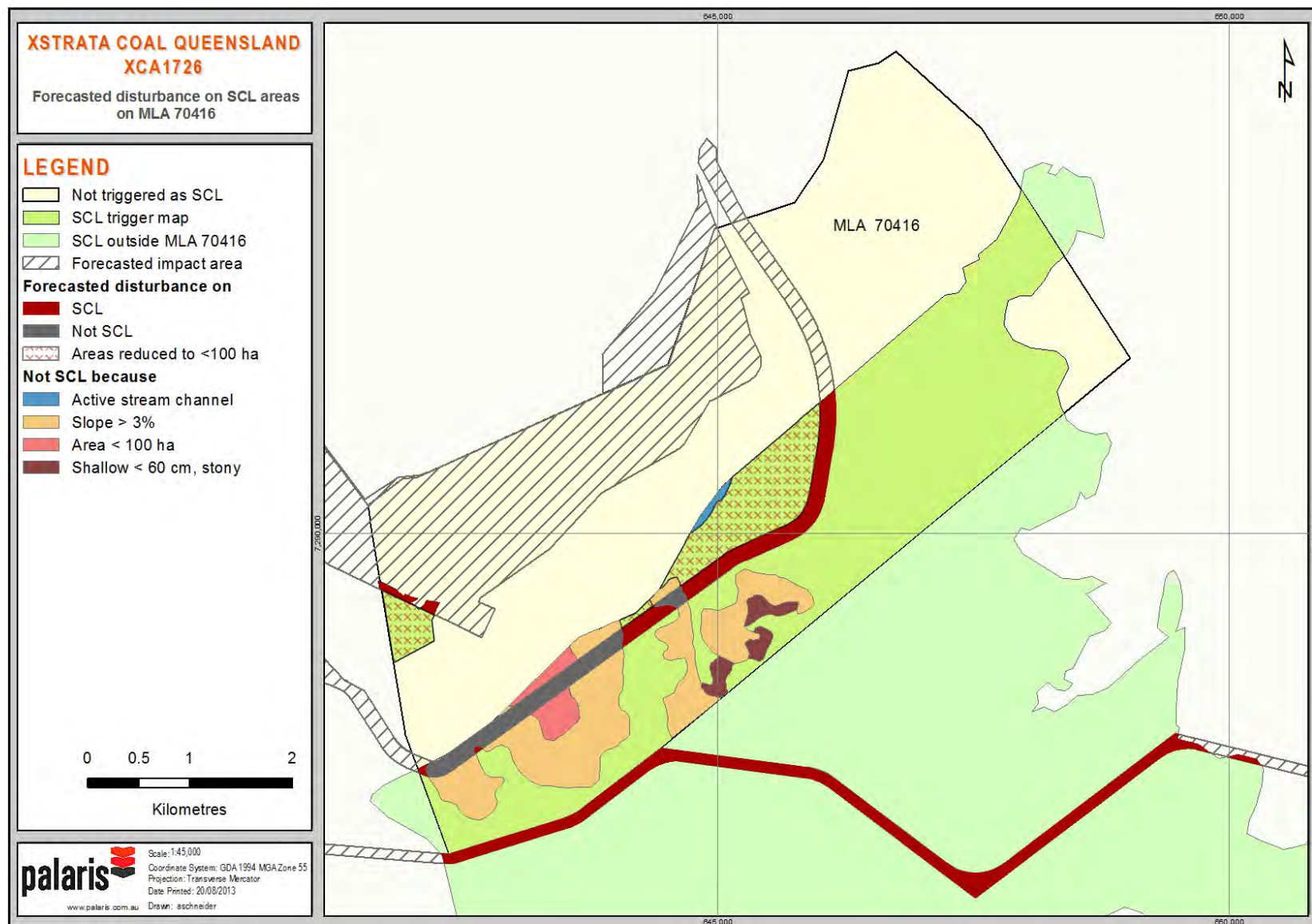


Figure 4.8 Areas of SCL Actually Impacted by Mine Development on MLA70416 and Outside Mine lease (Road Option)

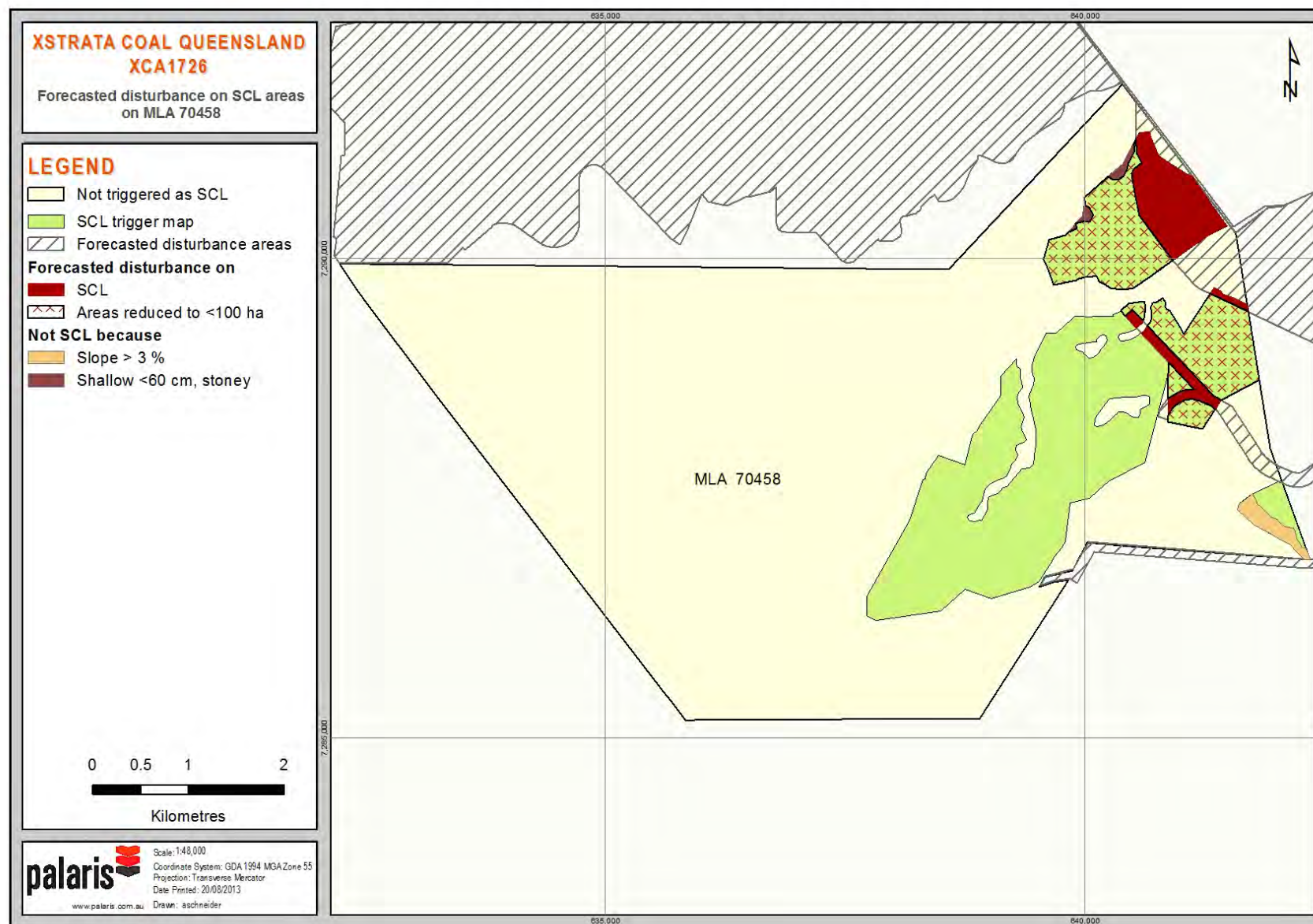


Figure 4.9 Areas of SCL Actually Impacted by Mine Development on MLA70458

4.6 Potential Mitigation Measures

Open cut coal mining by its very nature is destructive of surface landscapes. Rolleston coal expansion project will disturb some 326 ha of mapped SCL land that has been confirmed as meeting the Western Management Zone criteria for the site. This loss of land will require mitigation in line with the SCL Mitigation Arrangements principles (www.derm.qld.gov.au). A further 208 ha may also be subject to compensation depending on what options are taken up by the Project with respect to road location and the potentially isolated area within MLA70416. Should the Project elect to realign all the proposed infrastructure rendering the residual SCL areas >100 ha in most instances as discussed above, the finally permanently impacted SCL area would be approximately 156 ha subject to financial compensation. This does not include the potential 90 ha associated with the possible road alignment outside MLA70416.

The intent of mitigation arrangements is to compensate for the loss of SCL where a proposed development leads to permanent loss of productivity or other impacts on SCL. Where any temporary or permanent impacts cannot be avoided or minimised to a significant extent, then mitigation measures in the form of offsets that improve productivity in some other manner or alternatively by payment of compensation into a formal mitigation fund will be required. The accumulated funds can then be applied by government to targeted research, agricultural development or other infrastructure that will benefit agricultural productivity within the State.

As permanent impacts cannot be avoided with open cut mining, options available to the Project include:

- minimising the area of disturbance within the SCL lands to the maximum extent possible
- negotiate mitigation measures through a Deed of Agreement for a project(s) that will lead to a benefit to the State's cropping productivity, or
- making a financial contribution to the Mitigation Fund for subsequent distribution to a specific project.

The guidelines specifically state that '*mitigation measures cannot include activities aimed at re-creating SCL as an offset or restoration works that would ordinarily be undertaken as part of a mining operation.*' This does not exclude adopting measures though that might be applied to improve the 'soil structure' of other cropping land. It is not clear why 'soil structure' has been specifically nominated as an acceptable option when other means might be available to address productivity of soils that perhaps fail on one or other of the zonal criteria. It is worth noting that should an offset be proposed, then the mitigation strategy should at least equal the financial contribution that would be required for the mitigation fund and be in addition to normal project investment. These funds would also be applied within the defined local area relevant to the area in which the loss of SCL occurred.

It is important that any offset to be achieved by mitigation must be for public and not private benefit. This severely limits the opportunities in this part of the Central Highlands where agriculture is largely opportunistic within a mainly grazing environment. It may be possible to identify a project within the Emerald Irrigation Area to the north where an investment in improving the water supply distribution through piping to reduce losses could extend the availability and security of supplies. If sufficient funds were made available from accumulations in the mitigation fund, this might be an optional long-term strategy to improve regional agricultural productivity. It is not considered though to be a viable option as a unilateral proposal by this Project. Discussions should be initiated with DNR&M to resolve the optimum way forward in this matter.

It is unlikely that productivity improvements could be achieved on other soils within the mine site where disturbance will not occur as a means of mitigation. This is largely because soil depth is the main limiting factor for soils across the mine lease area, in association (to varying degrees) with limitations of slope, stoniness/rockiness, soil moisture holding capacity and chemical attributes such as sodicity/salinity.

The best approach in this instance is considered to be initially minimisation of the area of direct impact in association with payment to the mitigation fund of all other areas of impacted SCL, including those areas that will fail the residual size limitation as a consequence of the impact.

4.7 Compensation Requirements

The Project area lies within the Central Highlands Isaac sub-zone of the Western Cropping Zone with respect to the SCL Mitigation Arrangements funding guidelines. The rate for contribution to the fund in this sub-zone is \$4,750/ha of affected SCL.

This study has identified 326 ha of land within MLAs 70416 and 70458 that meet the SCL zonal criteria for the Western Management Zone and that lie within the proposed disturbance area as currently proposed. This includes areas of SCL that following development are less than 100 ha and would be precluded from production due to limited size. (Note: there is potentially a further 208 ha that may be subject to compensation depending on whether the Project opts to construct the detour road external to MLA70416 and/or adopt the recommendation for treatment of the residual 97 ha within MLA70416. If the infrastructure is realigned as discussed, the final area subject to compensation would be 156 ha with a further 90 ha for the external road option.

Based on these considerations, the mitigation contribution equates to approximately \$1,548,500 (or alternatively \$2,536,500) prior to a determination being given by NRM following application by the proponent for a formal validation. The calculations are set out in *Table 4.22*.

Table 4.22 Summary of Compensation Calculations for SCL Mitigation Fund Contribution for Permanent Impacts on MLA70416 and MLA70458

Item	Area (ha)	Mitigation Fund Contribution (\$)	Optional additional cost (\$)	Total if all options considered (\$)
Directly impacted area of SCL in disturbance area on MLA70416	54	256,500		
Directly impacted area of SCL in disturbance area on MLA70458	86	408,500		
Total of residual SCL areas created on MLA70458 that are <100 ha and thus deemed unworkable	186	883,500		
Total contribution for direct impacts		1,548,500		
Area of eastern road detour option outside MLA70416	90		427,500	
Area isolated by internal road detour option that may be considered unworkable on mainly MLA70416	118		560,500	
Total for optional impacts			988,000	
Grand Total				2,536,500

With adoption of a realignment strategy for all proposed infrastructure within both MLA70416 and MLA70458, the permanently impacted area becomes 156 ha, leading to a financial contribution of \$741,000. The implementation of the external road would add a further \$427,500, making a total of \$1,168,500.

5 Recommendations for Future Actions

Although the initial survey was done prior to release of the final SCL guidelines, this report reflects an assessment of the soils described during the field survey against the final guidelines criteria.

This has allowed an accurate definition of the trigger mapping and identification of areas to be excluded from SCL. In the absence of measured soil water storage and the need to rely on lookup tables, there is some potential for small areas of particular soils within larger mapped units to be excluded/included for which reliable data are not available or easily acquired. For this reason, the recommended approach is that the SCL mapping in these areas is accepted. Thus, by accepting the trigger mapping for these remaining areas there should be no need for further field investigations.

To calculate the financial contributions, a decision on the road options is required. Both of these options will have permanent impact on SCL areas. An allowance has been made in Section 4 for these options as an indicative value in the absence of a detailed design.

Though this report assesses the probable impacts on SCL as a consequence of the planned disturbance area, more accurate definition is required prior to submission of an application for SCL validation and determination of all necessary approvals. This will only be possible when all final mine development designs are to hand and affected area calculations can be made.

6 References

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Appendix A

Representative Soil Types

(i) **Soil Type A1 (Sites: 165 634948E, 7293334N; SPR035, 640569E, 7289380N)**

Landform

Date: 12/7/11

ASC: Dark Grey and Black Vertosols

Landform: Flat, old alluvial plain.

Slope (%): <1

Land use: Cropping and grazing.

Disturbance: cleared

Micro Relief: nil

Drainage: imperfect

Vegetation: nearby remnants are Flooded Coolibah, Moreton Bay Ash with areas of Poplar Box, Belah and Sally Wattle.

Substrate: Clay alluvium



Soil Profile

Surface: No coarse fragments, deep cracking, strong self-mulching

A1 0-25 cm Dark greyish brown 10YR3/2, medium clay (silty), strong subangular blocky/granular structure, nil coarse fragments, no inclusions, field pH 6.5

B21 25-50 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky/prismatic, no mottles, 5% carbonate nodules, field pH 8.0.

B22 50-110+ cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky/prismatic, no mottles, field pH 8.5.



(ii) **Soil Type A2 (Site 6, 644121E, 7302126N; 35, 640500E, 7301335N)**

Landform

Date: 20/6/11

ASC: Black Vertosol

Landform: Active drainage channel in undulating plains.

Slope (%): 1-2

Land use: Grazing.

Disturbance: none in channel

Micro Relief: nil

Drainage: imperfect

Vegetation: Occasional Silver-leaved Ironbark, Black Tea Tree.

Substrate: Clayey alluvium



Soil Profile

Surface: No coarse fragments, deep cracking, coarse granular self-mulching

A1 0-5 cm Very dark grey 10YR3/1, medium heavy clay (fine sandy), coarse granular, nil coarse fragments, few carbonate nodules, field pH 8.5

B21 5-100 cm Very dark grey 10YR3/1, medium heavy clay (sandy), coarse angular blocky, no mottles, 5% carbonate nodules, field pH 8.5.

B22 100-150+ cm Dark greyish brown 10YR4/2, medium clay, moderate subangular blocky, no mottles, prominent nodular carbonate (10-15%), field pH 9.0.



(iii) Soil Type A3 (Site 84, 637947E, 7296497N)

Landform

Date: 20/6/11

ASC: Brown Dermosol

Landform: Levee

Slope (%): 2

Land use: Grazing.

Disturbance: some clearing for grazing

Micro Relief: nil

Drainage: moderate

Vegetation: Occasional Silver-leaved Ironbark.

Substrate: Alluvium over basalt



Soil Profile

Surface: Firm sandy, non-cracking

A1 0-40 cm Dark brown 10YR3/1, fine sandy clay, very hard, no inclusions, field pH 7.0

B21 40-100+ cm Dark 10YR3/1, sandy clay, coarse hard blocky, no mottles, field pH 7.5.



(iv) **Soil Type A4 (Site 267 644195E, 7291132N; SPR034, 640834E, 7289698N)**

Landform

Date: 11/7/11
 ASC: Brown Chromosol
 Landform: alluvial plain.
 Element : flat
 Pattern : crest
 Slope (%): 1
 Land use: Grazing
 Disturbance: partially cleared
 Micro Relief: nil
 Drainage: imperfect
 Vegetation: Flooded Coolibah, Wilga, Moreton Bay Ash. Blue grass and Buffel
 Substrate: recent alluvium



Soil Profile

Surface: No coarse fragments, non-cracking, firm sandy

A1 0-20 cm Greyish brown 10YR4/2, silty clay loam, weak granular, nil coarse fragments, no inclusions, field pH 6.5

B21 20-50 cm Dark brown 10YR3/3, sandy clay, moderate sub-angular blocky structure, no mottles, , field pH 7.0.

B22 50-95 cm Very dark greyish brown 10YR3/2, sandy clay, coarse and hard angular blocky, minor grey mottles, few plant roots, 5% soft carbonate, field pH 9.0.

B23 95-130 cm Dark yellowish Brown 10YR4/4, light sandy clay, coarse weak blocky, prominent (10-15%) soft carbonate and grey mottles



(v) **Soil Type A5 (Site 280, 643412E, 7289974N; SPR011, 638226E, 7285422N)**

Landform

Date: 22/6/11

ASC: Brown Dermosols

Landform: Slightly elevated levee on old alluvial plain.

Slope (%): 1-2

Date:

Land use: Grazing

Disturbance: partially cleared.

Micro Relief: nil

Drainage: imperfect

Vegetation: Poplar Box regrowth with blue grass and Buffel



Soil Profile

Surface: No coarse fragments, non-cracking

A11 0-15 cm Brown 10YR4/3, clay loam, weak granular, nil coarse fragments, no inclusions, field pH 6.5

A12 15-110 cm Brown 7.5YR5/4, sandy clay loam, moderate sub-angular blocky, no mottles, field pH 7.0.

B21 110-130+ cm Dark greyish brown 10YR4/2, light sandy clay, coarse angular blocky, <5% yellow and grey mottles, 5% soft carbonate, field pH 8.0.



(vi) **Soil Type B1 (Site 132, 637396E, 7295525N; SPR031, 639596E, 7290665N)**

Landform

Date: 19/6/11
 ASC: Black and Grey Vertosols
 Landform: Mid slope of undulating plains.
 Slope (%): 4-6
 Land use: Grazing.
 Disturbance: partial clearing
 Micro Relief: nil
 Rockiness: 10- 20%, > 60 mm
 Drainage: slow
 Vegetation: Mountain Coolibah, Silver-leaved Ironbark, Bloodwood
 Substrate: weathered basalt



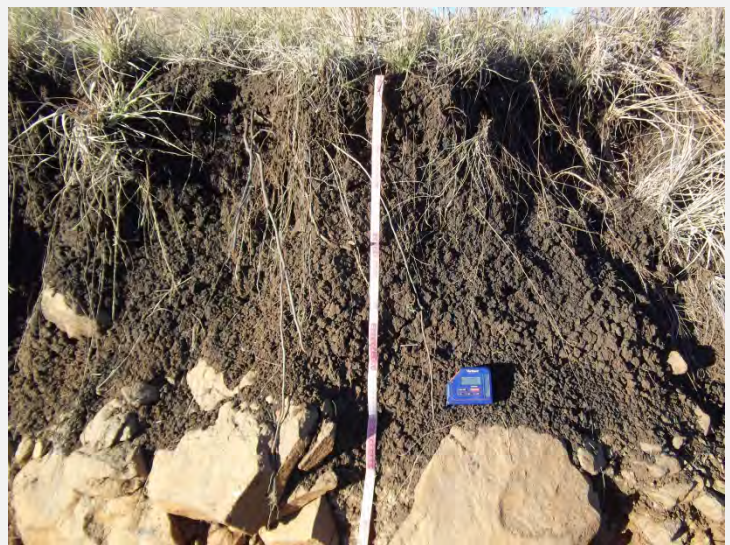
Soil Profile

Surface: >20% coarse fragments (>600 mm), coarse granular self-mulching, cracking

A1 0-3 cm Very dark greyish brown 10YR3/2, medium clay, coarse granular, nil coarse fragments, field pH 6.5.

B21 3-55 cm Dark greyish brown 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5.

C 55-105 cm hard basalt, field pH 8.5.



(vii) Soil Type B2 (Site 79, 638800E, 7296917N)

Landform

Date: 16/6/11

ASC: Black and Grey Vertosols

Landform: Mid slope of undulating plains.

Slope (%): 3-4

Land use: Grazing.

Disturbance: partial clearing

Micro Relief: nil

Rockiness: Nil to >20%, > 60 mm

Drainage: impeded

Vegetation: Mountain Coolibah, spear grass

Substrate: weathered basalt



Soil Profile

Surface: No coarse fragments, self-mulching, cracking

A1 0-3 cm Very dark grey 10YR3/1, medium clay, strong granular structure, few quartz fragments, field pH 7.0.

B21 3-75 cm Very dark grey 10YR3/1, medium heavy clay, strong angular blocky, no mottles, field pH 7.0.

BC 75-85 cm Very dark grey 10YR3/1, medium heavy clay, strong angular blocky, increasing weathered parent material, 5% carbonate nodules, field pH 8.5.

C 85+ cm weathered basalt



(viii) Soil Type B3 (Site 130, 637796E, 7295950N; SPR029, 640178E, 7290701N)

Landform

Date: 19/6/11

ASC: Black and Grey Vertosol

Landform: Mid slope of gently undulating plain.

Slope (%): 2-3

Land use: Grazing. Old cultivation

Disturbance: mainly cleared

Micro Relief: nil

Rockiness: < 20%, > 60 mm

Drainage: impeded

Vegetation: Brigalow, Belah, blue grass

Substrate: weathered basalt



Soil Profile

Surface: occasional basalt surface floater, strong self-mulching, cracking.

A1 0-3 cm Very dark greyish brown 10YR3/2, medium clay, strong granular, field pH 6.5.

B21 3-75 cm Very dark grey 10YR3/1, medium heavy clay, strong subangular blocky, no mottles, field pH 7.5.

BC 75-100 cm Dark greyish brown 10YR4/2, medium heavy clay, strong angular blocky, 5% carbonate nodules, field pH 8.0.

C 100+ cm weathered basalt



(ix) Soil Type B4 (Site 85, 637384E, 7296314N; SPR032, 639564E, 7290914N)

Landform

Date: 18/6/11

ASC: Dark Brown and Reddish Brown Rudosols

Landform: Upper slope of undulating plain.

Slope (%): 4-7

Land use: Grazing.

Disturbance: partial clearing

Micro Relief: nil

Rockiness: > 20%, > 60 mm

Drainage: impeded

Vegetation: Silver-leaved ironbark, Mountain Coolibah, sparse spear grass

Substrate: weathered basalt



Soil Profile

Surface: 5% mixed coarse fragments (including quartz gravels), firm

A1 0-30 cm Brown 10YR4/3, fine sandy clay, weak granular structure, >20% stone 5-25 mm diameter; field pH6.5

C 30+ cm weathered basalt



(x) **Soil Type B5 (Site 235, 645417E, 7289477N)**

Landform

Date: 12/7/11

ASC: Brown Rudosol and Brown Chromosol

Landform: Low ridge in undulating plain.

Element : crest

Slope (%): 3-4

Land use: Grazing

Disturbance: partially cleared

Micro Relief: nil

Rockiness: > 20%, > 60 mm

Drainage: imperfect

Vegetation: Poplar Box and Buffel

Substrate: basalt and calcareous sediments



Soil Profile

Surface: Non-cracking, firm sandy

A1 0-5 cm Dark yellowish brown 10YR4/4, sandy loam, massive, nil coarse fragments, no inclusions, field pH 6.5

B21 5-55 cm Dark brown 10YR3/3, light clay, moderate sub-angular blocky structure, no mottles, , field pH 7.5.

C 55+ cm basalt and calcareous mixed sediments, pH 8.5.



(xi) Soil Type C1 (Site 233, 644720E, 7289509N; SPR02, 641948E, 7287877N)

Landform

Date: 22/6/11

ASC: Brown Vertosol

Landform: Lower slope of undulating plains.

Slope (%): 2-3

Land use: Grazing.

Disturbance: cleared

Micro Relief: occasional normal gilgai

Rockiness: < 20%, >60 mm

Drainage: imperfect

Vegetation: Brigalow regrowth (minor). Dense Buffel Grass

Substrate: Mixed colluvium



Soil Profile

Surface: < 20% mixed surface coarse fragments, weak cracking, and slight sandy crust.

A1 0-30 cm very dark greyish brown 10YR3/2, medium clay, strong angular blocky, few quartz coarse fragments, 5% carbonate nodules field pH 8.5

B21 30-65 cm Dark brown 10YR3/3, medium clay, coarse angular blocky, no mottles, some Mn nodules, field pH 6.5.

B22 65-110+ cm Brown 10YR4/3, medium clay, moderate sub-angular blocky, few yellow and grey mottles, coarse and hard angular blocky, 10% rounded gravels, 5% nodular carbonate, field pH 9.0.



(xii) **Soil Type C2 (Site 29, 641287E, 7302099N)**

Landform

Date : 17/6/11
 ASC: Brown Dermosol
 Landform: Upper slope of undulating basalt plains.
 Slope (%): 3-4
 Land use: Grazing.
 Disturbance: partial clearing
 Micro Relief: nil
 Drainage: slow
 Vegetation: Silver-leaved Ironbark, Bloodwood
 Substrate: weathered calcareous material (probably basalt derived)

No image

Soil Profile

Surface: No coarse fragments, firm, non-cracking

A1 0-45 cm Brown 7.5YR4/2, fine sandy clay, weak granular structure, nil coarse fragments, field pH 6.0.

B21 45-90 cm Very dark grey 10YR3/1, medium heavy clay, coarse angular blocky – very hard, no mottles, field pH 7.5.

B22 90-110 cm Very dark grey 10YR3/1, medium heavy clay, coarse angular blocky – very hard, 5% grey mottles, field pH 8.5, prominent nodular carbonate (10-15%).

C 110+ cm weathered calcareous material pH 9.0



Appendix B

Correlation with Prior Land Resource Surveys

Soil Type	Land System (Storey <i>et al.</i> 1967)	Land unit/Soil Type (Storey <i>et al.</i> 1967)	Agricultural Management Unit (AMU) (Bourne and Tuck, 1993)
A1	Funnel	Land unit 4. <i>Vermont</i> with minor <i>Clematis</i>	Adelong
A2	Oxford	Land unit 4. Mainly <i>Vermont</i>	Moramana
A3	Comet	Land unit 2 <i>Clematis</i>	Glen Idol
A4		Land units 1 and 2 Varied soils. Mainly <i>Clematis</i> and <i>Springwood</i>	Isaac
A5		Land unit 1 <i>Wyseby</i>	No Similar AMU
B1	Oxford	Land unit 1. <i>Bruce</i> and <i>Arcturus</i> with Rugby near outcrops.	Jimbaroo
B2		Land unit 2. Mainly <i>Arcturus</i> with areas of <i>Bruce</i>	Orion
B3		Land unit 3. Mainly <i>May Downs</i> with areas of shallower <i>Arcturus</i>	Orion
B4		Land unit 1. Mainly <i>Rugby</i>	Highlands
B5		Land unit 1 Mainly <i>Gindie</i> with some <i>Cheshire</i> .	
C1	Racecourse	Land unit 2. Mainly <i>Glenora</i> with areas of <i>Rolleston</i>	Rolleston / Springton
C2			No similar AMU

Soil Type Correlation with Previous Surveys Across The Area

Appendix C

Laboratory Data

Site No 2 - Soil type is B2 – Grey and Black Vertosols

Analyte	Unit	Depth		
		0-10	20-30	60-70
pH - Water	pH units	6.95	7.66	8.34
pH - CaCl ₂	pH units	6.43	N.A.	N.A.
Electrical Conductivity	dS/m	0.07	0.06	0.15
Nitrate Nitrogen	mg/kg	1	<1	<1
Ammonium Nitrogen	mg/kg	1.07	N.A.	N.A.
Chloride	mg/kg	17	9	21
Sulphur - KCl	mg/kg	2.3	1.6	1.7
Phosphorus - Colwell extr	mg/kg	34	2	3
Sodium	mg/kg	373	114	132
Potassium	mg/kg	83	116	59
Calcium	mg/kg	9320	5520	5270
Magnesium	mg/kg	2770	2330	2510
Aluminium	mg/kg	<1	<1	<1
Cation Exchange	meq/100g	71.5	47.8	48.0
Exchangeable Sodium	meq/100g	1.62	0.50	0.57
Exchangeable Sodium Percent	%	2.3	1.0	1.2
Exchangeable Potassium	meq/100g	0.21	0.30	0.15
Exchangeable Potassium Percent	%	0.3	0.6	0.3
Exchangeable Calcium	meq/100g	46.6	27.6	26.4
Exchangeable Calcium Percent	%	65.2	57.7	54.9
Exchangeable Magnesium	meq/100g	23.1	19.4	20.9
Exchangeable Magnesium Percent	%	32.2	40.6	43.6
Exchangeable Aluminium	meq/100g	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA
Calcium/Magnesium Ratio		2.02	1.42	1.26
Zinc	mg/kg	0.7	0.2	0.3
Copper	mg/kg	1.2	1.3	0.7
Iron	mg/kg	26	26	13
Manganese	mg/kg	25	12	4
Boron	mg/kg	<0.2	0.2	0.2
Organic Carbon	%	1.6	1.0	0.5
Phosphorus Buffer Index		83.2	N.A.	N.A.
Soil Texture (F6)		SCL	N.A.	N.A.
Dispersion Index		1	N.A.	N.A.
Field Capacity	%	NA	NA	41.2
Wilting Point	%	NA	NA	23.9

Site No 6 - Soil type is A2 – Black Vertosols

Analyte	Unit	Depth			
		0-10	20-30	60-70	100-110
pH - Water	pH units	7.31	7.57	8.27	8.31
pH - CaCl ₂	pH units	6.75	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.11	0.05	0.15	0.17
Nitrate Nitrogen	mg/kg	3	<1	<1	<1
Ammonium Nitrogen	mg/kg	1.55	N.A.	N.A.	N.A.
Chloride	mg/kg	18	17	33	17
Sulphur - KCl	mg/kg	1.7	2.3	1.7	2.4
Phosphorus - Colwell extr	mg/kg	22	3	3	8
Sodium	mg/kg	144	216	278	72
Potassium	mg/kg	368	75	67	404
Calcium	mg/kg	7050	6980	7750	5030
Magnesium	mg/kg	2260	2250	2330	1760
Aluminium	mg/kg	<1	<1	<1	<1
Cation Exchange	meq/100g	55.6	54.8	59.5	41.2
Exchangeable Sodium	meq/100g	0.63	0.94	1.21	0.31
Exchangeable Sodium Percent	%	1.1	1.7	2.0	0.8
Exchangeable Potassium	meq/100g	0.94	0.19	0.17	1.03
Exchangeable Potassium Percent	%	1.7	0.4	0.3	2.5
Exchangeable Calcium	meq/100g	35.2	34.9	38.7	25.2
Exchangeable Calcium Percent	%	63.3	63.7	65.1	61.1
Exchangeable Magnesium	meq/100g	18.8	18.7	19.4	14.7
Exchangeable Magnesium Percent	%	33.8	34.2	32.6	35.6
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.87	1.86	2.00	1.72
Zinc	mg/kg	0.4	0.1	0.2	0.2
Copper	mg/kg	1.7	1.6	1.1	1.1
Iron	mg/kg	29	25	18	19
Manganese	mg/kg	22	12	5	3
Boron	mg/kg	<0.2	<0.2	0.2	<0.2
Organic Carbon	%	1.0	0.8	0.5	0.5
Phosphorus Buffer Index		112.9	N.A.	N.A.	N.A.
Soil Texture (F6)		HC	N.A.	N.A.	N.A.
Dispersion Index		0	N.A.	N.A.	N.A.
Field Capacity	%	46.3	50.5	46.1	52.7
Wilting Point	%	29.6	28.7	28.7	31.9

Site No 29 - Soil type is C2 – Brown Dermosols

Analyte	Unit	Depth			
		0-10	30-40	60-70	100-110
pH - Water	pH units	6.45	6.31	8.20	8.36
pH - CaCl ₂	pH units	5.70	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.02	0.02	0.38	0.55
Nitrate Nitrogen	mg/kg	<1	<1	<1	1
Ammonium Nitrogen	mg/kg	0.71	N.A.	N.A.	N.A.
Chloride	mg/kg	8	13	619	980
Sulphur - KCl	mg/kg	0.8	1.0	2.3	3.8
Phosphorus - Colwell extr	mg/kg	8	1	1	1
Sodium	mg/kg	35	78	556	840
Potassium	mg/kg	83	35	25	34
Calcium	mg/kg	1540	1370	3670	4950
Magnesium	mg/kg	882	867	2140	2790
Aluminium	mg/kg	<1	<1	<1	<1
Cation Exchange	meq/100g	15.4	14.5	38.7	51.8
Exchangeable Sodium	meq/100g	0.15	0.34	2.42	3.65
Exchangeable Sodium Percent	%	1.0	2.3	6.2	7.1
Exchangeable Potassium	meq/100g	0.21	0.09	0.06	0.09
Exchangeable Potassium Percent	%	1.4	0.6	0.2	0.2
Exchangeable Calcium	meq/100g	7.71	6.87	18.4	24.8
Exchangeable Calcium Percent	%	50.0	47.3	47.5	47.8
Exchangeable Magnesium	meq/100g	7.35	7.23	17.8	23.3
Exchangeable Magnesium Percent	%	47.7	49.7	46.1	45.0
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.05	0.95	1.03	1.06
Zinc	mg/kg	0.3	0.1	0.2	0.1
Copper	mg/kg	0.9	1.4	0.7	0.5
Iron	mg/kg	33	52	15	12
Manganese	mg/kg	36	13	4	2
Boron	mg/kg	0.4	0.4	0.4	0.4
Organic Carbon	%	0.7	0.6	0.7	0.4
Phosphorus Buffer Index		51.5	N.A.	N.A.	N.A.
Soil Texture (F6)		SCL	N.A.	N.A.	N.A.
Dispersion Index		5	N.A.	N.A.	N.A.
Field Capacity	%	NA	NA	NA	NA
Wilting Point	%	NA	NA	NA	NA

Site No 69 - Soil type is B4 – Dark Brown and Reddish Brown Rudosols

Analyte	Unit	Depth			
		0-10	20-30	60-70	90-100
pH - Water	pH units	7.76	8.44	8.68	8.60
pH - CaCl ₂	pH units	6.70	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.07	0.11	0.26	0.46
Nitrate Nitrogen	mg/kg	1	<1	4	<1
Ammonium Nitrogen	mg/kg	1.27	N.A.	N.A.	N.A.
Chloride	mg/kg	6	1	43	276
Sulphur - KCl	mg/kg	2.0	1.1	9.2	55.3
Phosphorus - Colwell extr	mg/kg	3	1	2	8
Sodium	mg/kg	236	560	1030	1370
Potassium	mg/kg	345	220	233	230
Calcium	mg/kg	7030	6690	6450	6360
Magnesium	mg/kg	2280	2690	2910	3070
Cation Exchange	meq/100g	56.1	58.9	61.6	63.9
Exchangeable Sodium	meq/100g	1.03	2.44	4.47	5.96
Exchangeable Sodium Percent	%	1.8	4.1	7.3	9.3
Exchangeable Potassium	meq/100g	0.88	0.56	0.60	0.59
Exchangeable Potassium Percent	%	1.6	1.0	1.0	0.9
Exchangeable Calcium	meq/100g	35.2	33.4	32.2	31.8
Exchangeable Calcium Percent	%	62.7	56.8	52.4	49.7
Exchangeable Magnesium	meq/100g	19.0	22.4	24.3	25.6
Exchangeable Magnesium Percent	%	33.9	38.1	39.4	40.0
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.85	1.49	1.33	1.24
Zinc	mg/kg	0.3	0.2	0.3	0.4
Copper	mg/kg	1.2	1.1	1.3	1.5
Iron	mg/kg	19	17	17	17
Manganese	mg/kg	10	6	6	5
Boron	mg/kg	0.2	<0.2	0.2	<0.2
Organic Carbon	%	1.0	0.8	0.7	0.7
Phosphorus Buffer Index		118.4	N.A.	N.A.	N.A.
Soil Texture (F6)		HC	N.A.	N.A.	N.A.
Dispersion Index		0	N.A.	N.A.	N.A.
Field Capacity	%	49.9	49.6	52.0	54.2
Wilting Point	%	28.5	28.4	27.4	30.0

Site No 79 - Soil type is B2 - Grey and Black Vertosols

Analyte	Unit	Depth		
		0-10	20-30	60-70
pH - Water	pH units	7.02	7.66	7.81
pH - CaCl ₂	pH units	6.17	N.A.	N.A.
Electrical Conductivity	dS/m	0.07	0.06	0.08
Nitrate Nitrogen	mg/kg	<1	<1	<1
Ammonium Nitrogen	mg/kg	1.56	N.A.	N.A.
Chloride	mg/kg	46	7	4
Sulphur - KCl	mg/kg	2.3	2.2	1.6
Phosphorus - Colwell extr	mg/kg	50	12	14
Sodium	mg/kg	155	265	275
Potassium	mg/kg	911	260	308
Calcium	mg/kg	8630	9860	9820
Magnesium	mg/kg	2680	2890	2810
Aluminium	mg/kg	1	<1	<1
Cation Exchange	meq/100g	68.5	75.2	74.5
Exchangeable Sodium	meq/100g	0.67	1.15	1.19
Exchangeable Sodium Percent	%	1.0	1.5	1.6
Exchangeable Potassium	meq/100g	2.34	0.67	0.79
Exchangeable Potassium Percent	%	3.4	0.9	1.1
Exchangeable Calcium	meq/100g	43.1	49.3	49.1
Exchangeable Calcium Percent	%	63.0	65.6	65.9
Exchangeable Magnesium	meq/100g	22.4	24.1	23.4
Exchangeable Magnesium Percent	%	32.6	32.0	31.4
Exchangeable Aluminium	meq/100g	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA
Calcium/Magnesium Ratio		1.93	2.05	2.10
Zinc	mg/kg	0.5	0.3	0.3
Copper	mg/kg	2.0	1.8	1.8
Iron	mg/kg	43	37	34
Manganese	mg/kg	33	12	11
Boron	mg/kg	0.6	0.4	0.6
Organic Carbon	%	1.2	0.9	1.0
Phosphorus Buffer Index		157.7	N.A.	N.A.
Soil Texture (F6)		HC	N.A.	N.A.
Dispersion Index		0	N.A.	N.A.
Field Capacity	%	--	--	--
Wilting Point	%	--	--	--

Site No 85 - Soil type is B4 - Dark Brown and Reddish Brown Rudosols

Analyte	Unit	Depth	
		0-10	20-30
pH - Water	pH units	7.81	7.70
pH - CaCl ₂	pH units	7.12	N.A.
Electrical Conductivity	dS/m	0.12	0.11
Nitrate Nitrogen	mg/kg	<1	<1
Ammonium Nitrogen	mg/kg	0.92	N.A.
Chloride	mg/kg	7	4
Sulphur - KCl	mg/kg	1.2	2.1
Phosphorus - Colwell extr	mg/kg	15	3
Sodium	mg/kg	96	118
Potassium	mg/kg	328	206
Calcium	mg/kg	6440	7350
Magnesium	mg/kg	960	900
Aluminium	mg/kg	<1	<1
Cation Exchange	meq/100g	41.4	45.3
Exchangeable Sodium	meq/100g	0.42	0.51
Exchangeable Sodium Percent	%	1.0	1.1
Exchangeable Potassium	meq/100g	0.84	0.53
Exchangeable Potassium Percent	%	2.0	1.2
Exchangeable Calcium	meq/100g	32.2	36.8
Exchangeable Calcium Percent	%	77.7	81.1
Exchangeable Magnesium	meq/100g	8.00	7.50
Exchangeable Magnesium Percent	%	19.3	16.6
Exchangeable Aluminium	meq/100g	NA	NA
Exchangeable Aluminium Percent	%	NA	NA
Calcium/Magnesium Ratio		4.02	4.90
Zinc	mg/kg	0.3	0.3
Copper	mg/kg	1.5	2.1
Iron	mg/kg	16	23
Manganese	mg/kg	19	19
Boron	mg/kg	0.6	0.6
Organic Carbon	%	1.6	1.2
Phosphorus Buffer Index		100.1	N.A.
Soil Texture (F6)		CL	N.A.
Dispersion Index		0	N.A.
Field Capacity	%	35.4	39.4
Wilting Point	%	22.4	26.0

Site No 130 - Soil type is B3 – Black and Dark Grey Vertosols

Analyte	Unit	Depth			
		0-10	20-30	50-60	90-100
pH - Water	pH units	7.28	7.66	7.74	8.12
pH - CaCl ₂	pH units	6.44	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.05	0.05	0.05	0.14
Nitrate Nitrogen	mg/kg	<1	<1	<1	<1
Ammonium Nitrogen	mg/kg	0.72	N.A.	N.A.	N.A.
Chloride	mg/kg	8	5	5	8
Sulphur - KCl	mg/kg	1.6	1.1	1.1	2.4
Phosphorus - Colwell extr	mg/kg	8	2	2	1
Sodium	mg/kg	134	146	154	209
Potassium	mg/kg	215	71	58	59
Calcium	mg/kg	7580	7730	7960	8490
Magnesium	mg/kg	2650	2630	2630	2760
Aluminium	mg/kg	<1	1	<1	<1
Cation Exchange	meq/100g	61.1	61.4	62.5	66.5
Exchangeable Sodium	meq/100g	0.58	0.64	0.67	0.91
Exchangeable Sodium Percent	%	1.0	1.0	1.1	1.4
Exchangeable Potassium	meq/100g	0.55	0.18	0.15	0.15
Exchangeable Potassium Percent	%	0.9	0.3	0.2	0.2
Exchangeable Calcium	meq/100g	37.9	38.7	39.8	42.4
Exchangeable Calcium Percent	%	62.0	62.9	63.6	63.8
Exchangeable Magnesium	meq/100g	22.1	21.9	21.9	23.0
Exchangeable Magnesium Percent	%	36.1	35.7	35.1	34.6
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.72	1.76	1.81	1.84
Zinc	mg/kg	0.7	0.2	0.2	0.2
Copper	mg/kg	1.9	1.5	1.5	1.4
Iron	mg/kg	39	24	22	26
Manganese	mg/kg	24	11	10	8
Boron	mg/kg	0.6	0.4	0.2	0.4
Organic Carbon	%	1.0	0.8	0.8	0.7
Phosphorus Buffer Index		177.9	N.A.	N.A.	N.A.
Soil Texture (F6)		HC	N.A.	N.A.	N.A.
Dispersion Index		0	N.A.	N.A.	N.A.
Field Capacity	%	52.7	50.2	49.5	51.1
Wilting Point	%	33.3	31.6	31.8	31.5

Site No 132 - Soil type is B1 – Black and Dark Grey Vertosols

Analyte	Unit	Depth		
		0-10	20-30	60-70
pH - Water	pH units	7.20	7.08	7.52
pH - CaCl ₂	pH units	6.52	N.A.	N.A.
Electrical Conductivity	dS/m	0.07	0.04	0.04
Nitrate Nitrogen	mg/kg	<1	<1	<1
Ammonium Nitrogen	mg/kg	0.82	N.A.	N.A.
Chloride	mg/kg	11	6	4
Sulphur - KCl	mg/kg	1.7	2.3	1.2
Phosphorus - Colwell extr	mg/kg	15	6	3
Sodium	mg/kg	160	161	200
Potassium	mg/kg	283	291	149
Calcium	mg/kg	9360	8810	9140
Magnesium	mg/kg	1340	1290	1250
Aluminium	mg/kg	<1	<1	<1
Cation Exchange	meq/100g	59.4	56.3	57.4
Exchangeable Sodium	meq/100g	0.69	0.70	0.87
Exchangeable Sodium Percent	%	1.2	1.2	1.5
Exchangeable Potassium	meq/100g	0.73	0.75	0.38
Exchangeable Potassium Percent	%	1.2	1.3	0.7
Exchangeable Calcium	meq/100g	46.8	44.0	45.7
Exchangeable Calcium Percent	%	78.8	78.3	79.6
Exchangeable Magnesium	meq/100g	11.2	10.8	10.5
Exchangeable Magnesium Percent	%	18.8	19.1	18.2
Exchangeable Aluminium	meq/100g	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA
Calcium/Magnesium Ratio		4.18	4.09	4.37
Zinc	mg/kg	0.4	0.3	0.2
Copper	mg/kg	2.2	2.4	1.5
Iron	mg/kg	39	39	27
Manganese	mg/kg	24	28	10
Boron	mg/kg	0.6	0.6	1.0
Organic Carbon	%	1.1	1.0	0.7
Phosphorus Buffer Index		144.9	N.A.	N.A.
Soil Texture (F6)		HC	N.A.	N.A.
Dispersion Index		0	N.A.	N.A.
Field Capacity	%	48.4	45.9	42.5
Wilting Point	%	29.9	28.4	27.8

Site No 165 - Soil type is A1 – Black Vertosols

Analyte	Unit	Depth			
		0-10	20-30	60-70	100-110
pH - Water	pH units	8.26	8.73	8.68	8.33
pH - CaCl ₂	pH units	7.52	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.14	0.16	0.41	1.29
Nitrate Nitrogen	mg/kg	<1	<1	<1	<1
Ammonium Nitrogen	mg/kg	0.68	N.A.	N.A.	N.A.
Chloride	mg/kg	11	15	401	2103
Sulphur - KCl	mg/kg	2.2	1.6	23.4	37.4
Phosphorus - Colwell extr	mg/kg	7	2	20	29
Sodium	mg/kg	151	655	1020	1350
Potassium	mg/kg	546	334	341	325
Calcium	mg/kg	6100	4980	4590	4370
Magnesium	mg/kg	3300	3700	4060	4240
Aluminium	mg/kg	<1	<1	<1	<1
Cation Exchange	meq/100g	60.1	59.5	62.1	63.9
Exchangeable Sodium	meq/100g	0.66	2.85	4.45	5.85
Exchangeable Sodium Percent	%	1.1	4.8	7.2	9.2
Exchangeable Potassium	meq/100g	1.40	0.86	0.87	0.83
Exchangeable Potassium Percent	%	2.3	1.4	1.4	1.3
Exchangeable Calcium	meq/100g	30.5	24.9	22.9	21.8
Exchangeable Calcium Percent	%	50.8	41.9	36.9	34.2
Exchangeable Magnesium	meq/100g	27.5	30.8	33.8	35.3
Exchangeable Magnesium Percent	%	45.8	51.9	54.5	55.3
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.11	0.81	0.68	0.62
Zinc	mg/kg	0.4	0.3	0.3	0.6
Copper	mg/kg	1.5	1.7	1.7	1.5
Iron	mg/kg	30	31	27	22
Manganese	mg/kg	5	3	3	2
Boron	mg/kg	0.8	0.6	1.2	1.2
Organic Carbon	%	1.0	1.0	0.8	0.7
Phosphorus Buffer Index		122.3	N.A.	N.A.	N.A.
Soil Texture (F6)		HC	N.A.	N.A.	N.A.
Dispersion Index		0	N.A.	N.A.	N.A.
Field Capacity	%	51.2	50.6	53.9	48.3
Wilting Point	%	27.8	28.2	29.2	27.5

Site No 233 - Soil type is C1 – Brown Vertosols

Analyte	Unit	Depth			
		0-10	20-30	50-60	90-100
pH - Water	pH units	7.14	8.03	8.40	8.57
pH - CaCl ₂	pH units	6.28	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.05	0.13	0.16	0.20
Nitrate Nitrogen	mg/kg	1	1	<1	<1
Ammonium Nitrogen	mg/kg	0.97	N.A.	N.A.	N.A.
Chloride	mg/kg	11	6	2	5
Sulphur - KCl	mg/kg	2.2	1.6	2.0	6.0
Phosphorus - Colwell extr	mg/kg	58	11	5	6
Sodium	mg/kg	92	113	216	397
Potassium	mg/kg	447	249	218	222
Calcium	mg/kg	5630	5900	7140	7090
Magnesium	mg/kg	854	847	1080	1330
Aluminium	mg/kg	<1	<1	<1	<1
Cation Exchange	meq/100g	36.8	37.7	46.2	48.8
Exchangeable Sodium	meq/100g	0.40	0.49	0.94	1.73
Exchangeable Sodium Percent	%	1.1	1.3	2.0	3.5
Exchangeable Potassium	meq/100g	1.15	0.64	0.56	0.57
Exchangeable Potassium Percent	%	3.1	1.7	1.2	1.2
Exchangeable Calcium	meq/100g	28.2	29.5	35.7	35.5
Exchangeable Calcium Percent	%	76.5	78.3	77.3	72.7
Exchangeable Magnesium	meq/100g	7.12	7.05	9.00	11.0
Exchangeable Magnesium Percent	%	19.3	18.7	19.5	22.6
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		3.96	4.18	3.96	3.21
Zinc	mg/kg	1.1	0.4	0.3	0.3
Copper	mg/kg	1.8	1.4	1.1	1.2
Iron	mg/kg	59	32	29	28
Manganese	mg/kg	34	14	9	10
Boron	mg/kg	0.8	0.4	0.4	0.8
Organic Carbon	%	1.6	0.8	0.7	0.5
Phosphorus Buffer Index		127.4	N.A.	N.A.	N.A.
Soil Texture (F6)		LMC	N.A.	N.A.	N.A.
Dispersion Index		0	N.A.	N.A.	N.A.
Field Capacity	%	--	--	--	--
Wilting Point	%	--	--	--	--

Site No 254 - Soil type is A5 – Brown Dermosols

Analyte	Unit	Depth			
		0-10	20-30	60-70	100-110
pH - Water	pH units	6.70	7.07	7.76	8.30
pH - CaCl ₂	pH units	5.88	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.03	0.02	0.02	0.06
Nitrate Nitrogen	mg/kg	<1	<1	<1	<1
Ammonium Nitrogen	mg/kg	1.03	N.A.	N.A.	N.A.
Chloride	mg/kg	5	3	16	7
Sulphur - KCl	mg/kg	1.1	0.3	0.6	0.6
Phosphorus - Colwell extr	mg/kg	47	75	32	28
Sodium	mg/kg	36	67	80	310
Potassium	mg/kg	312	273	176	363
Calcium	mg/kg	2560	3260	2990	4350
Magnesium	mg/kg	959	1140	1120	2380
Aluminium	mg/kg	<1	<1	<1	<1
Cation Exchange	meq/100g	21.8	26.8	25.1	43.9
Exchangeable Sodium	meq/100g	0.16	0.29	0.35	1.35
Exchangeable Sodium Percent	%	0.7	1.1	1.4	3.1
Exchangeable Potassium	meq/100g	0.80	0.70	0.45	0.93
Exchangeable Potassium Percent	%	3.7	2.6	1.8	2.1
Exchangeable Calcium	meq/100g	12.8	16.3	15.0	21.8
Exchangeable Calcium Percent	%	58.9	60.8	59.5	49.6
Exchangeable Magnesium	meq/100g	7.99	9.50	9.37	19.9
Exchangeable Magnesium Percent	%	36.7	35.5	37.3	45.2
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.60	1.72	1.60	1.10
Zinc	mg/kg	0.5	0.2	0.2	0.3
Copper	mg/kg	0.9	0.7	0.5	1.5
Iron	mg/kg	38	64	16	31
Manganese	mg/kg	21	19	5	5
Boron	mg/kg	0.2	0.4	0.2	0.4
Organic Carbon	%	1.2	0.6	0.3	0.5
Phosphorus Buffer Index		56.1	N.A.	N.A.	N.A.
Soil Texture (F6)		LC	N.A.	N.A.	N.A.
Dispersion Index		6	N.A.	N.A.	N.A.
Field Capacity	%	24.8	29.3	21.4	42.8
Wilting Point	%	12.6	15.2	10.8	23.5

Site No 267 - Soil type is A4 – Brown Chromosols

Analyte	Unit	Depth			
		0-10	20-30	60-70	90-100
pH - Water	pH units	7.00	7.50	8.57	8.83
pH - CaCl ₂	pH units	6.37	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.05	0.03	0.08	0.55
Nitrate Nitrogen	mg/kg	2	<1	<1	<1
Ammonium Nitrogen	mg/kg	2.04	N.A.	N.A.	N.A.
Chloride	mg/kg	8	<0.5	2	591
Sulphur - KCl	mg/kg	2.7	1.1	1.7	32.2
Phosphorus - Colwell extr	mg/kg	83	35	15	61
Sodium	mg/kg	72	124	818	1380
Potassium	mg/kg	370	236	218	226
Calcium	mg/kg	4270	4270	3410	3650
Magnesium	mg/kg	1950	2040	2740	2650
Cation Exchange	meq/100g	38.9	39.5	44.0	46.9
Exchangeable Sodium	meq/100g	0.31	0.54	3.56	5.99
Exchangeable Sodium Percent	%	0.8	1.4	8.1	12.8
Exchangeable Potassium	meq/100g	0.95	0.61	0.56	0.58
Exchangeable Potassium Percent	%	2.4	1.5	1.3	1.2
Exchangeable Calcium	meq/100g	21.3	21.4	17.1	18.3
Exchangeable Calcium Percent	%	54.9	54.0	38.8	38.9
Exchangeable Magnesium	meq/100g	16.3	17.0	22.8	22.1
Exchangeable Magnesium Percent	%	41.9	43.1	51.9	47.1
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.31	1.25	0.75	0.83
Zinc	mg/kg	1.2	0.7	0.2	0.2
Copper	mg/kg	2.3	1.9	2.1	0.9
Iron	mg/kg	91	48	21	15
Manganese	mg/kg	16	9	5	2
Boron	mg/kg	<0.2	<0.2	<0.2	<0.2
Organic Carbon	%	2.2	1.2	0.6	0.3
Phosphorus Buffer Index		91.9	N.A.	N.A.	N.A.
Soil Texture (F6)		SiC	N.A.	N.A.	N.A.
Dispersion Index		0	N.A.	N.A.	N.A.
Field Capacity	%	41.0	39.8	49.5	39.3
Wilting Point	%	22.1	21.3	26.5	21.2

Site No 280 - Soil type is A5 – Brown Dermosols

Analyte	Unit	Depth			
		0-10	20-30	60-70	90-100
pH - Water	pH units	7.01	7.42	8.16	8.62
pH - CaCl ₂	pH units	6.21	N.A.	N.A.	N.A.
Electrical Conductivity	dS/m	0.05	0.05	0.09	0.36
Nitrate Nitrogen	mg/kg	<1	<1	<1	<1
Ammonium Nitrogen	mg/kg	1.87	N.A.	N.A.	N.A.
Chloride	mg/kg	13	3	29	361
Sulphur - KCl	mg/kg	2.4	1.7	1.6	7.0
Phosphorus - Colwell extr	mg/kg	89	41	36	44
Sodium	mg/kg	63	292	555	807
Potassium	mg/kg	533	360	380	262
Calcium	mg/kg	3970	4310	5150	5130
Magnesium	mg/kg	1820	1900	2430	1910
Cation Exchange	meq/100g	36.7	39.5	49.4	45.7
Exchangeable Sodium	meq/100g	0.27	1.27	2.41	3.51
Exchangeable Sodium Percent	%	0.7	3.2	4.9	7.7
Exchangeable Potassium	meq/100g	1.37	0.92	0.98	0.67
Exchangeable Potassium Percent	%	3.7	2.3	2.0	1.5
Exchangeable Calcium	meq/100g	19.9	21.5	25.7	25.6
Exchangeable Calcium Percent	%	54.2	54.5	52.1	56.0
Exchangeable Magnesium	meq/100g	15.2	15.8	20.3	15.9
Exchangeable Magnesium Percent	%	41.3	40.0	41.1	34.8
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.31	1.36	1.27	1.61
Zinc	mg/kg	1.7	0.3	0.2	0.2
Copper	mg/kg	1.9	2.6	1.9	0.8
Iron	mg/kg	81	44	21	15
Manganese	mg/kg	20	18	6	2
Boron	mg/kg	0.2	0.4	0.6	0.2
Organic Carbon	%	1.9	1.2	1.0	0.3
Phosphorus Buffer Index		83.3	N.A.	N.A.	N.A.
Soil Texture (F6)		SiC	N.A.	N.A.	N.A.
Dispersion Index		2	N.A.	N.A.	N.A.
Field Capacity	%	42.4	43.4	51.9	34.6
Wilting Point	%	25.6	24.0	26.3	18.2

Site No 313 - Soil type is B5 – Brown Rudosols and Brown Chromosols

Analyte	Unit	Depth		
		0-10	20-30	50-70
pH - Water	pH units	6.90	7.12	8.16
pH - CaCl ₂	pH units	5.91	N.A.	N.A.
Electrical Conductivity	dS/m	0.03	0.08	0.26
Nitrate Nitrogen	mg/kg	<1	<1	<1
Ammonium Nitrogen	mg/kg	1.23	N.A.	N.A.
Chloride	mg/kg	4	28	108
Sulphur - KCl	mg/kg	1.1	6.1	16.8
Phosphorus - Colwell extr	mg/kg	6	2	1
Sodium	mg/kg	55	274	519
Potassium	mg/kg	316	351	291
Calcium	mg/kg	1470	3710	4100
Magnesium	mg/kg	567	1870	2140
Cation Exchange	meq/100g	13.2	36.2	41.4
Exchangeable Sodium	meq/100g	0.24	1.19	2.26
Exchangeable Sodium Percent	%	1.8	3.3	5.5
Exchangeable Potassium	meq/100g	0.81	0.90	0.75
Exchangeable Potassium Percent	%	6.2	2.5	1.8
Exchangeable Calcium	meq/100g	7.37	18.5	20.5
Exchangeable Calcium Percent	%	56.1	51.2	49.6
Exchangeable Magnesium	meq/100g	4.73	15.6	17.9
Exchangeable Magnesium Percent	%	35.9	43.0	43.2
Exchangeable Aluminium	meq/100g	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA
Calcium/Magnesium Ratio		1.56	1.19	1.15
Zinc	mg/kg	0.5	0.3	0.2
Copper	mg/kg	0.7	1.6	1.1
Iron	mg/kg	14	17	12
Manganese	mg/kg	18	7	4
Boron	mg/kg	<0.2	<0.2	<0.2
Organic Carbon	%	0.8	0.9	0.7
Phosphorus Buffer Index		25.1	N.A.	N.A.
Soil Texture (F6)		FSCL	N.A.	N.A.
Dispersion Index		8	N.A.	N.A.
Field Capacity	%	20.6	44.9	44.1
Wilting Point	%	9.2	24.2	23.4

Site No SPR01 - Soil type is A5 – Brown Dermosols

Analyte	Units	Depth			
		0-15	20-30	50-60	60-100
pH - Water	pH units	7.44	7.24	7.83	8.31
pH - CaCl ₂	pH units	6.55	-	-	-
Electrical Conductivity	dS/m	0.04	0.02	0.02	0.04
Nitrate Nitrogen					
Ammonium Nitrogen					
Chloride	mg/kg	10	6	11	<1
Sulphur - KCl	mg/kg	4.5	1.1	1.3	0.6
Phosphorus - Colwell extr	mg/kg	94	81	63	74
Sodium	mg/kg	58	96	165	252
Potassium	mg/kg	342	236	243	246
Calcium	mg/kg	2970	3800	4620	4890
Magnesium	mg/kg	950	1170	1460	1680
Aluminium					
Cation Exchange	meq/100g	23.9	29.8	36.6	40.1
Exchangeable Sodium	meq/100g	0.25	0.42	0.72	1.09
Exchangeable Sodium Percent	%	1.1	1.4	2.0	2.7
Exchangeable Potassium	meq/100g	0.88	0.61	0.62	0.63
Exchangeable Potassium Percent	%	3.7	2.0	1.7	1.6
Exchangeable Calcium	meq/100g	14.8	19	23.1	24.4
Exchangeable Calcium Percent	%	62.1	63.8	63	60.9
Exchangeable Magnesium	meq/100g	7.92	9.77	12.2	14
Exchangeable Magnesium Percent	%	33.2	32.8	33.3	34.8
Exchangeable Aluminium	meq/100g	NA	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA	NA
Calcium/Magnesium Ratio		1.87	1.94	1.89	1.75
Zinc	mg/kg	1	0.3	0.3	0.2
Copper	mg/kg	1.7	1.7	2.1	1.9
Iron	mg/kg	110	61	46	33
Manganese	mg/kg	14	20	16	8
Boron	mg/kg	0.8	0.6	0.6	0.4
Organic Carbon	%	0.8	0.7	0.7	0.5
Phosphorus Buffer Index		83.5	0	0	0
Soil Texture (F6)		CL			
Dispersion Index		3			
Field Capacity	%	18.4	26.4	28.6	29.5
Wilting Point	%	8.1	12.1	13.2	14.3
Nitrogen	mg/kg	1140	1100	1040	982

Site No SPR02 - Soil type is C1 – Brown Vertosols

Analyte	Units	Depth		
		0-10	20-30	30-60
pH - Water	pH units	7.69	8.34	8.76
pH - CaCl ₂	pH units	6.93	0	0
Electrical Conductivity	dS/m	0.09	0.11	0.29
Nitrate Nitrogen				
Ammonium Nitrogen				
Chloride	mg/kg	10	42	313
Sulphur - KCl	mg/kg	4.1	1.2	2.5
Phosphorus - Colwell extr	mg/kg	10	3	3
Sodium	mg/kg	210	458	764
Potassium	mg/kg	205	113	138
Calcium	mg/kg	5130	4830	5220
Magnesium	mg/kg	1270	1340	1570
Aluminium				
Cation Exchange	meq/100g	37.7	37.6	42.8
Exchangeable Sodium	meq/100g	0.91	0.199	3.32
Exchangeable Sodium Percent	%	2.4	5.3	7.8
Exchangeable Potassium	meq/100g	0.52	0.29	0.35
Exchangeable Potassium Percent	%	1.4	0.8	0.8
Exchangeable Calcium	meq/100g	25.7	24.2	26.1
Exchangeable Calcium Percent	%	68.1	64.2	61.0
Exchangeable Magnesium	meq/100g	10.6	11.2	13.0
Exchangeable Magnesium Percent	%	28.0	29.7	30.5
Exchangeable Aluminium	meq/100g	NA	NA	NA
Exchangeable Aluminium Percent	%	NA	NA	NA
Calcium/Magnesium Ratio		2.43	2.16	2.0
Zinc	mg/kg	0.3	0.3	0.2
Copper	mg/kg	1.2	1.1	1
Iron	mg/kg	31	29	24
Manganese	mg/kg	35	16	8
Boron	mg/kg	0.4	0.4	0.6
Organic Carbon	%	0.9	0.7	0.6
Phosphorus Buffer Index		75.3		
Soil Texture		LMC		
Dispersion Index		0		
Field Capacity	%	26.7	32.5	37.6
Wilting Point	%	13.8	14.0	15.5
Nitrogen	mg/kg	1290	92	936

Appendix D

Land Suitability Rating Tables for Cropping and Grazing in the Semi-Arid Sub Tropics of Queensland

Limitation	Land Suitability Class				
	1	2	3	4	5
Water availability	PAWC >150 mm	PAWC 125-150 mm	PAWC 100-125 mm	PAWC 75-100 mm	PAWC <75 mm
Nutrient deficiency	Bicarb P >10 ppm	Bicarb P 5-10 ppm and Exch K >0.3 meq%	Bicarb P 5-10 ppm and Exch K ≤0.3 meq% Or pH <5 @ 60-90 cm below surface or pH>9 @ 60-90 cm below surface	Bicarb P <10 ppm and Exch K ≤0.3 meq% Or pH <5 @ 30-60 cm below surface or pH>9 @ 30-60 cm below surface	pH <5 within 30 cm of surface or pH>9 within 30 cm of surface
Soil physical factors	Cracking clays with very fine self-mulch (peds <2 mm) or rigid soils with a loose, soft or firm surface when dry	Cracking clays with fine self-mulch (peds 2-10 mm)	Cracking clays with coarse self-mulch (peds 10-20 mm) or rigid soils with a hard setting surface when dry	Cracking clays with coarse peds at the surface >20 mm)	-
Soil workability	Friable cracking clays indicated by very fine self-mulch or rigid soils with a loose, soft or firm surface when dry	Firm cracking clays indicated by fine self-mulch or rigid soils with a hard setting surface when dry	Stiff cracking clays indicated by coarse self-mulch with peds >10 mm, crusting or hard setting surface	-	-
Salinity	Root zone EC <0.15 mS/cm or Cl <300 ppm	Root zone EC 0.15 - 0.3 mS/cm or Cl 300-600 ppm	Root zone EC 0.3-0.9 mS/cm or Cl 600-900 ppm	Root zone EC 0.9-1.2 mS/cm or Cl 900-1500 ppm	Root zone EC >1.2 mS/cm or Cl ≥1500 ppm
Rockiness	<10% coarse surface gravel (>60 mm diam) and rock outcrop	10-20% coarse gravel and rock outcrop	20-50% surface cobble (60-200 mm diam) and rock outcrop	50-90% surface cobble (60-200 mm diam) and rock outcrop or 20-50% stone and boulders (>200 mm diam)	>90% surface cobble and rock outcrop or >50% stone and boulders (>200 mm diam) and rock outcrop
Microrelief	No melonholes (depressions <30 cm deep and usually surrounded by mounds)	Melonholes 30-60 cm deep cover <20% of surface area or melonholes >60 cm deep cover <10% surface area	Melonholes 30-60 cm deep cover 20-50% of surface area or melonholes >60 cm deep cover 10-20% surface area	Melonholes 60-100 cm deep cover 50% surface area	Melonholes at least 100 cm deep cover at least 50% surface area
Wetness	Undulating terrain or elevated plains	Low-lying level plains with melonholes covering <25% surface area or rigid soils with sodic subsoil (ESP 6-14) within 60 cm of surface or non-sodic rigid soils with coarse pale grey and yellow mottles within 75 cm of surface	Low-lying level plains with melonholes covering 25-50% surface area or rigid soils with sodic subsoil (ESP ≥15) within 60 cm of surface or non-sodic rigid soils with coarse pale grey and yellow mottles within 50 cm of surface	Seasonal swamps and low-lying runon areas	Permanent swamps and lakes
Topography	No gully dissection	Occasional deep gullies impede cultivation slightly	Many deep gullies reduce arable area by <33% or require major changes to cultivation practices	Many deep gullies make the arable areas too small to cultivate	Abundant deep gullies prevent any practical cultivation
Water erosion	Slopes <0.5% on cracking clays without melonholes or slopes <1% on melonhole clays or slopes <1% on non-sodic rigid soils or slopes <0.5% on sodic rigid soils	Slopes 0.5-1% on cracking clays without melonholes or slopes 1-3% on melonhole clays or slopes 1-2% on non-sodic rigid soils or slopes <0.5% on sodic rigid soils	Slopes 1-3% on cracking clays without melonholes or slopes 2-4% on non-sodic rigid soils or slopes 1-2% on sodic rigid soils	Slopes 3-5% on all cracking clays or slopes 4-6 on non-sodic rigid soils or slopes 2-3% on sodic rigid soils	Slopes >5% on all cracking clays or slopes >6% on non-sodic rigid soils or slopes >3% on sodic rigid soils
Flooding	No flooding	Rare flooding (only during abnormal 1:50 to 1:100 year events)	Infrequent flooding (inundation occurs <50% of the time that stream flow increases)	Occasional flooding (inundation occurs ≥50% of the times that stream flow increases)	Regular flooding (inundation occurs whenever stream flow increases)

Table D1. Suitability Classification for Rainfed, Broadacre Cropping

Limitation	Land suitability class				
	1	2	3	4	5
Water availability	PAWC >125 mm	PAWC 100-125 mm	PAWC 75-100 mm	PAWC 50-75 mm	PAWC <50 mm
Nutrient deficiency	Brigalow, gidgee or blackwood or softwood scrub soils with Bicarb P>10 ppm	Eucalypt vegetation and downs with Bicarb P>10 ppm	Other soils with Bicarb P 5-10 ppm except sands and loams at least 75 cm deep or overlying rock at shallow depth	Sands and loams at least 75 cm deep or overlying rock at shallow depth with Bicarb P 5-10 ppm or Bicarb P ≤4 ppm	pH <5 within 30 cm of surface or pH>9 within 30 cm of surface
Soil physical factors	Cracking clays with very fine self-mulch (peds <2 mm) or rigid soils with a loose, soft or firm surface when dry	Cracking clays with fine self-mulch (peds 2-10 mm) or rigid soils with a hard setting surface when dry	Cracking clays with coarse peds (peds ≥10 mm) or crust on the surface when dry	-	-
Salinity	Root zone EC <0.15 mS/cm or Cl <300 ppm	Root zone EC 0.15 - 0.3 mS/cm or Cl 300-600 ppm	Root zone EC 0.3-0.9 mS/cm or Cl 600-900 ppm	Root zone EC 0.9-1.2 mS/cm or Cl 900-1500 ppm	Root zone EC >1.2 mS/cm or Cl ≥1500 ppm
Rockiness	<20% coarse surface gravel (>60 mm diam) and rock outcrop	20-50% coarse gravel and rock outcrop	50-90% surface cobble (60-200 mm diam) and rock outcrop	>90% surface cobble (60-200 mm diam) and rock outcrop	Rock outcrop and surface coarse fragments cover total area
Microrelief	Melonholes cover 20% surface area)	Shallow melonholes 30-60 cm deep cover 20-50% of surface area	Deep melonholes >60 cm deep cover 20-50% surface area	-	-
pH	5.6-6.6	6.6-8.0 5.0-5.6	8.0-9.0 4.5-5.0	9.0-10.0 4.0-4.5	>10.0 <4.0
ESP	<5.0	5-10	10-15	15-30	>30
Wetness	Undulating terrain or elevated plains	Low-lying level plains or rigid soils with strongly sodic subsoil (ESP ≥15) within 60 cm of surface or non-sodic rigid soils with coarse pale grey and yellow mottles within 50 cm of surface	Shallow seasonal and permanent swamps		Permanent swamps and lakes
Topography	-	-	-	Many deep gullies make cultivation for sowing pastures impractical or slopes ≥15% make cultivation along contours impractical	Strongly dissected terrain over >75% of the area preventing adequate herd management
Water erosion	Slopes <1% on sodic rigid soils or slopes <3.0% on all other soils	Slopes 1-3% on sodic rigid soils or slopes 3-6% on cracking clays or slopes 3-12% on non-sodic rigid soils	Slopes 3-6% on sodic rigid soils or slopes 6-9% on cracking clays or slopes 12-20% on non-sodic rigid soils	Slopes 6-12% on sodic rigid soils or slopes 9-15% on cracking clays or slopes 20-45% on non-sodic rigid soils	Slopes >45%
Flooding	No flooding	Periodic flooding (from once in 50 years to whenever stream flow increases)			
Vegetation regrowth (management limitation)	Softwood, brigalow, gidgee or blackwood scrub without melonholes or Queensland bluegrass grasslands or Mountain Coolibah, bloodwood and ironbark woodlands	Brigalow, Gidgee or blackwood scrub with melonholes or Poplar box and ironbark woodlands without wattle understorey or Coolabah woodlands on flooded country		Eucalypt woodlands with wattle understorey or broad-leaved tea tree woodlands	

Table D2. Suitability for Beef Cattle Grazing

Appendix E

Field Observations

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
1	644085	7301402	D, A	B3	ASC: Black Vertosol Landform: Mid slope of gently undulating plain. Slope (%): 1 Land use: Grazing Disturbance: minor Micro Relief: Nil Drainage: Impeded Vegetation: Tall Silver Leaved Ironbark ,Mountain Coolibah, Grey Bloodwood Blue Grass Substrate: Weathered basalt	Surface: Strong self-mulching, cracking A1 0-4 cm Very dark grey 10YR3/1, medium clay, strong granular, field pH 6.5 B21 4-75 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky, no mottles, field pH 7.5 B22 75-100 cm Dark greyish brown 10YR3/2, medium heavy clay, strong angular blocky, 5% carbonate nodules, field pH 7.5 C 100+ cm Weathered basalt	
2	643864	7301598	D, R, A	B2	Date: 16/6/11 ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Very dark greyish brown 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 4-60 cm Very dark greyish brown 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 B22 60-90 cm Very dark grey 10YR3/1, medium heavy clay, strong angular blocky, increasing weathered parent material, field pH 7 C 90+ cm Weathered basalt	Samples taken; 0-10cm, 20-30cm, 60-70cm.
3	643795	7301688	D, C	B5	ASC: Brown Dermosol Landform: Low ridge, crest Slope (%): 3-4 Land use: Grazing Disturbance: Partially Cleared Drainage: Imperfect Vegetation: Mountain Coolibah, Substrate: Hard basalt	Surface: 10-20% coarse fragments, non-cracking, firm sandy A1 0-20 cm Dark yellowish brown 10YR4/4, light clay, massive, nil coarse fragments, no inclusions, field pH 6.5 B21 20-30 cm Dark brown 10YR3/3, light clay, moderate sub-angular block, field pH 7.5 C 30+ cm hard basalt, pH 8.5	

¹ Observation types: A - Auger boring (equivalent to A in the Australian Soil and Land Survey Field Handbook); C - Vertical exposure in creek, cutting or gully (equivalent to E in the Australian Soil and Land Survey Field Handbook); P - Soil pit (equivalent to P in the Australian Soil and Land Survey Field Handbook); D - Profile description recorded; O - Observation of surface soil, landform, rock type, and natural vegetation (if present) made and recorded (to assist with check site requirements of SCL process); R - Results from soil chemical analysis available.

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
4	643849	7301919	D, A	B1	ASC: Black Vertosol Landform: Lower slope of undulating plains. Slope (%): 2 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: Coarse granular self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, coarse granular, nil coarse fragments, field pH 6.5 B21 3-55 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 55-60+ cm Weathered basalt	
5	634750	7302011	D, C	A2	ASC: Black Vertosol Landform: Active drainage channel in undulating basalt plains. Slope (%): 1-2 Land use: Grazing Disturbance: none in channel Micro Relief: Nil Drainage: Imperfect Vegetation: Moreton Bay Ash, Bloodwood, Black Tea Tree. Substrate: Weathered and fresh basalt	Surface: 5% mixed (mainly quartz) coarse fragments, deep cracking, coarse granular self-mulching A1 0-5 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 5-100 cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5 C 100+ cm Weathered basalt	
6	644121	7302126	D, R, C	A2	Date: 15/6/11 ASC: Black Vertosol Landform: Active drainage channel in undulating basalt plains. Slope (%): 1-2 Land use: Grazing Disturbance: None in channel Micro Relief: Nil Drainage: Imperfect Vegetation: Moreton Bay Ash, Bloodwood, Black Tea Tree. Substrate: Weathered and fresh basalt	Surface: 5% mixed (mainly quartz) coarse fragments, deep cracking, coarse granular self-mulching A1 0-5 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 5-100 cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5 B22 100-120 cm Brown 10YR4/3, medium clay, moderate sub-angular blocky, no mottles, nodular carbonate (10%), field pH 8.5 C 120+ cm Weathered basalt	Samples taken; 0-10cm, 20-30cm, 60-70cm, 100-120cm.
7	644338	7302050	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Land use: Grazing	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, field pH 7.5 B21 4-80 cm Dark 10YR3/2, medium heavy clay, strong	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Micro Relief: Nil Vegetation: Mountain Coolibah, Substrate: Weathered basalt	angular blocky, no mottles, field pH 7.5 C 80+ cm Weathered basalt	
8	644635	7302232	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Land use: Grazing Micro Relief: Nil Vegetation: Mountain Coolibah, Silver Leaved Ironbark Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, field pH 7.5 B21 4-75 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 75+ cm Weathered basalt	
9	644590	7302032	D, C	A2	ASC: Black Vertosol Landform: Active drainage channel in undulating basalt plains. Slope (%): 2 Land use: Grazing Micro Relief: Nil Drainage: Imperfect Vegetation: Black Tea Tree. Substrate: Basalt	Surface: Few coarse fragments, cracking, coarse granular self-mulching A1 0-5 cm Dark 10YR3/2, medium heavy clay, moderate granular, pH 7.0 B21 5-90 cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5 B22 90+ cm Brown 10YR4/3, medium clay, moderate sub-angular blocky, some nodular carbonate field pH 8.5	
10	644261	7302496	D, A	B1	ASC: Black Vertosol Landform: Lower slope of undulating plains. Slope (%): 1 Land use: Grazing Micro Relief: Nil Vegetation: Mountain Coolibah, Substrate: Basalt	Surface: Granular self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, coarse granular B21 3-55 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 55+ cm Weathered basalt	
11	643955	7302568	D, C	A2	ASC: Black Vertosol Landform: Active drainage channel – upper position Slope (%): 1-2 Micro Relief: Nil Drainage: Imperfect Vegetation: Moreton Bay Ash, Bloodwood, Black Tea Tree. Substrate: Hard basalt	Surface: Cracking, coarse granular self-mulching A1 0-5 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 5-85 cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5 C 85+ cm Weathered basalt	
12	643777	7302393	O	B1	Basalt downs	Black clay surface	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
13	643173	7302782	D, A	B1	ASC: Black Vertosol Landform: Lower slope Slope (%): 1 Land use: Grazing Micro Relief: Nil Vegetation: Mountain Coolibah, Substrate: Basalt	Surface: Granular self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, coarse granular B21 3-55 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 55+ cm Weathered basalt	
14	643157	7302596	D, A	B1	ASC: Black Vertosol Landform: Lower slope Slope (%): 1 Vegetation: Mountain Coolibah, Substrate: Basalt	Surface: Granular self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, coarse granular B21 3-60 cm Dark 10YR3/2, medium heavy clay C 60+ cm Weathered basalt	
15	643507	7301725	D, C	B5	ASC: Brown Rudosol Landform: Low ridge in undulating plain. Element : Midslope Slope (%): 3-5 Land use: Grazing Disturbance: Partially cleared Micro Relief: Nil Drainage: Imperfect Vegetation: Silver-leaved Ironbark Substrate: Calcareous sediments	Surface: 2-5% coarse fragments, non-cracking, firm sandy A1 0-10 cm Yellowish brown 10YR4/4, light sandy clay, massive, nil coarse fragments, no inclusions, field pH 6.5 C 10+ cm Calcareous mixed sediments, pH 8.5	
16	643191	7301776	D, A	B1	ASC: Black Vertosol Landform: Lower slope Slope (%): 1 Vegetation: Mountain Coolibah, Grey Bloodwood Substrate: basalt	Surface: Granular self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, coarse granular B21 3-55 cm Dark 10YR3/2, medium heavy clay C 55+ cm Weathered basalt	
17	642859	7301766	D, A	B5	ASC: Grey Rudosol Landform: undulating plain. Element Crest Slope (%): 3-5 Land use: Grazing Disturbance: Partially cleared Micro Relief: Nil Drainage: Imperfect Vegetation: Mountain Coolibah , Grey Bloodwood, Silver	Surface: 5% coarse fragments, non-cracking, firm sandy A1 0-20 cm Grey 7.5YR4/2, light silty clay, hard and massive, nil coarse fragments or inclusions, field pH 6.5 B21 20-35 cm Brown 7.5YR5/3 increasing gravels, sandy clay loam C 35+ cm Basalt	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Leaved Ironbark Substrate: Calcareous sediments		
18	642546	7301762	O		BOUNDARY Black downs and shallow UF ridge		
19	642067	7301749	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-2 cm Black 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 2-85 cm Black 10YR3/2, medium heavy clay, pH 7.5. BC 85-90 cm Increasing parent material C 90+ cm Weathered basalt	
20	641629	7302045	D, A	C2	ASC: Brown Dermosol Landform: Mid slope of undulating plains. Slope (%): 2 Vegetation: Silver Leaved Ironbark, Substrate: Weathered basalt	Surface: No coarse fragments, non-cracking, firm sandy A1 0-30 cm Dark reddish brown 5YR3/4, light silty clay, weak structure, field pH 7.5 B21 30-60+ cm Dark 10YR3/3, med heavy clay, pH 8.0, some carbonate nodules	
21	641437	7302274	D, A	B2	ASC: Black Vertosol Landform: Lower slope of undulating plains. Slope (%): 1 Land use: Grazing Micro Relief: Nil Vegetation: Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 4-70 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 70+ cm Weathered basalt	
22	641819	7302483	D, A	B3	ASC: Black Vertosol Landform: Mid slope of gently undulating plain Slope (%): 2 Land use: Grazing Old cultivation Disturbance: Cleared Micro Relief: Nil Drainage: Impeded Vegetation: Blue Grass Substrate: Weathered basalt	Surface: Occasional basalt surface floater, strong self-mulching, cracking A1 0-3 cm Very dark greyish brown 10YR3/2, medium clay, strong granular, field pH 6.5. B21 3-75 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky, no mottles, field pH 7.5. BC 75-100 cm Dark greyish brown 10YR4/2, medium heavy clay, strong angular blocky, 5% carbonate nodules, field pH 8.0. C 100+ cm Weathered basalt	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
23	641122	7302410	D, A	C2	ASC: Grey Dermosol Landform: Mid slope of undulating plains Slope (%): 2-4 Vegetation: Silver Leaved Ironbark Substrate: Weathered basalt	Surface: Non-cracking, firm sandy A1 0-20 cm Dark brown 10YR4/3, light medium clay, weak, field pH 7.5 B21 20-65cm 10YR4/2, medium clay, pH 8.0, some carbonate nodules B21 65-90+cm black hard med heavy clay	
24	640819	7302557	D, C	B1	ASC: Brown Vertosol Landform: Lower slope of undulating plains. Slope (%): 1 Land use: Grazing Micro Relief: Nil Vegetation: Mountain Coolibah Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-50 cm Dark red brown medium clay, strong granular C 50+ cm Weathered basalt	
25	641967	7301646	O	B2	ASC: Black Vertosol Vegetation: Mountain Coolibah, Silver Leaved Ironbark	Black cracking clay	
26	642375	7301159	D, A	B2	ASC: Black Vertosol Landform: crest on low ridge on undulating plains. Slope (%): 1 Vegetation: Mountain Coolibah, Silver Leaved Ironbark Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/2, medium clay, strong granular B21 5-80 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 80+ cm Weathered basalt	
27	642632	7300904	D, A	B2	ASC: Black Vertosol Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark red brown, medium clay B21 4-70 cm Dark 10YR3/2, medium heavy clay C 70+ cm Weathered basalt	
28	642830	7301082	D, C	A2	ASC: Black Vertosol Landform: Active drainage channel in undulating basalt plains. Slope (%): 1-2 Land use: Grazing Disturbance: none in channel Micro Relief: Nil Drainage: Imperfect Vegetation: Thick Black Tea Tree	Surface: Cracking, coarse granular self-mulching A1 0-5 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 5-70 cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5 C 70+ cm Weathered basalt	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Substrate: Weathered and fresh basalt		
29	641287	7302099	D, R, A	C2	Date : 17/6/11 ASC: Black Dermosol Landform: Upper slope of undulating basalt plains. Slope (%) : 3 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Silver Leaved Ironbark, Bloodwood Substrate: Weathered calcareous material (probably basalt)	Surface: No coarse fragments, firm, non-cracking A1 0-45 cm Brown 7.5YR4/2, fine sandy clay, weak granular, nil coarse fragments, field pH 6.0 B21 45-90 cm Very dark grey 10YR3/1, medium heavy clay, coarse angular blocky – very hard, no mottles, field pH 7.5 B22 90-110 cm Very dark grey 10YR3/1, medium heavy clay, coarse angular blocky – very hard, 5% grey mottles, field pH 8.5, prominent nodular carbonate (10-15%) C 110+ cm Weathered calcareous sediments pH 9.0	Samples taken; 0-10cm, 30-40cm, 60-70cm, 90-100cm.
30	641160	7302001	O	B1		Shallow rocky dark clay on basalt	
31	641036	7301876	O	C2	Silver Leaved Ironbark ridge	Shallow red brown	
32	640886	7301732	O	A2	Drainage line	Black clay on basalt 40 cm to Weathered rock	
33	640714	7301565	D, C	B4	ASC: Rudosol Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: 40-50% coarse fragments, non-cracking A1 0-20 cm gravelly Dark red brown, 5YR4/2, massive sandy clay loam C 20+ cm Weathered basalt	
34	640675	7301518	O	-	BOUNDARY Black downs and shallow RED UF ridge		
35	640500	7301335	D, C	A2	ASC: Black Vertosol Landform: Active drainage channel in undulating basalt plains. Slope (%) : 1-2 Land use: Grazing Disturbance: None in channel Micro Relief: Nil Drainage: Imperfect Vegetation: Moreton Bay Ash, Bloodwood, Black Tea Tree Substrate: Weathered and fresh basalt	Surface: 5% mixed (mainly quartz) coarse fragments, deep cracking, coarse granular self-mulching A1 0-4 cm Black 10YR3/1, medium heavy clay, moderate granular, field pH 7.0 B21 4-100 cm Black 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5 C 100+ cm Weathered basalt	
36	640200	7301472	D, C	B4	ASC: Rudosol Landform: Jump-up	Surface: 5% mixed coarse fragments (quartz), firm, non-cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Slope (%): 5 Vegetation: Mountain Coolibah, Substrate: Hard basalt	A1 0-20 cm Brown 7.5YR4/3, medium clay, weak granular, 20% stone 5-25mm diameter C 20+ cm Weathered basalt	
37	639752	7301652	D, C	B5	ASC: Brown Rudosol Landform: Ridgeline Slope (%): <2 Vegetation: Silver Leaved Ironbark and Mountain Coolibah, Substrate: Hard basalt	Surface: Non-cracking A1 0-30 cm Reddish brown 7.5YR4/3, medium clay, weak granular, pH 7.0 C 30+ cm Basalt	
38	639383	7301811	D, A	B3	ASC: Black Verrtosol Slope (%): <2 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: No coarse fragments, strong self-mulching, cracking A1 0-4 cm Dark brown, medium clay B21 4-100+ cm Dark 10YR3/2, medium heavy clay, well drained, no mottles	
39	638957	7301986	O	C2	Harder, non-cracking		
40	639409	7302135	D, A	C2	ASC: Grey Dermosol Landform: Upper slope of undulating basalt plains Slope (%): 1 Vegetation: Silver Leaved Ironbark, Substrate: Weathered calcareous material	Surface: No coarse fragments, firm, non-cracking A1 0-30 cm Grey brown 7.5YR4/2, fine sandy clay, weak granular, B21 30-90+ cm Very dark grey 10YR3/1, medium heavy clay, hard coarse angular blocky, field pH 7.5	
41	639574	7302607	D, A	B2	ASC: Brown Vertosol Slope (%): <2 Vegetation: Mountain Coolibah, Micro Relief: Some linear gilgai 10-15cm deep Substrate: Weathered basalt	Surface: No coarse fragments, strong self-mulching, cracking A1 0-4 cm Dark brown, medium clay B21 4-65+ cm Dark 10YR3/2, medium heavy clay	
42	639875	7302506	O	B5	Silver Leaved Ironbark ridgeline	Red, non-cracking, gravelly, sandy clay loam	
43	640030	7302324	D, C	A2	ASC: Black Vertosol Landform: Flat on active drainage channel in undulating basalt plains. Slope (%): 1-2 Micro Relief: Nil Drainage: Imperfect	Surface: Cracking, coarse granular self-mulching A1 0-2 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 2-100+ cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Vegetation: Black Tea Tree Substrate: Weathered and fresh basalt		
44	640303	7302302	O	B1	Silver Leaved Ironbark ridge	Gravelly, dark clay, shallow	
45	639954	7302069	D, A	C2	ASC: Grey Dermosol Landform: Upper slope of undulating plain Slope (%): 4 Vegetation: Silver Leaved Ironbark Substrate: Weathered calcareous material	Surface: No coarse fragments, firm, non-cracking A1 0-30 cm Brown 7.5YR4/2, fine sandy clay, weak granular B21 30-60+ cm Very dark grey 10YR3/2, medium heavy clay, hard coarse angular blocky	
46	640798	7301159	D, A	B1	ASC: Black Vertosol Slope (%): <2 Vegetation: Mountain Coolibah Micro Relief: Some linear gilgai 10-15cm deep Substrate: Weathered basalt	Surface: No coarse fragments, strong self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay. pH 7.5 B21 2-55 cm Dark 10YR3/2, medium heavy clay C 55+ cm Weathered parent material	
47	640958	7300898	O	B1	Same as previous site	15cm to Weathered material	
48	641233	7300953	D, R, A	A2	ASC: Grey Vertosol Landform: Drainage channel in basalt plains. Slope (%): 1-2 Micro Relief: Nil Vegetation: Moreton Bay Ash, Black Tea Tree. Substrate: Basalt	Surface: 5% mixed (mainly quartz) coarse fragments, deep cracking, coarse granular self-mulching A1 0-2 cm Dark brown 10YR3/3, medium heavy clay, moderate granular, no inclusions, field pH 6.0 B21 2-55 cm 10YR4/2, medium heavy clay, strong angular blocky, field pH 7.5 B22 55-110+ cm Brown 10YR4/3, medium clay	
49	641479	7300774	O	A2	Old alluvial plain Slope <1%	Black cracking clay	Close to Silver Leaf Ironbark brown soil
50	641641	7300700	D, C	A2	ASC: Black Vertosol Landform: Active drainage channel Slope (%): 2 Vegetation: Black Tea Tree. Substrate: Weathered and fresh basalt	Surface: Cracking, coarse granular self-mulching A1 0-5 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 5-100+ cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5	
51	641464	7300514	D, A	B2	ASC: Grey Vertosol Slope (%): Upper midslope 2% Vegetation: Mountain Coolibah	Surface: No coarse fragments, strong self-mulching, cracking A1 0-3 cm Dark, 10YR3/2, medium clay. Granular pH 7.5	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Micro Relief: Nil Substrate: Weathered basalt	B21 3-50 cm Brown 10YR4/2, medium heavy clay B22 3-80 cm Brown 10YR4/2, medium heavy clay, increasing weathered parent material C 80+ cm Weathered parent material	
52	641376	7300273	O	B1	Same as 51	Assume same as 51	
53	641092	7300488	D, A	C2	ASC: Black Dermosol Landform: Crest of low ridge Slope (%): 4 Vegetation: Silver Leaved Ironbark, Substrate: Weathered calcareous material	Surface: 5% mixed coarse fragments, firm, non-cracking A1 0-45 cm Dark 10YR3/2, sandy clay, weak structure B21 45-65+ cm Brown 7.5YR4/4, medium heavy clay, very hard coarse angular blocky	
54	641026	7300414	D, A	B1	ASC: Brown Rudosol Landform: Upper slope from ridge. slope 4% Vegetation: Mountain Coolibah, Micro Relief: Nil Substrate: Weathered basalt	Surface: No coarse fragments, non-cracking A1 0-30 cm Brown 10YR4/3, Light sandy clay. weak granular pH 6.5 C 30+ cm Weathered parent material	
55	641017	7300160	D, A	A3	ASC: Black Dermosol Landform: Flat, old alluvial plain. Slope (%): 1 Micro Relief: Nil Drainage: Very slow Vegetation: Silver Leaved Ironbark Substrate: alluvial depositional material	Surface: No coarse fragments, non-cracking A1 0-55 cm Dark 10YR3/2, medium clay (silty), granular, field pH 6.5 B21 5-55 cm Dark 10YR3/1, medium heavy clay, hard angular blocky, no mottles, field pH 8.0 C 55+ cm rounded gravels and weathered calcareous sediments. pH 8.5	
56	640707	7300910	O	B1	Shallow downs black clay		
57	640620	7300580	D, A	B3	ASC: Grey Vertosol Landform: Upper midslope Slope (%): 2 Vegetation: Scattered Mountain Coolibah, Micro Relief: Nil Substrate: Weathered basalt	Surface: No coarse fragments, strong self-mulching, cracking A1 0-3 cm Dark, 10YR3/2. medium clay, granular B21 3-90+ cm Brown 10YR4/2, medium heavy clay, no sign of weathered parent material	
58	640459	7300764	D, C	A2	ASC: Black Vertosol Landform: Flat alluvial plain. Vegetation: Flooded Coolibah, Black Tea Tree. Substrate: Alluvial depositional material	Surface: Deep cracking, coarse granular A 0-25 cm Dark 10YR3/2, medium clay (silty) B21 25-120 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky / prismatic, no mottles, 5%	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						carbonate nodules, field pH 8.0	
59	640073	7300950	D, A	B1	ASC: Brown Dermosol Landform: Ridge Slope (%): Slope 3-4 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: 5% coarse fragments 5-30mm, non-cracking A1 0-5 cm Dark grey, 10YR3/1. Fine silty clay. weak granular pH 6.5 B21 5-60 cm brown 10YR4/3, medium heavy clay, well structured, 7.5 C 60+ cm Weathered parent material	
60	639800	7300602	D, C	B1	ASC: Black Dermosol Slope (%): 2 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: 5% coarse fragments 5-30mm, non-cracking A1 0-50 cm Dark grey, 10YR3/2. Medium heavy clay. strong granular, pH 6.5 C 60+ cm Weathered parent material	
61	639787	7301114	O	B1	Appears same as 60		
62	639415	7301619	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Micro Relief: some Gilgai (20-30% of surface). 5-15cm deep Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: No coarse fragments, strong self-mulching, cracking A1 0-4 cm Dark brown, medium clay B21 4-65+ cm Dark 10YR3/2, medium heavy clay	
63	639423	7301357	D, A	C2	ASC: Brown Dermosol Landform: Upper slope Slope (%): 3 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Silver Leaved Ironbark, Bloodwood Substrate: Weathered calcareous material	Surface: 10% coarse fragments, firm, non-cracking A1 0-20 cm Grey 7.5YR4/2, med clay, weak sub angular, field pH 6.0 B21 20-50 cm brown 10YR4/3, medium heavy clay, coarse angular blocky – very hard, a few grey mottles, field pH 7.0 C 50+ cm Bedrock	
64	638920	7301666	O	B5	coming off ridge Silver Leaved Ironbark	Hardsetting, brown sandy surface, Non-cracking.	
65	639008	7301530	D, C	C2	ASC: Brown Dermosol Landform: Upper slope Slope (%): 3	Surface: 10% coarse fragments, firm, non-cracking A1 0-15 cm reddish brown 7.5YR5/4, med clay, mod sub	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Silver Leaved Ironbark, Bloodwood Substrate: Weathered calcareous material	angular, field pH 6.0 B21 15-90 cm brown 7.5YR4/4, medium heavy clay, coarse angular blocky field pH 7.0 C 90+ cm Weathered sediments	
66	639319	7301047	D, C	A2	ASC: Black Vertosol Landform: Active drainage channel in undulating basalt plains Substrate: Weathered and fresh basalt	Surface: 5% mixed coarse fragments, deep cracking, coarse granular self-mulching A1 0-5 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 5-100+ cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5	
67	639591	7300633	D, A	B1	ASC: Black Vertosol Slope (%): 2 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: Cacking A1 0- 3 cm Dark grey, 10YR3/2. Medium heavy clay. strong granular pH 6.5 B21 3-45 cm Dark well-structured med heavy clay C 45+ cm Weathered parent material	
68	640000	7300138	D, A	B1	ASC: Black Vertosol Landform: Upper slope Slope (%): 3 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: Cracking, self-mulching A1 0- 2 cm Dark grey, 10YR3/2. medium clay. strong granular B21 2-55 cm Dark well-structured medium heavy clay C 55+ cm Weathered parent material	
69	639947	7299869	O	B4	Shallow ridge soil Vegetation: Mountain Coolibah	50-60% surface rock 10-600mm Shallow	
70	639643	7299746	O	A2	ASC: Black Vertosol Landform: Creek line Vegetation: melaleuca	Black cracking clay	
71	639451	7299662	O	B5	Very rocky gravelly Vegetation: Silver Leaved Ironbark	Shallow	
72	639314	7299605	O	A2	Same as 70		
73	639001	7299400	O	B4	Landform: Ridge	Shallow	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Very rocky		
74	640525	7300045	D, C	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Micro Relief: Nil Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 4-80 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 80+ cm Weathered basalt	
75	639008	7296066	D, A	B2	ASC: Black Vertosol Landform: Mid slope Slope (%): 2 Land use: Grazing Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 3-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 60+ cm Weathered basalt	Contour banks here
76	639124	7296369	D, A	B2	ASC: Black Vertosol Landform: Mid slope Slope (%): 2 Land use: Grazing Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 3-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 60+ cm Weathered basalt	
77	638992	7296598	D, A	B3	ASC: Black Vertosol Landform: Mid slope of undulating plains Slope (%): 2 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular B21 2-90 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 BC 90-100 cm increasing weathered parent material, field pH 7.5 C 100+ cm Weathered basalt	
78	638800	7296917	O	B2		Soil is > 60 cm	
79	639070	7297780	D, R, A	B2	Date: 16/6/11 ASC: Black Vertosol Landform: Mid slope of undulating plains.	Surface: No coarse fragments, self-mulching, cracking A1 0-3 cm Very dark grey 10YR3/1, medium clay, strong	Samples taken; 0-10cm, 20-30cm, 60-70cm.

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Slope (%) : 2-3 Land use : Grazing Disturbance : Partial clearing Micro Relief : Nil Drainage : Impeded Vegetation : Mountain Coolibah, Spear Grass Substrate : Weathered basalt	granular, few quartz fragments, field pH 7.0 B21 3-75 cm Very dark grey 10YR3/1, medium heavy clay, strong angular blocky, no mottles, field pH 7.0 BC 75-85 cm Very dark grey 10YR3/1, medium heavy clay, strong angular blocky, increasing weathered parent material, 5% carbonate nodules, field pH 8.5 C 85+ cm Weathered basalt	(extra 30-40cm for PAWC)
80	639213	7297907	O	B2	ASC : Black Vertosol Slope (%) : 5 Vegetation : Mountain Coolibah	65 cm deep	
81	639200	7298200	O	B2	ASC : Black Vertosol Landform : Low ridge Vegetation : Mountain Coolibah	60 cm deep	
82	639156	7298504	D, C	B1	ASC : Black Vertosol	Surface : Self-mulching, cracking A1 0-3 cm Brown 10YR4/2, medium clay, strong granular B21 3-35 cm Very dark grey 10YR3/1, medium heavy clay, strong angular blocky, no mottles, field pH 7.0 C 35+ cm	
83	638356	7296671	O	A2	Black clay alluvia- drainage line		
84	637947	7296497	D, A	A3	ASC : Black Dermosol Landform : Slightly higher alluvial levee Vegetation : Silver Leaved Ironbark Substrate : Basalt	Surface : Firm sandy, non-cracking A1 0-40 cm Dark 10YR3/1, fine sandy clay, very hard, no inclusions, field pH 7.0 B21 40-100+ cm Dark 10YR3/1, sandy clay, coarse hard, blocky, no mottles, field pH 7.5	
85	637384	7296314	D, R, P	B4	Date : 18/6/11 ASC : Brown Tenosol Landform : Upper slope of undulating plain. Slope (%) : 3-4 Land use : Grazing Disturbance : Partial clearing Micro Relief : Nil Drainage : Impeded Vegetation : Silver Leaved ironbark, Mountain Coolibah,	Surface : 5% mixed coarse fragments (including quartz), firm, non-cracking A1 0-30 cm Dark 10YR4/3, fine sandy clay, weak granular, 20% stone 5-25mm diameter C 30+ cm Weathered basalt	Old Xstrata geol. pit Samples taken; 0-10cm, 20-30cm

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					sparse Spear Grass Substrate: Weathered basalt		
86	637149	7296315	O	A2	Black clay drainage line	Soil >100 cm	
87	636966	7296182	O	B5	ASC: Brown Dermosol Slope (%): <1% Vegetation: Silver Leaved Ironbark	Brown non-cracking hard <60 cm deep	
88	636617	7296210	D, A	A3	ASC: Brown Dermosol Landform: Slightly higher alluvial levee Slope (%): 2 Vegetation: Silver Leaved Ironbark	Surface: 20% surface stone, firm sandy, non-cracking A1 0-45 cm Dark 10YR3/1, fine sandy clay, very hard, field pH 6.0. B21 45-80+ cm Dark 10YR3/1, sandy clay, coarse hard blocky, no mottles, field pH 7.5.	
89	636093	7296587	O	A2	Black clay alluvia	Deep	
90	635450	7296800	O	B1	ASC: Black Dermosol Landform: Low ridge Slope (%): Vegetation: Mountain Coolibah, Silver Leaved Ironbark	Shallow dark clay, non-cracking	
91	635700	7296250	D, A	A3	ASC: Brown Dermosol Landform: Slightly higher alluvial levee Slope (%):1-2 Vegetation: Silver Leaved Ironbark woodlands	Surface: Firm sandy non-cracking A1 0-35 cm Dark 10YR3/1, fine sandy clay, very hard, field pH 6.0. B21 35-80+ cm Dark 10YR3/1, sandy clay, coarse hard blocky, field pH 7.5.	
92	636595	7295739	D, A	A3	ASC: Brown Dermosol Landform: Slightly higher alluvial levee Slope (%):1-2 Vegetation: Silver Leaved Ironbark, Grey Bloodwood woodlands. Thick Spear Grass	Surface: Firm sandy, non-cracking A1 0-5 cm Dark 7.5YR3/2, fine sandy clay, very hard, field pH 6.0. B21 5-45 cm Dark reddish brown 5YR4/3, sandy clay, coarse hard blocky, field pH 7.0. C 45+ cm Weathered basalt	
93	638819	7296258	D, A	B1	ASC: Brown Vertosol Landform: Mid slope of undulating plains. Slope (%): 3	Surface: No coarse fragments, granular self-mulching, cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah, Bloodwood, spear / Blue Grass Substrate: Weathered basalt	A1 0-2 cm Brown 7.5YR4/3, medium heavy clay, strong granular B21 2-55 cm Brown 7.5YR4/2, medium heavy clay, strong angular blocky, field pH 7.5. C 55+ cm Weathered basalt	
94	638904	7295503	O	B4	Boundary	Surface: 90% rock 20-600 mm diameter	
95	638277	7295283	D, A	B5	ASC: Brown Dermosol Landform: Small ridge Vegetation: Mountain Coolibah, Silver Leaved Ironbark	A/B 0-50 cm Red medium clay, coarse angular blocky C 50+ cm Basalt	Old GTES site 12
96	638564	7295348	D, A	A3	ASC: Black Vertosol Landform: Old alluvial plain Vegetation: Tall Silver Leaved Ironbark, Moreton Bay Ash	Surface: Cracking, coarse granular mulch A1 0-35 cm Black medium heavy clay, strong subangular blocky C 35-120+ cm Heavy clay, dark (black), prismatic hard	Old GTES site 13
G10	638792	7293975	D, A	B5	ASC: Rudosol Landform: Ridge Vegetation: Tall Silver Leaved Ironbark, Wilga, Sandalwood, <i>Casuarina cristata</i> , <i>Carissa ovata</i>	Surface: Firm sandy non-cracking, no gravel A1 0-35 cm Light sandy clay, reasonable structure C 35-90+ cm Weathered basalt	Old GTES site 10
G11	638625	7294198	D, A	C1	ASC: Grey Vertosol Vegetation: Brigalow	Surface: Granular crust, cracking A1 0-40 cm Well-structured grey brown clay B21 40-100 cm Coarse hard grey-brown medium clay, lots carbonate	Old GTES site 11 Harder to dig. Small area of grey clay brigalow within reddish soils
97	638633	7295382	O	A2	Alluvial fringing country	Dark cracking alluvial clay	
98	638268	7295296		B5	ASC: Red Dermosol Landform: Ridge Vegetation: Silver Leaved Ironbark	Surface: Firm sandy non-cracking A1 0-5 cm Reddish brown 5YR3/2, fine sandy clay, very hard, field pH 6.0. B21 5-55 cm Dark reddish brown 5YR4/3, sandy clay, coarse hard blocky. C 55+ cm Weathered basalt	Shallow rocky
99	638053	7295211	O	B4	Vegetation: Mountain Coolibah	Dark clay	Very shallow rocky
100	637913	7295110	D, A	A3	ASC: Red Dermosol	Surface: Firm sandy non-cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Landform: Flat alluvial area Vegetation: Silver Leaved Ironbark, woodlands, Thick Spear Grass	A1 0-5 cm Dark 10YR3/2, fine sandy clay, very hard, B21 5-55+ cm Dark reddish brown 5YR4/3, sandy clay, coarse hard blocky, field pH 7.0.	
101	637707	7294948	O	B4		Surface: Rocky, boulders (>50% of surface) Shallow soil	
102	637565	7294834	O	B1	As 101 Slope (%) : 3	Surface: very rocky, 20-30% surface gravel and cobble Black clay	
103	637336	7294646	O	A2	ASC: Black Vertosol Landform: Alluvial plain Slope (%) : <1 Vegetation: Thick Blue Grass	Surface: Cracking, self-mulching Black clay	
104	636989	7294704	D, A	B1	ASC: Grey Vertosol Landform: Upper midslope of undulating plains Slope (%) : 4-5 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Vegetation: Mountain Coolibah, / Blue Grass Substrate: Weathered basalt	Surface: 2-5% coarse fragments, strong granular self-mulching, cracking A1 0-3 cm Brown 10YR4/3, medium heavy clay, strong granular B21 3-50 cm Grey 10YR4/2, medium heavy clay, strong angular blocky, field pH 7.5 C 50+ cm Weathered basalt	
105	636632	7294848	D, A	B1	ASC: Brown Vertosol Landform: upper midslope of undulating plains Slope (%) : 4 Vegetation: Mountain Coolibah, Blue Grass Substrate: Weathered basalt	Surface: 2-5% coarse fragments, strong granular self-mulching, cracking A1 0-30 cm Grey 10YR4/2, medium clay, strong granular B21 3-55 cm Yellowish brown 10YR5/4, medium heavy clay, strong angular blocky C 55+ cm Weathered basalt	
106	636154	7295042	D, A	B5	ASC: Brown Vertosol Slope (%) : 3 Vegetation: Silver Leaved Ironbark	Surface: Firm sandy non-cracking A1 0-4 cm Reddish brown 5YR3/2, fine sandy clay B21 4-35 cm Dark reddish brown 5YR4/3, sandy clay, coarse hard blocky C 35+ cm Weathered basalt	Shallow rocky

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
107	635898	7295167	D, A	B1	ASC: Black Vertosol Slope (%): 3 Vegetation: Mountain Coolibah woodland	Surface: 5% surface fragments, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular B21 4-40 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 40+ cm Weathered basalt	
108	635735	7295217	O	A2	ASC: Black Vertosol Landform: Alluvial flat	Black cracking clay	
109	635300	7295450	D, C	B1	ASC: Black Vertosol Landform: Ridge Slope (%): 3-4 Vegetation: Silver Leaved Ironbark woodland	Surface: Cracking, self-mulching A1 0-5 cm Dark 10YR3/2, medium clay, strong granular B21 5-35 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, C 35+ cm hard basalt	
110	637700	7295229	D	B4	ASC: Black Rudosol Landform: Broad rocky ridge Slope (%): 6-7 Vegetation: Mountain Coolibah	Surface: 80-90% rock up to 30cm diameter A1 0-10 to 15 cm Black fine sandy clay C 10 to 15 cm Hard rock	
111	635795	7294731	D, A	B1	ASC: Black Dermosol Landform: Undulating hills, midslope of ridge Slope (%): 3-4 Vegetation: Silver Leaved Ironbark woodland	Surface: Non-cracking and firm A1 0-2 cm Dark 10YR3/2, medium clay, strong granular B21 2-35 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 35+ cm Hard basalt	
112	635981	7294912	O	B1	ASC: Black Dermosol or Vertosol Landform: Undulating hills	Dark brown clay	
113	636170	7294860	O	B1	ASC: Black Dermosol or Vertosol Landform: Undulating hills	Dark brown clay	
114	636378	7294489	O	B1	ASC: Black Dermosol or Vertosol Landform: Undulating hills	Dark brown clay	
115	636045	7294589	O	B1	ASC: Black Dermosol or Vertosol Landform: Undulating hills	Dark brown clay	
116	635782	7294474	D, A	B5	ASC: Brown Rudosol Landform: Midslope	Surface: Firm sandy, non-cracking A1 0-12 cm Reddish brown 7.5YR4/4, fine sandy clay	Shallow soil

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Slope (%): 3 Vegetation: Silver Leaved Ironbark	C 12+ cm Basalt	
117	635755	7294243	D, A	B5	ASC: Red Rudosol Landform: Plateau surface Slope (%): 1 Vegetation: Bloodwood, Silver Leaved Ironbark mixed woodland	Surface: Non-cracking and firm, 50% mixed gravels up to 30 mm diameter A1 0-45 cm Red brown 5YR4/4, light sandy clay, weak structure C 45+ cm Hard basalt	
118	635800	7293825	O	B4	ASC: Black Vertosol Vegetation: Mountain Coolibah woodland.	Surface: 30-40% surface stone/rock Dark cracking clay	
119	635513	7294155	O	B5	ASC: Red Rudosol Slope (%): 5-8 Vegetation: Silver Leaved Ironbark woodland.	Surface: 30-40% surface stone/rock, non-cracking Reddish brown clay	
120	635302	7294199	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2-3 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah downs Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 4-80 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 80+ cm Weathered basalt	
Site No.	Easting	Northing	Type*	Soil	Landform / Vegetation	Soil Profile	Comments
121	634766	7294110	D, A	B2	ASC: Black Vertosol	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 4-70 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 70+ cm Weathered basalt	Similar to 120, very uniform country
122	634910	7293670	D, A	B2	ASC: Black Vertosol	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular,	Similar to 120, very uniform country

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						nil coarse fragments, field pH 7.5. B21 4-75 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 75+ cm Weathered basalt	
123	635127	7294502	D, A	B2	ASC: Black Vertosol Landform: Midslope of undulating plains. Slope (%): 2 Land use: Grazing Vegetation: Mountain CoolibahSubstrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 4-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 60+ cm Weathered basalt	
124	635368	7294623	D, A	B1	ASC: Black Dermosol Landform: Undulating hills Slope (%): 3 Land use: Grazing Vegetation: Mountain Coolibah	Surface: Non-cracking and firm A1 0-20 cm Dark 10YR3/2, medium clay, strong granular C 20+ cm Hard basalt	
125	635508	7294717	D, A	B1	ASC: Black Dermosol Landform: Undulating hills Slope (%): 3-4 Land use: Grazing Vegetation: Mountain Coolibah	Surface: Non-cracking and firm A1 0-2 cm dark 10YR3/2, medium heavy clay, strong granular, B21 2-50 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 50+ cm Hard basalt	
126	638673	7295848	D, A	B2	ASC: Grey Vertosol Landform: Mid slope of undulating plains. Slope (%): 2-3 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-4 cm Brown 10YR4/2, medium clay, strong granular, nil coarse fragments, field pH 6.5 B21 4-25 cm Dark 10YR4/2, medium heavy clay, strong angular blocky, field pH 7.5 B22 25-80 cm Brown 10YR4/3, medium heavy clay, angular blocky, field pH 8.5 C 80+ cm Weathered basalt	
127	638461	7296063	D, A	B1	ASC: Grey Vertosol Slope (%): 2 Vegetation: Mountain Coolibah	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/1, medium heavy clay, strong granular	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						B21 4-55 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 55+ cm Hard basalt	
128	638197	7296327	D, P	B1	ASC: Grey Vertosol Landform: Lower slope Slope (%): 2 Vegetation: Mountain Coolibah, Silver Leaved Ironbark	Surface: Self-mulching, cracking A1 0-3 cm Grey10YR4/2, medium heavy clay, strong granular B21 3-50 cm brown 10YR4/2, medium heavy clay, strong angular blocky C 50+ cm Hard basalt	Old Xstrata pit
129	637956	7296177	D, A	B3	ASC: Grey Vertosol Landform: Mid slope of gently undulating plains Slope (%): 1 Vegetation: Blue Grass, scattered Silver Leaved Ironbark Substrate: Weathered basalt	Surface: Strongly self-mulching, cracking A1 0-2 cm Grey 10YR4/2, medium clay, strong granular, field pH 6.5 B21 2-75 cm Grey 10YR4/2, medium heavy clay, strong sub-angular blocky, no mottles, field pH 7.5 BC 75-105 cm Brown 10YR4/4, medium heavy clay, strong angular blocky, few carbonate nodules, field pH 8.5 C 105+ cm Weathered basalt	
130	637796	7295950	D, R, A	B3	Date: 19/6/11 ASC: Black Vertosol Landform: Mid slope of gently undulating plain. Slope (%): 2 Land use: Grazing, old cultivation Disturbance: Cleared Micro Relief: Nil Drainage: Impeded Vegetation: Blue Grass Substrate: Weathered basalt	Surface: Occasional basalt surface floater, strongly self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, field pH 6.5 B21 3-75 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, no mottles, field pH 7.5 BC 75-100 cm Dark greyish brown 10YR4/2, medium heavy clay, strong angular blocky, 5% carbonate nodules, field pH 8.0 C 100+ cm Weathered basalt	Pasture dominated by Blue Grass (i.e. very little spear). Samples taken; 0-10 cm, 20-30 cm, 50-60 cm, 90-100 cm.
131	637656	7295331	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark brown, medium clay, strong granular, field pH 7.5 B21 4-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 60+ cm Weathered basalt	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Substrate: Weathered basalt		
132	637396	7295525	D, R, P	B1	Date: 19/6/11 ASC: Black Vertosol Landform: Mid slope of undulating plains Slope (%): 2 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: 10% of 10 – 600mm basalt coarse fragments, self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, coarse granular, nil coarse fragments, and field pH 6.5 B21 3-55 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 55-105 cm Weathered calcareous material, field pH 8.5	Samples taken; 0-10 cm, 20-30 cm, 40-50 cm.
133	637224	7295729	D, A	B1	ASC: Black Dermosol Landform: Lower slope of ridge Slope (%): 3-4 Vegetation: Mountain Coolibah woodland	Surface: Non-cracking and firm A1 0-2 cm Dark 10YR3/2, medium heavy clay, strong granular B21 2-45 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 45+ cm Hard basalt	
134	637002	7295630	D	B1	ASC: Black Dermosol Landform: Lower slope of ridge Slope (%): 3 Vegetation: Spear Grass	Surface: Non-cracking A1 0-2 cm Dark 10YR3/2, medium heavy clay, strong granular B21 2-45 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 45+ cm Hard basalt	
135	637184	7295976	D	B1	ASC: Black Rudosol Landform: Upper slope Slope (%): 3-4 Vegetation: Mountain Coolibah woodland	Surface: Non-cracking, 60% surface cobble A1 0-40 cm Dark 10YR3/2, medium heavy clay, strong granular C 40+ cm Hard basalt	
136	637185	7296777	O	B1	ASC: Brown Vertosol or Dermosol Landform: Mid-upper slope	Dark brown, medium clay	
137	637091	7297053	O	B1	ASC: Brown Vertosol or Dermosol Landform: Mid-upper slope	Dark brown, medium clay	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
138	637082	7297114	O	B2	ASC: Brown Vertosol or Dermosol Landform: Mid slope of undulating plains	Dark brown, medium clay	
139	637340	7297043	O	B1	ASC: Brown Vertosol or Dermosol Landform: Mid-upper slope	Dark brown, medium clay	
140	637562	7296917	O	B1	ASC: Brown Vertosol or Dermosol Landform: Mid-upper slope	Dark brown, medium clay	
141	637699	7296682	O	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains.	Dark brown, medium clay	
142	637827	7296519	O	B1	ASC: Brown Vertosol or Dermosol Landform: Mid-upper slope	Dark brown, medium clay	
143	637292	7296612	O	B2	ASC: Brown Vertosol or Dermosol Landform: Mid slope of undulating plains.	Dark brown, medium clay	
144	636543	7296615	D, A, C	A2	ASC: Black Vertosol Landform: Active drainage channel in undulating basalt plains Vegetation: Blue Gum, Black Tea Tree Substrate: Weathered and fresh basalt	Surface: Cracking, coarse granular self-mulch A1 0-5 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 5-100 cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 7.5 B22 100-120 cm Brown 10YR4/3, medium clay, moderate sub-angular blocky, no mottles, nodular carbonate (10%), field pH 8.5 C 120+ cm Weathered basalt	
145	636615	7296757	D, C	A2	ASC: Black Vertosol Landform: Old alluvial plain Slope (%): <1 Land use: Grazing Micro Relief: Nil Drainage: Imperfect Vegetation: Blue Grass Substrate: Alluvium	Surface: Cracking, coarse granular self-mulch A1 0-2 cm Dark 10YR3/1, medium heavy clay, granular, field pH 7.0 B21 2-110+ cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, nodular carbonate (10%), field pH 8.5	
146	636230	7297135	O	A2	Same as 145 but broader plain		
147	636659	7297009	O	B5	ASC: Brown Rudosol Landform: Ridge Vegetation: Silver Leaved Ironbark	A1 0-35 cm Reddish brown sandy clay loam C 35+ cm Rock	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
148	300m north		O	B5	Same as 147		
149	400m north		D, A	B1	ASC: Brown Rudosol Landform: Upper slope Slope (%): 2-3 Vegetation: Mountain Coolibah woodland Substrate: Basalt	Surface: Non-cracking, 20% surface cobble A1 0-35 cm dark 10YR3/2, medium heavy clay, strong granular C 35+ cm Hard basalt	
150	636850	7296947	D, C	A2	ASC: Black Vertosol Landform: Plain Slope (%): <1 Land use: Grazing Micro Relief: Nil Drainage: Imperfect Vegetation: Cleared Substrate: Weathered and fresh basalt	Surface: 5% mixed (mainly quartz) coarse fragments, deep cracking, self-mulching A1 0-3 cm Dark 10YR3/2, medium heavy clay, coarse granular, field pH 6.5 B21 3-80 cm Dark 10YR3/1, medium heavy clay, strong angular blocky, field pH 7.5 B22 80-110 cm Brown 7.5YR4/2, medium clay, moderate sub-angular blocky, nodular carbonate (<10%), field pH 8.5 C 110+ cm Weathered basalt	Probably cropped in the past
151	636934	7296745	O	A2	Same as 150		
152	636622	7296511	O	A2	Same as 150 Vegetation: Black Tea Tree (Melaleuca)	Deep black clay	
153	636592	7294723		B1	ASC: Black Rudosol Landform: Low hills Slope (%): 2-3 Vegetation: Mountain Coolibah Substrate: Basalt	Surface: Non-cracking A1 0-35 cm Dark 10YR3/2, medium heavy clay, strong granular C 35+ cm Hard basalt	
154	636218	7294326	O	B1	Same as 153		
155	636682	7293825	O	B1	Same as 153	55 cm to bedrock	
156	637004	7294311	D, A	B1	ASC: Black Rudosol Substrate: Basalt	Surface: Non-cracking A1 0-45 cm Dark 10YR3/2, medium heavy clay, strong granular C 45+ cm Hard basalt	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
157	635257	7294416	D, C	B1	ASC: Black Dermosol Landform: Small drainage line in low hills Slope (%) : 2-3 Vegetation: Mountain Coolibah Substrate: Basalt	Surface: Non-cracking, 10% surface stone (mixed) A1 0-2 cm Dark 10YR3/2, medium heavy clay, strong granular B21 2-50 cm Dark 10YR3/2, med heavy clay, pH 8.0 C 50+ cm Hard basalt	
158	634992	7293932	D, A	B2	ASC: Black Vertosol Landform: Flatter area in undulating plains Slope (%) : 2-3 Land use: Grazing Disturbance: Partial clearing Vegetation: Occasional Mountain Coolibah, Blue Grass Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 2-70 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 70+ cm Weathered basalt	
159	634856	7293841	O	B4	ASC: Brown Rudosol Landform: Rocky scarp Slope (%) : 9-10 Land use: Grazing Disturbance: Partial clearing Vegetation: Silver Leaved Ironbark and Mountain Coolibah	Surface: >80% rock A1 0-<10 cm Reddish brown sandy clay loam C 10+ cm Rock	
160	635139	7293422		A3	ASC: Brown Dermosol Landform: Flat old alluvial area Vegetation: Silver Leaved Ironbark, woodlands, dense Spear Grass	Surface: Firm, sandy, non-cracking A1 0-80 cm 7.5YR5/4, sandy clay, hard coarse structure, 30% carb nodules, field pH 8.5 B21 80-130 cm Pale brown 7.5YR5/6, silty light clay, field pH 7.0	Not a representative soil – alluvial variant
161	635323	7293290	O	A2	ASC: Black Vertosol Substrate: Alluvium	Dark clay	
162	635646	7293475	D, A	A2	ASC: Black Vertosol Landform: Level alluvial plain in undulating basalt plains Slope (%) : <1 Land use: Grazing Micro Relief: Nil Drainage: Imperfect Vegetation: Moreton Bay Ash	Surface: Cracking, self-mulching A1 0-2 cm Dark 10YR3/2, medium heavy clay, moderate granular, no inclusions, field pH 7.0 B21 2-75 cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, no mottles, field pH 8.0 B22 75-110 cm Grey 10YR4/2, medium clay, moderate	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Substrate: Weathered and fresh basalt	sub-angular blocky, no mottles, nodular carbonate (10%), field pH 8.5 C 120+ cm Weathered basalt	
163	635661	7293607	O	B4	ASC: Rudosol Landform: Scarp Slope (%) : 10% Vegetation: Red Ash, Silver Leaved Ironbark, Wilga, Grey Bloodwood, Black Tea Tree.	Surface: 80-90% basalt cobble on surface Very little soil	
164	635888	7293569	O	A2	Same as 162		
165	634948	7293334	D, R, C	A1	Date: 20/6/11 ASC: Black Vertosol Landform: Alluvial deposition adjacent to active drainage channel in undulating plains. Slope (%) : 1-2 Land use: Grazing Disturbance: None in channel Micro Relief: Nil Drainage: Imperfect Vegetation: Occasional Silver Leaved Ironbark, Black Tea Tree. Substrate: Alluvium	Surface: No coarse fragments, deep cracking, coarse self-mulch A1 0-5 cm Dark 10YR3/1, medium heavy clay (fine sandy), coarse granular, nil coarse fragments, few carbonate nodules, field pH 8.5 B21 5-100 cm Dark 10YR3/1, medium heavy clay (sandy), coarse angular blocky, no mottles, 5% carbonate nodules, field pH 8.5 B22 100-150+ cm Grey 10YR4/2, medium clay, moderate sub-angular blocky, no mottles, prominent nodular carbonate (10-15%), field pH 9.0	Samples taken; 0-10 cm, 20-30 cm, 50-60 cm, 100-110 cm
166	634387	7294007	O	-	Boundary start of downs above alluvium		
167	634003	7293917	D, A	B3	ASC: Black Vertosol Landform: Lower slope of undulating plains. Slope (%) : 1-2 Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark brown, medium clay, strong granular, field pH 7.5 B21 4-75 cm Dark 10YR2/1, medium heavy clay, strong angular blocky, field pH 7.5 B22 75-100+ cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 8.5	
168	634013	7293576	D	B4	ASC: Rudosol Landform: Convex ridge Slope (%) : 4-5	Surface: Firm, sandy, very rocky, 50-70% rock A1 0-<20 cm Sandy clay loam C 20+ cm Rock	
169	633967	7293512	O	A2	ASC: Black Vertosol	Surface: Cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Landform: Alluvial plain Vegetation: Black Tea Tree, Blue Gum, Moreton Bay Ash, Silver Leaved Ironbark	Deep black clay	
170	634703	7293189	O	A2	ASC: Black Vertosol Vegetation: Occasional Brigalow with Moreton Bay Ash	Same as 169	
171	634180	7293237	D, A	A3	ASC: Black Dermosol Landform: Slightly elevated levee Slope (%): 2 Vegetation: Silver Leaved Ironbark	Surface: Firm, sandy, non-cracking A1 0-40 cm Dark 10YR3/1, fine sandy clay, very hard, field pH 6.0 B21 40-90+ cm Dark 10YR3/1, sandy clay, coarse hard blocky, no mottles, field pH 7.5	
172	633453	7293252	O	A3	ASC: Black Dermosol	Same as 171	
173	633030	7293234	D, A	A3	ASC: Black Dermosol Landform: Slightly elevated levee Slope (%): 1 Vegetation: Silver Leaved Ironbark	Surface: Firm, sandy, non-cracking A1 0-15 cm Dark 10YR3/1, fine sandy clay, very hard, field pH 6.0 B21 15-80+ cm Dark 10YR3/1, sandy clay, coarse hard blocky, no mottles, field pH 7.5	
174	633061	7292923	D, C	A4	ASC: Brown Dermosol Landform: Active creek channel Vegetation: <i>Casuarina cristata</i> , Moreton Bay Ash, Blue Gum, Black Tea Tree	Surface: Firm, sandy, non-cracking A1 0-70 cm Brown 10YR4/4, coarse sandy loam, loose, field pH 6.0 B21 70-120+ cm Brown 7.5YR5/3, sandy clay loam, field pH 7.5	
175	633254	7292656	D	B4	ASC: Rudosol Landform: Low ridge Slope (%): 4-5 Vegetation: Silver Leaved Ironbark	Surface: Firm, sandy, 50-70% rock A1 0-<20 cm Sandy clay loam C 20+ cm	
176	633707	7292664	D, A	B2	ASC: Brown Vertosol Landform: Ridge crest in undulating plains Slope (%): 2 Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood	Surface: 20% coarse fragments, self-mulching, cracking Profile 0-75 cm Brown 7.5YR4/3, medium clay, moderate angular blocky, nil coarse fragments, field pH 7.5 B21 75+ cm Weathered basalt	
177	634200	7292719	O	B2	ASC: Brown Vertosol	Same as 176	
178	633525	7292211	D, A	B2	ASC: Black Vertosol	Surface: Self-mulching, cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Landform: Mid slope of undulating plains. Slope (%): 2 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5 B21 4-70 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 C 70+ cm Weathered basalt	
179	633425	7292090	O	B5	ASC: Rudosol Landform: Ridge crest Vegetation: Silver Leaved Ironbark	Shallow soil on rocky ridge	
180	633672	7291741	D, A	B2	ASC: Grey Vertosol Landform: Mid slope of undulating plains Slope (%): 2 Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-4 cm Grey 10YR4/1, medium clay, strong granular B21 4-75 cm Grey 10YR4/1, medium heavy clay, strong angular blocky, field pH 7.5 C 75+ cm Weathered basalt	
181	633856	7291857	O	B4	ASC: Rudosol Landform: Scarp Vegetation: Silver Leaved Ironbark , Mountain Coolibah	Surface: <40% rock Shallow brown soil	
182	634031	7292003	O	B4	ASC: Black Rudosol Landform: Scarp Vegetation: Mountain Coolibah	Surface: >40% rock A1 0-40 cm Dark sandy clay	
183	634209	7292142	O	B5	ASC: Brown Rudosol Landform: Scarp Vegetation: Silver Leaved Ironbark, Mountain Coolibah	Surface: >40% cobble and stone Profile: Shallow red-brown sandy clay loam	
184	634317	7292224	D, A	B5	ASC: Brown Rudosol Vegetation: Silver Leaved Ironbark, Mountain Coolibah	A1 0-30 cm Reddish brown, sandy clay loam, pH 6.0 30+ cm Rock	
185	634516	7292392	O	B5	ASC: Brown Rudosol Slope (%): 6-7 Vegetation: Mountain Coolibah, Silver Leaved Ironbark	A1 0-40 cm Red brown medium clay, pH 6.0 40+ cm Rock	
186	634750	7292410	O	B4	ASC: Black Rudosol Landform: Ridge crest Vegetation: Mountain Coolibah	Surface: >40% cobble and stone A1 0-40 cm Dark medium clay, pH 6.0 40+ cm Rock	
187	633384	7291523	O	B4	Landform: Rocky knoll		

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
188	633124	7291316	D, A	B4	ASC: Brown Rudosol Landform: Ridge crest Vegetation: Mountain Coolibah, Silver Leaved Ironbark .	Surface: >50% cobble and stone A1 0-30 cm Reddish brown, sandy clay loam, pH 6.0 30+ cm Rock	
189	632694	7290989	D, A	B4	ASC: Brown Rudosol Vegetation: Mountain Coolibah, Silver Leaved Ironbark	Surface: >50% cobble and stone A1 0-30 cm Reddish brown, sandy clay loam, pH 6.0 30+ cm Rock	
190	632411	7290779	O	B5	ASC: Red Rudosol Vegetation: Bonewood scrub	Surface: >50% cobble and stone Shallow cover of red sandy clay amongst rock	
191	632255	7290656	O	B1	ASC: Black Rudosol Vegetation: Mountain Coolibah	Surface: >40% cobble and stone A1 0-40 cm Black clay C 40+ cm Rock	
193	632391	7291056	D, A	B1	ASC: Black Vertosol or Dermosol Landform: Upper slope of undulating plain Vegetation: Bloodwood, Mountain Coolibah, Silver Leaved Ironbark Substrate: Weathered basalt	A1 0-2 cm Dark 10YR3/1, medium clay, strong granular B21 2-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7 C 60+ cm Weathered basalt	
194	633075	7291842	D, A	B5	ASC: Brown Rudosol Landform: Ridge Slope (%): 4 Vegetation: Silver Leaved Ironbark	Surface: >40% cobble and stone A1 0-20 cm Reddish brown, light sandy clay 20+ cm Rock	
195	632944	7292204	D, C	A2	ASC: Black Vertosol Landform: Level alluvial plain in undulating basalt plains Slope (%): 2 Vegetation: Black Tea Tree, Mountain Coolibah Substrate: Basaltic alluvium	Surface: Cracking, self-mulching A1 0-2 cm Dark 10YR3/2, medium heavy clay, moderate granular B21 2-100 cm Dark 10YR3/1, medium heavy clay (sandy), strong angular blocky, field pH 8.0 D 100+ cm Weathered basalt	Close to boundary with rocky ridges
196	632350	7292400	O	B1	ASC: Black Vertosol or Dermosol Landform: Low ridge Vegetation: Mountain Coolibah , Silver Leaved Ironbark	Shallow black clay	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
197	632882	7292413	O	A2	ASC: Black Vertosol Landform: Alluvial plain	Black cracking clay	
198	632789	7292694	D, A	C2	ASC: Brown Dermosol Landform: Isolated alluvial intergrade Slope (%): <2 Vegetation: Silver Leaved Ironbark , <i>Acacia harpophylla</i>	Surface: Sandy, non-cracking A11 0-20 cm Dark 10YR3/2, sandy loam, weak structure, pH 6.0 A12 20-40 cm Dark 10YR3/2, sandy clay loam B21 40-80+ cm Brown 10YR5/3, sandy clay, quartz gravels common, 5% yellow mottles	
199	632428	7292424	O	B5	ASC: Brown Rudosol Vegetation: Silver Leaved Ironbark	Surface: 30-40% surface rock A1 0-10 cm Dark brown silty clay C 10+ cm Rock	
200	632984	7292828	O	C2	ASC: Brown Rudosol Landform: Undulating rises Vegetation: Silver Leaved Ironbark	Sandy brown surface, same as 198	
201	635336	7295370	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains Slope (%): 2 Micro Relief: Nil Vegetation: Mountain Coolibah, Spear Grass	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, field pH 7.5 B21 4-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 60+ cm Weathered basalt	
202	639661	7295468	D, A	B2	ASC: Black Vertosol Landform: Upper slope of undulating plains Slope (%): 4 Drainage: Slow Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular B21 2-55 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 55+ cm Weathered basalt	
203	639797	7295251	D, A	B4	ASC: Black Rudosol Landform: Ridge crest	Surface: >40% stone 0-10 cm black medium clay, 10 cm Weathered parent material	
204	634914	7295099	D, A	B1	ASC: Black Vertosol	Surface: Self-mulching, cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Slope (%): 5 Drainage: Slow Vegetation: Blue Grass pasture	A1 0-2 cm black self-mulching med heavy clay B2 2-55 cm black, med heavy clay, well structured C 55+ cm Basalt	
205	633985	7294845	D, A	B2	ASC: Black Vertosol Landform: Midslope of undulating plains. Slope (%): 2 Land use: Grazing Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, field pH 7.5 B21 4-65 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 B22 65-90 cm Dark 10YR3/1, medium heavy clay, strong angular blocky, increasing weathered parent material, field pH 7.5 C 90+ cm Weathered basalt	
206	634136	7294855	D, C	B3	ASC: Black Vertosol Landform: Lower slope of gently undulating plain Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Blue Grass Substrate: Weathered basalt	Surface: Occasional basalt surface floater, strongly self-mulching, cracking A1 0-3 cm Very dark greyish brown 10YR3/2, medium clay, strong granular, field pH 6.5 B21 3-95 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky, no mottles, field pH 7.5 C 95+ cm Weathered basalt	Followed an erosion gully across the alluvial flats
207	634275	7294857	D, C	B2	ASC: Black Vertosol Landform: Lower slope of gently undulating plain. Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Blue Grass Substrate: Weathered basalt	Surface: Strongly self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, field pH 6.5 B21 3-80 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 7.5 C 80+ cm Weathered basalt	
208	634469	7294857	D, C	B3	ASC: Black Vertosol Landform: base slope of gently undulating plain. Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Blue Grass Substrate: Weathered basalt	Surface: Occasional basalt surface floater, strongly self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, field pH 6.5 B21 3-150 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 7.5 C 150+ cm Weathered basalt	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
209	634101	7294620	O	B4	ASC: Black Rudosol Landform: Ridge	Shallow non-cracking clay	
210	634246	7294310	D, A	B3	ASC: Black Vertosol Landform: lower slope of gently undulating plain. Slope (%): 1 Land use: Grazing Micro Relief: Nil Vegetation: Blue Grass Substrate: Weathered basalt	Surface: Strongly self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, field pH 6.5. B21 3-100 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 7.5. C 100+ cm Weathered basalt	
211	633600	7294388	O	B4	ASC: Black Rudosol	Surface: 60-70% cobble and stone A1 <10 cm Black clay <10 cm to rock C 10+cm Rock	
212	633508	7294005	O	B4	ASC: Black Rudosol	Same as 211	
213	633212	7293588		B5	ASC: Brown Rudosol Landform: Ridge crest Slope (%):8-9 Vegetation: Mountain Coolibah.	Surface: 80-90% cobble and stone A1 Shallow brown clay loam	
214	632902	7293216	D,C	A2	ASC: Black Dermosol Landform: Level alluvial plain Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Silver Leaved Ironbark , Moreton Bay Ash, Blue Grass Substrate: Weathered basalt	Surface: Firm, non-cracking A1 0-25 cm Dark 10YR4/1, medium clay silty, weak blocky, field pH 6.5 B21 25-45 cm Dark 10YR3/1, brown mottles, medium heavy clay, coarse angular blocky, field pH 7.5 B22 45-70 cm dark medium clay C 70+ cm Weathered basalt	
215	632805	7293595	O	B4	ASC: Rudosol Landform: Ridge, Vegetation: Mountain Coolibah , Silver Leaved Ironbark	Shallow sandy soil	
216	632493	7293259	D, A	B3	ASC: Black Vertosol Landform: Level area at lower slope of gently undulating plain Slope (%): <1 Land use: Grazing Micro Relief: Nil	Surface: Strongly self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, field pH 6.5 B21 3-100+ cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, no mottles, field pH 7.5	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Vegetation: Blue Grass Substrate: Weathered basalt		
217	632425	7293332	O	B4	ASC: Rudosol Landform: Rocky scarp Slope (%):15	Shallow, rocky soil	
218	632193	7293351	O	B4	ASC: Rudosol	Shallow, rocky soil	Boundary – edge of rocky ridge
219	632750	7294064	O	B4	ASC: Rudosol Landform: Rolling Hills Vegetation: Mountain Coolibah	Shallow, rocky soil	
220	633150	7294021	O	B4	ASC: Rudosol	Same as 219	
221	633251	7294509	O	B4	ASC: Rudosol	Same as 219	
222	638190	7294785	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains Slope (%): 2 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-3 cm Dark 10YR3/2, heavy clay, strong granular, field pH 7.5. B21 3-35 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 B22 35-80 cm Dark 10YR3/1, medium heavy clay, strong angular blocky, increasing weathered parent material, field pH 7.5 C 80+ cm Weathered basalt	
223	638442	7294764	D, A	C1	ASC: Black Vertosol Landform: Lower slope of undulating plains Slope (%): 2-3 Land use: Grazing Disturbance: Cleared Micro Relief: occasional normal gilgai Drainage: Imperfect Vegetation: Brigalow regrowth Moreton Bay Ash	Surface: Few surface coarse fragments, weakly cracking A1 0-70 cm Dark 10YR3/2, medium clay, strong angular blocky, few quartz coarse fragments, 5% carbonate nodules field pH 8.0 B21 70-120+ cm Brown 10YR4/3, few yellow mottles, medium clay, coarse angular blocky few rounded gravels, 5% nodular carbonate, field pH 8.5	
224	639300	7295214	O	B1	ASC: Rudosol Landform: Ridge crest	Shallow, rocky soil	
225	639342	7294575	O	B1	ASC: Rudosol Landform: Ridge crest	Same as 224	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
226	638058	7294671	D, A	A1	ASC: Black Vertosol Landform: Alluvial plain Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Brigalow scrub Substrate: Alluvia	Surface: Self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, field pH 6.5 B21 3-90+ cm Dark 10YR3/1, medium heavy clay, hard blocky, few grey mottles, field pH 8.5	
227	637869	7294486	D, A	A1	ASC: Black Vertosol Landform: Alluvial plain Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Brigalow, Silver Leaved Ironbark	Surface: Sandy, slight crust, cracking A1 0-3 cm Dark 10YR3/2, medium clay, weak granular, field pH 6.5 B21 3-70+ cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, no mottles, field pH 7.5	
228	638118	7295015	D, C	A2	ASC: Black Dermosol Landform: Creek channel Vegetation: Riverine casuarina, Moreton Bay Ash, Wilga, Paperbark, Blue Gum	Profile: Deep black silty clay	
229	643175	7288178	D, C	C1	ASC: Black Vertosol Landform: Gently undulating plain Slope (%): 2-3 Land use: Grazing Disturbance: Cleared Micro Relief: Occasional normal gilgai Drainage: Imperfect Vegetation: Brigalow regrowth, Yellowwood, Beefwood, Wilga, Emu Apple, dense Buffel. Moreton Bay Ash Substrate: Sedimentary rock	Surface: Coarse self-mulch, weakly cracking A1 0-5 cm dark greyish brown 10YR3/2, medium clay, coarse angular blocky, few quartz coarse fragments, field pH 7.0 B21 5-40 cm med heavy clay, 10YR3/2, B22 40- 75 cm Dark 10YR3/2, few yellow mottles, medium clay, coarse angular blocky, 5% nodular carbonate, field pH 8.5. B/C 75-120+ cm mixture of pale silty sediments and brown light clay	
230	642761	7288675	O	C1	ASC: Black Vertosol Landform: Gently undulating plain Slope (%): 2-3	Surface: Coarse self-mulch, weakly cracking A1 0-5 cm dark greyish brown 10YR3/2, medium clay, coarse angular blocky, few quartz coarse fragments, field pH 7.0 B21 5-40 cm med heavy clay, 10YR3/2, B22 40- 50+ cm Dark 10YR3/2, few yellow mottles, medium clay, coarse angular blocky, 5% nodular carbonate, field pH 8.5	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
231	643102	7288681	D, A	C1	ASC: Black Vertosol Landform: Gently undulating plains. Slope (%): 2-3 Land use: Grazing Disturbance: Cleared Micro Relief: occasional normal gilgai Vegetation: Brigalow regrowth,	Surface: coarse mulch, weak cracking A1 0-5 cm Dark 10YR3/2, medium clay, coarse angular blocky B21 5-40 cm Dark 10YR3/2, medium heavy clay B22 40- 80+ cm Dark 10YR3/2, few yellow mottles, medium clay, coarse angular blocky, 5% nodular carbonate, field pH 8.5	
232	644599	7289212	D, C	C1	ASC: Grey Vertosol Landform: Gently undulating plain Slope (%): 3 Land use: Grazing Disturbance: Cleared brigalow, probably blade ploughed in last 5 years Micro Relief: Occasional normal gilgai Drainage: Imperfect Vegetation: Brigalow regrowth, Yellowwood, Beefwood, Wilga, Emu Apple, dense Buffel. Moreton Bay Ash Substrate: Sedimentary rock	Surface: 30% mixed surface rock 2-15 cm diameter, coarse mulch, weak cracking A1 0-5 cm Dark 10YR3/2, medium clay, coarse angular blocky, few quartz coarse fragments, field pH 7.0 B21 5-75+ cm Grey 10YR4/2, few yellow mottles, medium clay, coarse angular blocky, 5% nodular carbonate, field pH 8.5 B/C 75-120 cm Yellowish brown light / medium clay	
233	644720	7289509	D, R, A	C1	Date: 22/6/11 ASC: Black Vertosol Landform: Lower slope of undulating plains. Slope (%): 2-3 Land use: Grazing Disturbance: Cleared Micro Relief: Occasional normal gilgai Drainage: Imperfect Vegetation: Brigalow regrowth (minor), thick Buffel grass Substrate: Mixed depositional material	Surface: 20% mixed surface coarse fragments, weak cracking, and slight sandy crust A1 0-30 cm Dark 10YR3/2, medium clay, strong angular blocky, few quartz coarse fragments, 5% carbonate nodules field pH 8.5 B21 30-65 cm Dark brown 10YR3/3, medium clay, coarse angular blocky, some Mn nodules, field pH 6.5 B22 65-110+ cm Brown 10YR4/3, few yellow, grey mottles, medium clay, moderate coarse and hard angular blocky 10% rounded gravels, 5% nodular carbonate, field pH 9.0	Probably blade ploughed in past 5 years. Samples taken; 0-10 cm, 20-30 cm, 50-60 cm, 90-100 cm.
234	645100	7289757	O	C1	ASC: Black Vertosol Landform: Lower slope of undulating plains. Slope (%): 3-4	Same as 233	
235	645417	7289477	D	B5	ASC: Rudosol Landform: Small elevated platerau Vegetation: Grey gum, Dead Finish, Buffel.	Surface: Plateau margins very rocky, hard surface, 30% gravel	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						A1 0-30 cm Brown 5YR4/4 C 30+ cm Rock	
236	645510	7290002	D, A	C1	ASC: Black Vertosol Landform: Gently undulating plains. Slope (%): 1-2 Land use: Grazing Disturbance: Cleared Micro Relief: Nil Vegetation: Brigalow regrowth	Surface: Sandy, weakly cracking A1 0-40 cm Dark 10YR3/2, medium clay, moderate angular blocky B22 40- 80+ cm Dark 10YR3/2, medium clay, coarse angular blocky, some nodular carbonate, field pH 8.5	
237	644863	7289965	D, A	C1	ASC: Grey Dermosol Landform: Gently undulating plains Slope (%): 2 Micro Relief: Nil Vegetation: Brigalow regrowth	Surface: Non-cracking A1 0-5 cm Brown 10YR4/3, sandy clay, coarse angular blocky B21 5-70+ cm Grey 10YR4/2, 5% yellow mottles, medium heavy clay, coarse angular blocky, trace nodular carbonate, field pH 8.5	
238	644520	7290132	O	B5	ASC: Rudosol Landform: Ridge crest Vegetation: Silver Leaved Ironbark, Grey Bloodwood	A1 Red brown, sandy clay loam, gravelly C Shallow Rock	
239	644496	7290217	D, C	A4	ASC: Black Dermosol Landform: Recent alluvial plain Slope (%): 1 Land use: Grazing Disturbance: Mostly cleared Micro Relief: Nil Drainage: Imperfect Vegetation: Blue Gum, Casuarina, Moreton Bay Ash. Substrate: Recent alluvium	Surface: Non-cracking, firm, sandy A1 0-50 cm Brown 10YR4/3, silty clay loam, weak granular B2 50 -120 cm Brown 7.5YR5/3, fine sandy clay, weak sub-angular blocky, field pH 7.0	
240	644907	7290164	O	-	Boundary Vegetation: Yellowwood scrub	Edge of alluvium	
241	645184	7289937	D, A	C1	ASC: Grey Vertosol Slope (%): 3 Vegetation: Cleared Brigalow	Surface: weak cracking A1 0-5 cm Dark 10YR3/2, medium clay, coarse angular blocky, field pH 7.0 B21 5-75 cm Grey 10YR4/2, few yellow mottles, medium clay, hard, coarse angular blocky, 5% nodular carbonate,	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						field pH 8.5 B/C 75+ cm Yellowish brown light medium clay	
242	645830	7290070	O	C1	ASC: Grey Vertosol Slope (%): 3 Vegetation: Cleared Brigalow	Soil to 50 cm the same	
243	645921	7290551	O	C1	ASC: Grey Vertosol Slope (%): 3 Vegetation: Cleared Brigalow	Soil to 50 cm the same	
244	645488	7290711	D, A	C1	ASC: Black Vertosol or Brown Dermosol Slope (%): <2 Vegetation: Cleared Brigalow	Surface: Possibly cracking surface, weak crust A1 0-30 cm Dark 10YR3/2, medium clay, sub angular blocky B21 5-90+ cm Brown 10YR4/3, few mottles, medium clay, coarse angular blocky	
245	646497	7290509	D, A	C1	ASC: Black Vertosol Landform: Undulating plain Slope (%): <2 Vegetation: Brigalow and other regrowth	Surface: Cracking A1 0-40 cm Dark 10YR3/2, medium clay, moderate angular blocky B22 40- 80+ cm Dark 10YR3/2, medium clay, coarse angular blocky, some nodular carbonate, field pH 8.5	
246	646017	7290801	O	C1	ASC: Black Vertosol Landform: Undulating plain Slope (%): <2 Vegetation: Brigalow and other regrowth	Soil to 50 cm the same as 244	
247	646219	7291080	D, A	A1	ASC: Black Vertosol Landform: Level, old alluvial plain Slope (%): 1 Land use: Previously cropped Disturbance: Cleared Micro Relief: Nil Drainage: Slow Vegetation: Sally Wattle. Substrate: Alluvium	Surface: Deeply cracking, strongly self-mulching A1 0-4 cm Dark 10YR3/1, medium heavy clay, strong sub angular blocky, few carbonate nodules field pH 8.0 B21 4-50 cm Dark 10YR3/1, heavy clay, strong sub-angular blocky to prismatic structure, 5% carbonate nodules, field pH 8.5 B22 50-90+ cm Brown 10YR4/3, heavy clay, strong prismatic structure, trace soft, and 10-15% nodular carbonate, field pH 8.0	
248	646712	7291498	D, A	A1	ASC: Black Vertosol Landform: Level, old alluvial plain	Surface: Deeply cracking, strongly self-mulching	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Slope (%) : <1 Land use : Grazing Micro Relief : Occasional normal gilgai 10-15 cm deep Drainage : Imperfect Vegetation : Some Sally Wattle Substrate : Alluvium	A1 0-25 cm Dark 10YR3/2, medium clay strong sub angular blocky, field pH 6.0 B21 25-70 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 8.0 B22 70-90+ cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, increasing soft and nodular carbonate, field pH 8.5	
249	646401	7292082	D, A	A5	ASC : Grey Dermosol Landform : Slightly elevated levee on old alluvial plain. Slope (%) : <1 Land use : Grazing Micro Relief : Nil Vegetation : Poplar Box regrowth with Blue Grass and Buffel	Surface : Non-cracking, firm, sandy A1 0-25 cm Grey 10YR4/2, clay loam, weak granular structure, no inclusions, field pH 6.5 B21 25-100+ cm Brown 7.5YR4/4, 5% yellow and grey mottles, light sandy clay, weak blocky structure, 5% soft carbonate, field pH 8.0	
250	646682	7292341	O		Boundary between slightly elevated levee (A5) and lower-lying alluvial plain (A1)		
251	646892	7292390	O	A1	ASC : Black Vertosol Landform : Alluvial Plain Slope (%) : <1 Drainage : Imperfect Vegetation : Flooded Coolabah scrub Substrate : Alluvium	Same as 248	
252	646722	7292490	D, A	A1	ASC : Black Vertosol Landform : Gently undulating plains Micro Relief : Nil Drainage : Imperfect Vegetation : Brigalow and Belah Substrate : Alluvium	Surface : Cracking, self-mulching A1 0-5 cm Dark 10YR3/2, medium clay coarse granular, field pH 6.5 B21 5-45 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky to prismatic structure, field pH 8.0 B22 45-100+ cm Brown 10YR5/3, medium clay, coarse angular blocky, soft and nodular carbonate field pH 8.5	Below 45 cm depth quite hard with little root penetration
253	647240	7292817	O	A1	ASC : Black Vertosol Landform : Gently undulating plains Slope (%) : <0.5 Disturbance : Edge of old cultivation Vegetation : Old Brigalow Belah scrub	Black clay cracking with strong fine granular surface	Floods were approx. 1.5m deep here (grass in trees and on fence)

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
254	647618	7293223	D, R, A	A5	<p>Date: 22/6/11</p> <p>ASC: Brown Dermosol</p> <p>Landform: Slightly elevated levee on old alluvial plain</p> <p>Slope (%): <1</p> <p>Land use: Grazing</p> <p>Disturbance: Partially cleared</p> <p>Micro Relief: Nil</p> <p>Drainage: Imperfect</p> <p>Vegetation: Poplar Box regrowth with Blue Grass and Buffel</p>	<p>Surface: Non-cracking, firm, sandy</p> <p>A1 0-15 cm Brown 10YR4/3, clay loam, weak granular, field pH 6.5</p> <p>B21 15-110 cm Brown 7.5YR5/4, sandy clay loam, moderate sub-angular blocky, field pH 7.0</p> <p>B22 110-130+ cm Grey 10YR4/2, <5% yellow and grey mottles, light sandy clay, coarse angular blocky, 5% soft carbonate, field pH 8.0</p>	1.5m flood level evident. Samples taken: 0-10 cm, 20-30 cm, 80- 90 cm, 100-110 cm
255	647959	7293439	O		Boundary between slightly elevated levee (A5) and lower-lying alluvial plain (A1)		Nice scrub soil (cultivation) to east
256	648145	7293622	D, A	A5	<p>ASC: Brown Dermosol</p> <p>Landform: Slightly elevated levee on old alluvial plain</p> <p>Slope (%): 1-2</p> <p>Vegetation: Poplar Box regrowth with Blue Grass and Buffel</p>	<p>Surface: Non-cracking, firm sandy</p> <p>A1 0-25 cm Brown 10YR4/3, clay loam, weak granular</p> <p>B21 25-90+ cm Brown 7.5YR5/4, sandy clay loam, moderate sub-angular blocky, field pH 7.0</p>	
257	647690	7292715	D, A	A1	<p>ASC: Black Vertosol</p> <p>Slope (%): 1</p> <p>Land use: Previously cropping</p> <p>Micro Relief: Nil</p>	<p>Surface: Cracking, strongly self-mulching</p> <p>AP 0-25 cm Dark 10YR3/2, medium clay (silty), strong sub angular blocky to granular, field pH 6.5</p> <p>B21 25-90+ cm Dark10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 8.0</p>	
258	647926	7292606	D, A	A1	<p>ASC: Black Vertosol</p> <p>Landform: Gently undulating plain</p> <p>Micro Relief: Nil</p> <p>Drainage: Imperfect</p> <p>Vegetation: Brigalow and Belah</p> <p>Substrate: Alluvium</p>	<p>Surface: Cracking, self-mulching</p> <p>A1 0-5 cm Dark 10YR3/2, medium clay coarse granular, field pH 6.5</p> <p>B21 5-45 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky to prismatic, field pH 8.0.</p> <p>B22 45-100+ cm Brown 10YR5/3, medium clay, coarse angular blocky, soft and nodular carbonate field pH 8.5</p>	
259	648172	7292512	D, A	A1	<p>ASC: Black Vertosol</p> <p>Landform: Old alluvial plain</p> <p>Slope (%): 1</p> <p>Land use: Previously cropping.</p> <p>Micro Relief: Nil</p>	<p>Surface: Deep cracking, strongly self-mulching</p> <p>AP 0-25 cm Dark 10YR3/2, medium clay (silty), strong sub angular blocky field pH 6.5</p> <p>B21 25-50 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 8.0</p>	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Vegetation: Weeds (<i>Sesbania</i> sp.)	B22 50-110+ cm Dark 10YR3/1, medium heavy clay	
260	648920	7292187	P, O	A1	ASC: Black Vertosol Landform: Old alluvial plain Slope (%): 1	Soil to 50 cm same as 259	
262	649032	7291707	O	A1	ASC: Black Vertosol Landform: Alluvial plain Land use: Previously cropping	Surface: Cracking, strongly self-mulching AP 0-25 cm Dark 10YR3/2, medium clay B21 25-90+ cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky to prismatic, 5% carbonate nodules, field pH 8.0	
267	644195	7291132	D, R (pit)	A4	Date: 11/7/11 ASC: Brown Chromosol Landform: Alluvial plain. Slope (%): 1 Land use: Grazing Disturbance: Partially cleared Micro Relief: Nil Drainage: Imperfect Vegetation: Flooded Coolibah, Wilga, Moreton Bay Ash Grass and Buffel Substrate: Alluvium	Surface: Non-cracking, firm, sandy A1 0-20 cm Greyish brown 10YR4/2, silty clay loam, weak granular, field pH 6.5 B21 20-50 cm Brown 10YR3/3, sandy clay, moderate sub-angular blocky structure, field pH 7.0 B22 50-95 cm Dark 10YR3/2, minor grey mottles, sandy clay, coarse and hard angular blocky, few plant roots, 5% soft carbonate, field pH 9.0 B23 95-130 cm Brown 10YR4/4, few grey mottles, light sandy clay, coarse weak blocky, prominent (10-15%) soft carbonate	Adjacent to major creek channel on edge of cleared area. Samples taken; 0-10 cm, 50-60 cm, 90-100 cm.
268	644386	7291133	D, P	A1	ASC: Black Vertosol Landform: Level alluvial plain	Surface: Cracking, strongly self-mulching A1 0-15 cm Dark 10YR3/2, medium clay silty 15-60 cm Dark 10YR3/1, medium heavy clay, hard angular blocky 60-130 cm Brown 10YR4/3, med heavy clay, weak structure	
269	644559	7291198	D, P	A4	Black Dermosol	Surface: Non-cracking, firm sandy A1 0-10 cm Grey 10YR4/2, silty clay loam, weak granular, field pH 6.5 A2 10-12 cm sporadic bleach B21 12-120 cm Black 10YR3/1, grey mottles, medium heavy clay, coarse weak blocky, prominent (10-15%) soft carbonate	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
270	645028	7291364	D, A	A5	ASC: Black Dermosol Landform: Inter channel alluvial plain, slightly elevated Vegetation: Cleared Poplar Box	Surface: Firm, slight crust A1 0-5 cm Brown 10YR4/3, light silty clay, weak structure field pH 6.5 B21 5-80 cm Dark 10YR3/2, medium heavy clay, moderate sub-angular blocky, field pH 7.0. B23 80+ cm Brown 10YR4/4, grey mottles, medium heavy clay increasing carbonate nodules	
271	645019	7291916	O	A4	ASC: Dermosols Landform: Edge of creek channel Vegetation: Flooded Coolabah	Stratified alluvial loams / clay loams	Pit no Q01
272	645250	7292320	D, P	A1	ASC: Black Vertosol Landform: Level alluvial plain Slope (%): <1 Land use: Grazing Disturbance: Cleared Micro Relief: Nil Vegetation: Flooded Coolabah, Blue Grass	Surface: Deep cracking, strongly self-mulching A1 0-35 cm Dark 10YR3/2, medium clay (silty), strong sub angular blocky, field pH 6.5 B21 35-120+ cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky / prismatic, increasing soft and nodular carbonate (10-15%), field pH 8.5	Pit no. H04 Flood waters to almost 2 m through here in January
273	645119	7291689	D, A	A1	ASC: Black Vertosol Same as 272	Surface: Cracking, coarse self-mulching A1 0-25 cm Dark 10YR3/2, medium clay (silty), strong sub angular blocky, field pH 6.5 B21 25-120 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 8.5 B22 120 – 130+ cm Brown medium clay	
274	644605	7290733	D, P	A1	ASC: Black Vertosol Landform: Level, old alluvial plain Slope (%): <1 Land use: Grazing Micro Relief: Nil Drainage: Imperfect Vegetation: Flooded Coolabah, with areas of Poplar Box,	Surface: Deep cracking, self-mulching A1 0-25 cm Dark 10YR3/2, medium clay (silty), strong sub angular blocky to granular, field pH 6.5 B21 25-50 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky to prismatic, 5% carbonate nodules , field pH 8.0 B22 50-110+ cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky to prismatic, increasing soft and nodular carbonate (10-15%), field pH 8.5.	Pit no GT02
275	644193	7290935	D, P	A5	ASC: Black Dermosol Landform: Alluvial plain – slightly elevated above Vertosol	Surface: Firm, slight crust A1 0-5 cm Brown 10YR4/3, light silty clay, weak structure	Pit H23

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					area Vegetation: Poplar Box	field pH 6.5 B21 5-80 cm Very dark grey 10YR3/2, medium heavy clay, moderate sub-angular blocky, no mottles, field pH 7.0. B23 80+ cm Yellowish brown 10YR4/4, medium heavy clay increasing carbonate nodules and grey mottles,	
276	643801	7290936	D, P	A5	ASC: Black Dermosol Same as 275 Vegetation: Cleared Poplar Box	Surface: Firm, slight crust A1 0-25 cm Brown 10YR4/3, light silty clay, weak structure field pH 6.5 B21 25-80 cm Dark 10YR3/2, medium heavy clay, moderate sub-angular blocky, no mottles, field pH 7.0 B23 80-120+ cm Brown 10YR3/4, grey mottles, medium heavy clay increasing carbonate nodules	Pit H22 Poplar Box soil has reduced depth to coarse paler, subsoil (about 80 cm) as opposed to Flooded Coolabah. Also, it has a lighter surface generally non-cracking and is on slightly elevated levees
277	643996	7290733	D, P	A5	ASC: Black Dermosol Vegetation: Poplar Box	Surface: Cracking, coarse self-mulching A1 0-25 cm Dark 10YR3/2, medium clay (silty), strong sub angular blocky , field pH 6.5 B21 25-120 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 8.5. B22 120 – 130+ cm Yellowish brown medium clay	Pit H27
278	643807	7290531	O	A5	ASC: Black Dermosol Vegetation: Poplar Box	Pit excavation indicates same as 277	
279	643607	7290314		A5	ASC: Black Chromosol Vegetation: Poplar Box regrowth	A1 0-20 cm Dark 10YR3/2, sandy clay loam, weak blocky structure, field pH 6.5 B21 20-75 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 8.5 B22 75 – 130+ cm Yellowish brown medium clay	
280	643412	7289974	D, R, P	A5	Date: 11/7/11 ASC: Black Dermosol Landform: Slightly elevated ridge on alluvial plain. Slope (%) : 1 Land use: Grazing Disturbance: Extensively cleared Micro Relief: Occasional gilgai (<20% of surface. VI 20-30 cm, HI 200 cm. Drainage: Very slow	Surface: Firm, weakly cracking, slight crust A1 0-5 cm Brown 10YR4/3, silty clay, weak blocky structure, field pH 6.5 B21 5-30 cm Dark 10YR3/1, medium heavy clay, moderate sub-angular blocky, field pH 7.0 B22 30-90 cm Dark 10YR3/1, minor grey mottles, medium heavy clay, coarse, hard angular blocky, trace soft lime, field pH 8.0 B23 90-130 cm Brown 10YR4/4, grey mottles, medium	Stratified alluvial soil Pale air photo pattern Samples taken: 0-10 cm, 20-30 cm, 60-90 cm, 90-100 cm

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Vegetation: Poplar Box regrowth with Blue Grass, Spear Grass and Buffel Substrate: Recent alluvium	heavy clay, coarse weak blocky, prominent (10-15%) carbonate nodules	
281	642981	7289756	D, P	A5	ASC: Black Dermosol Landform: Slightly elevated levee on old alluvial plain Slope (%) : <1 Land use: Grazing Disturbance: Partially cleared Micro Relief: Nil Drainage: Imperfect Vegetation: Poplar Box regrowth with Blue Grass and Buffel	Surface: Non-cracking, firm, sandy A1 0-15 cm Brown 10YR4/3, clay loam, weak granular, field pH 6.5 B21 15-100 cm Grey10YR4/2, light sandy clay, coarse angular blocky, field pH 8.0. B22 100-110+ cm Brown 7.5YR5/4, 10% mottles, sandy clay loam, coarse block, field pH 7.0	Pit H42
282	643605	7290735	O	A5	ASC: Black Dermosol	Same as 281	
283	643404	7290531	O	A5	ASC: Black Dermosol	Same as 281	Pit H31
284	643395	7290341	D, P	A5	ASC: Black Dermosol Vegetation: Poplar Box regrowth with Blue Grass and Buffel	Surface: Firm, sandy A1 0-10 cm Brown 10YR4/3, clay loam, weak granular, nil coarse fragments, field pH 6.5 B21 10-80 cm Grey 10YR4/2, light sandy clay, coarse angular blocky, field pH 8.0 B22 80-100+ cm brown sandy clay, coarse blocky, pH 8.5	Pit Q08
285	643246	7290337	D, P	A5	ASC: Grey Dermosol Vegetation: Poplar Box	A1 0-30 cm Brown 10YR4/3, clay loam, weak granular, field pH 6.5 B21 30-90 cm Grey 10YR4/2, light sandy clay, coarse angular blocky, field pH 8.0 B22 90-100+ cm brown sandy clay, coarse blocky, pH 8.5	
286	642999	7290317	O	A5	ASC: Grey Dermosol	Same as 285	Drilling rig working. Quick observation only
287	642950	7290154	D, R	A4	ASC: Black Dermosol Landform: Active alluvial plain Slope (%) :<1 Vegetation: River Red Gum, Flooded Coolabah,	Surface: Non-cracking, firm, sandy Deep black clay to below 120 cm. Reasonably well structured	Pit H37
288	642800	7289934	D, R	A5	ASC: Grey Dermosol	Surface: Non-cracking, firm, sandy	Pit H39

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Micro Relief: Melon hole gilgai here – up to 40 cm deep Vegetation: Poplar Box regrowth	A1 0-15 cm Brown 10YR4/3, clay loam, weak granular, field pH 6.5 B21 15- 70 cm Grey 10YR4/2, <5% yellow and grey mottles, light sandy clay, coarse angular blocky, 5% soft carbonate, field pH 8.0 B22 70-110 cm Brown 7.5YR5/4, sandy clay loam, moderate sub-angular blocky, field pH 7.0	
289	642805	7290323	D, P	A5	ASC: Grey Dermosol Vegetation: Poplar Box regrowth with Blue Grass and Buffel	Surface: Non-cracking, firm, sandy A1 0-10 cm Brown 10YR4/3, clay loam, weak granular, field pH 6.5 B21 10-80 cm Grey 10YR4/2, light sandy clay, coarse angular blocky structure, field pH 8.0 B22 80-100+ cm brown sandy clay, coarse angular blocky pH 8.5	Pit H34
290	642581	7290338	D, P	A4	ASC: Black Dermosol Landform: Active alluvial plain Land use: Grazing Disturbance: Partially cleared Micro Relief: Nil Drainage: Imperfect Vegetation: River Red Gum, Flooded Coolibah, Wilga, Moreton Bay Ash. Blue Grass and Buffel Substrate: Recent alluvium	Surface: Non-cracking, firm, sandy Deep black clay to below 120 cm. Reasonably well structured	Pit Q06
291	642410	7290352	O	A4	ASC: Rudosol Vegetation: Riverine	Loamy stratified creek channel	Pit H33
292	642397	7289928	D, P	A5	ASC: Grey Dermosol Landform: Slightly elevated levee on old alluvial plain Micro Relief: Occasional sink hole up to 30 cm deep Drainage: Imperfect Vegetation: Poplar Box regrowth	Surface: Non-cracking, firm, sandy crust A1 0-15 cm Brown 10YR4/3, silty clay loam, weak granular structure, field pH 6.5 B21 15-70 cm Grey 10YR4/2, <5% yellow and grey mottles, light sandy clay, coarse angular blocky, 5% soft carbonate, field pH 8.0. B22 70-100+ cm Light brown medium clay, hard blocky	Pit H38
293	642600	7289721	D, P	A5	ASC: Grey Dermosol	Same soil as 292	Pit H41
294	642804	7289513	D, P	A5	ASC: Brown Dermosol	Surface: Non-cracking, firm, sandy	Pit H43

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Micro Relief: Occasional sink hole Drainage: Very slow Vegetation: Poplar Box regrowth	A1 0-25 cm Brown 10YR4/3, clay loam, weak granular, field pH 6.5 B21 25-110 cm Brown 7.5YR5/4, sandy clay loam, moderate sub-angular blocky, field pH 7.0	
295	642580	7289318	D, P	A5	ASC: Grey Dermosol Landform: Slightly elevated levee on old alluvial plain Slope (%): <1 Land use: Grazing Disturbance: Partially cleared Micro Relief: Occasional sink hole up to 30 cm deep Drainage: Imperfect Vegetation: Poplar Box regrowth	Surface: Non-cracking, firm sandy crust A1 0-15 cm Brown 10YR4/3, silty clay loam, weak granular, field pH 6.5 B21 15-70 cm Grey 10YR4/2, <5% yellow and grey mottles, light sandy clay, coarse angular blocky, 5% soft carbonate, field pH 8.0 B22 70-100+ cm Light Brown medium clay, quite hard structure. No roots down below 70 cm	Pit H44
296	642608	7289028	O	A4	ASC: Rudosols Landform: Stream bank (edge of Meteor creek) Vegetation: Riverine	Deep sandy loams	
297	642264	7289128	O	A1	ASC: Black Vertosols	Approximately 200 m to west the soil appears to be A1 (Flooded coolabah with tall healthy Poplar Box – not cleared or thinned) black clays	Site observed through fence in Springwood
298	642738	7289199	D, P	A5	ASC: Black Dermosol Landform: Relict alluvial plain Vegetation: Poplar Box and Silver Leaved Ironbark	Surface: Non-cracking, firm, sandy A1 0-5 cm Brown 10YR4/3, silty clay loam, weak granular, field pH 6.5 B21 5-75 cm Dark 7.5YR3/1, sandy clay, moderate blocky, field pH 7.0 B21 75-120+ cm Grey 10YR5/2, yellow and grey mottles, sandy clay, coarse angular blocky	Pit H46
299	642957	7289325	D, P	A5	ASC: Black Dermosol Landform: Relict alluvial plain Vegetation: Poplar Box and Silver Leaved Ironbark	Surface: Non-cracking, firm, sandy A1 0-15 cm Brown 10YR4/3, silty clay loam, weak granular structure, field pH 6.5 B21 15-70 cm Dark 7.5YR3/1, sandy clay, moderate blocky structure, field pH 7.0 B21 70-130+ cm Grey 10YR5/2, 5% yellow and grey mottles, sandy clay, coarse angular blocky, field pH 8.0	Pit H45
300	644050	7291371	D ,P	A1	ASC: Black Dermosol	Surface: No coarse fragments, deep cracking, strongly	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Landform: Level, relict alluvial plain Slope (%): <1 Micro Relief: Nil Drainage: Imperfect Vegetation: Scattered Flooded Coolabah, Moreton Bay Ash Substrate: Alluvium	self-mulching A1 0-25 cm Dark greyish brown 10YR3/2, medium clay (silty), strong sub angular blocky / granular structure, nil coarse fragments, no inclusions, field pH 6.5 B21 25-50 cm Very dark grey 10YR3/1, medium heavy clay, strong prismatic structure, few carbonate nodules , field pH 8.0 B22 50-100+ cm Very dark grey 10YR3/1, medium heavy clay, strong prismatic, increasing soft and nodular carbonate , field pH 8.5	
301	644188	7291349	O	A1	Same as 300		
302	644599	7291503	D, A	A1	ASC: Black Vertosol Landform: Alluvial plain. Slope (%): <1 Vegetation: Flooded Coolabah,	Surface: Deep cracking, strongly self-mulching A1 0-25 cm Dark 10YR3/2, medium clay (silty), strong sub angular blocky B21 25-50 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 8.0 B22 50-100+ cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, increasing soft and nodular carbonate (10-15%), field pH 8.5	
303	644697	7291854	O	A1	ASC: Black Vertosol Slope (%): 2 Vegetation : Flooded Coolabah,	Surface same as 302	
304	644945	7292103	O	A1	ASC: Black Vertosol Slope (%): 2 Vegetation: Flooded Coolabah, Riverine vegetation	Surface same as 302	
305	644701	7300729		B3	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 3-4 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular structure, B21 2-120 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5. C 120+ cm Weathered basalt	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
306	644599	7300615	O	A2	ASC: Black Vertosol Landform: Basalt drainage line	Deep black clay	
307	644503	7300494	D, A	B2	ASC: Black Vertosol Landform: Lower slope of gently undulating plain. Slope (%): 1 Land use: Grazing Micro Relief: Nil Vegetation: Blue Grass Substrate: Weathered basalt	Surface: Strongly self-mulching, cracking A1 0-3 cm Dark 10YR3/2, medium clay, strong granular, field pH 6.5 B21 3-65 cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, field pH 7.5 C 65+ cm Weathered basalt	
308	643326	7301301	D, A	B2	ASC: Black Vertosol Landform: Mid slope Slope (%): 1.5 Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, field pH 7.5 B21 4-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 B22 60-85 cm Dark 10YR3/1, medium heavy clay, strong angular blocky, increasing weathered parent material, field pH 7.5 C 85+ cm Weathered basalt	
309	643046	7300946	O	A2	ASC: Black Vertosol Landform: Basalt drainage line	Deep black clay	
310	643062	7300628	D,C	B2	ASC: Black Vertosol Landform: Mid slope Slope (%): 1.5 Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, field pH 7.5. B21 4-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 60+ cm Weathered basalt	
311	643052	7300656	D, A	B1	ASC: Black Vertosol or Dermosol Slope (%): 3 Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood	A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, field pH 7.5 B21 4-40 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 40+ cm Weathered basalt	
312	643059	7300575	D, A	B5	ASC: Grey Tenosol Slope (%): 1.5 Vegetation: Box, Dead Finish, Wilga	Surface: Firm, non-cracking A1 0-35 cm Grey 10YR5/2, light clay, weak structure, field pH 6.5	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						BC 35- 55 cm increasing weathered material C 55+ cm Weathered basalt	
313	643253	7300264	D,R,A	B5	Date: 12/7/11 ASC: Brown Chromosol Landform: Low ridge in undulating plain. Element : crest Slope (%): 3 Land use: Grazing Disturbance: Partially cleared Micro Relief: Nil Drainage: Imperfect Vegetation: Poplar Box and Buffel Substrate: Calcareous sediments	Surface: Non-cracking, firm sandy A1 0-5 cm Brown 10YR4/4, sandy loam, massive, field pH 6.5 B21 5-55 cm Dark brown 10YR3/3, light clay, moderate sub-angular blocky, field pH 7.5 C 55+ cm calcareous mixed sediments, pH 8.5	Adjacent to drainage line Samples taken: 0-5 cm, 10-20 cm, 50-60 cm
314	643395	7300191	O	A2	ASC: Black Vertosol Landform: Drainage line Slope (%): 2	Black cracking clay	
315	643627	7300191	O	B5	ASC: Chromosol	10YR5/6, sandy clay loam	Appears same as 313
316	643913	7300197	O	B3	ASC: Black Vertosol Vegetation: Small patch Brigalow, Wilga	Cracking grey clay, slight crust	
317	643814	7300498	O	B5	ASC: Chromosol	10YR5/6, sandy clay loam	Appears same as 313
318	644334	7300575	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2-3 Land use: Grazing Vegetation: Mountain Coolibah, Silver Leaved Ironbark Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/1, medium clay, strong granular, field pH 7.5 B21 4-80 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 80+ cm Weathered basalt	
319	644247	7300864	D, A	B2	ASC: Black Vertosol Slope (%): 2-3 Land use: Grazing Vegetation: Mountain Coolibah, Silver Leaved Ironbark Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/1, medium clay, strong granular, field pH 7.0 B21 4-65 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 8.0. C 65+ cm Weathered basalt	
320	644155	7301089	D, A	B2	ASC: Black Vertosol	Surface: Self-mulching, cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Landform: Mid slope of undulating plains Slope (%): 2-3 Land use: Grazing Vegetation: Mountain Coolibah, Silver Leaved Ironbark Substrate: Weathered basalt	A1 0-4 cm Dark 10YR3/1, medium clay, strong granular, field pH 7.5 B21 4-80 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 80+ cm Weathered basalt	
321	643714	7301352	O	B2	ASC: Black Vertosol	Soil depth at least 60 cm	Appears same as 320
322	643709	7300850	O	B2	ASC: Black Vertosol	Soil depth at least 60 cm	Appears same as 320
323	644072	7301624	D, A	B2	ASC: Black Vertosol Landform: Upper slope of undulating plains Slope (%): 2-3 Vegetation: Mountain Coolibah	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/1, medium clay, strong granular, field pH 7.5 B21 4-70 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 70+ cm Weathered basalt	
324	644650	7301380	D, A	B2	ASC: Black Vertosol Slope (%): 2-3 Vegetation: Mountain Coolibah, Silver Leaved Ironbark,	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/1, medium clay, strong granular, field pH 7.5 B21 4-70 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 70+ cm Weathered basalt	
325	644519	7301155	O	B2	ASC: Black Vertosol	Soil depth at least 60 cm	Appears same as 320
326	644792	7300950	O	B2	ASC: Black Vertosol	Soil depth 65 cm	Appears same as 320
327	645196	7301304	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Vegetation: Mountain Coolibah, Silver Leaved Ironbark	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/1, medium clay, strong granular, field pH 7.5 B21 4-70 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 C 70+ cm Weathered basalt	
328	645081	7301670	O	B2	ASC: Black Vertosol	Soil depth 75 cm	Appears same as 320
329	646998	7294066	D, A	A5	ASC: Black Vertosol	Surface: Firm, weakly cracking, slight crust	Walked across Meteor Creek

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Landform: Alluvial plain Slope (%): <1 Land use: Grazing Disturbance: Extensively cleared Vegetation: Previously Poplar Box, Buffel Substrate: Recent alluvium	A1 0-5 cm Brown 10YR4/3, silty clay, weak blocky, field pH 6.5 B21 5-70 cm Very dark grey 10YR3/1, medium heavy clay, moderate sub-angular blocky, field pH 7.0 B22 70-90+ cm Yellowish brown 10YR4/4, medium heavy clay, coarse weak blocky	
330	647726	7292312	D, A	A1	ASC: Black Vertosol Vegetation: Cleared – old cultivation	AP 0-30 cm Dark 10YR3/2, medium clay strong granular, field pH 6.5 B21 25-90+ cm Dark 10YR3/1, medium heavy clay, strong sub-angular blocky, 5% carbonate nodules, field pH 8.0	
331	648069	7292879	D, R, A	A1	Date: 12/7/11 Landform: flat, old alluvial plain. Slope (%): <1 Land use: Grazing, previously cropping. Disturbance: Cleared Micro Relief: Nil Drainage: Imperfect Vegetation: nearby remnants are Flooded Coolibah, Moreton Bay Ash with areas of Poplar Box, Belah and Sally Wattle. Substrate: alluvial depositional material	Surface: No coarse fragments, deep cracking, strongly self-mulching AP 0-25 cm Dark greyish brown 10YR3/2, medium clay (silty), strong sub angular blocky / granular structure, nil coarse fragments, no inclusions, field pH 6.5 B21 25-50 cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky / prismatic structure, no mottles, 5% carbonate nodules, field pH 8.0. B22 50-110+ cm Very dark grey 10YR3/1, medium heavy clay, strong sub-angular blocky / prismatic structure, no mottles, increasing soft and nodular carbonate (10-15%), field pH 8.5.	Edge of old cultivation. Samples taken; 0-10 cm, 50-60 cm, 90-100 cm.
332	641670	7290228	D,P	A5	Vegetation: Poplar Box	A1 0-30 cm Brown 10YR4/3, clay loam, weak granular structure, nil coarse fragments, no inclusions, field pH 6.5 B21 30-90 cm Dark greyish brown 10YR4/2, light sandy clay, coarse angular blocky structure, field pH 8.0. B22 90-100+ cm brown sandy clay, pH 8.5, coarse blocky.	
333	633574	7290240	D,C	B3	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 2 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow	Surface: Self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular structure, B21 2-90 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 B/C 90-100 cm increasing weathered parent material,	Springwood 13/7/2011

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Vegetation: Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate: Weathered basalt	field pH 7.5 C 100+ cm Weathered basalt	
334	633906	7290488	O		Boundary A2 / B2		
335	634096	7290633	D, A	B4	ASC: Brown Rudosol Landform: Scarp Slope (%) : >7 Vegetation: Mountain Coolibah, Silver Leaved Ironbark Substrate: Hard basalt	Surface: 10% coarse fragments, firm, non-cracking A1 0-20 cm Brown 7.5YR4/3, medium clay, weak granular, 20% stone 5-25mm diameter, C 20+ cm Weathered basalt	
336	634335	7290846	O		Boundary A2 / B2		
337	634455	7290944	D, A	B3	ASC: Black Vertosol Landform: Lower slope of undulating plains. Slope (%) : <1 Land use: Grazing Substrate: Weathered basalt	Surface: Few coarse fragments, self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular B21 2-100 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5. C 100+ cm Weathered basalt	
338	634384	7291189	D, A	B4	ASC: Black Rudosol Landform: Scarp Slope (%) : <4 Vegetation: Mountain Coolibah, Substrate: Hard basalt	Surface: Non-cracking A1 0-25 cm Dark 7.5YR3/2, med clay, granular C 25+ cm Weathered basalt	
339	634565	7291038	D, A	B3	ASC: Black Vertosol Landform: Lower slope of undulating plains. Slope (%) : <2 Land use: Grazing Substrate: Weathered basalt	Surface: Self mulching, cracking A1 0-4 cm Dark 10YR3/1, medium clay, strong granular B21 4-90 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5 BC 90-110 cm increasing weathered parent material, field pH 7.5 C 110+ cm Weathered basalt	
340	634862	7291290	D, A	C2	ASC: Red Dermosol Slope (%) : 1-2 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow	Surface: <5% coarse fragments, firm, non-cracking A1 0-3 cm Dark reddish brown 5YR3/4, light clay, mod sub angular blocky, field pH 6.0. B21 3-45 cm Red brown 2.5YR3/4, light clay, weak blocky, field pH 6.0 B22 45-70 cm Red brown 2.5YR4/6, light clay, weak	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Vegetation: Mountain Coolibah , Bloodwood Substrate: Weathered basalt	blocky, field pH 7.0 BC 70-80 cm C 80+ cm	
341	635054	7291646	D, A	B4	ASC: Black Rudosol Landform: Ridge Slope (%): >3-4 Vegetation: Mountain Coolibah	Surface: Non-cracking, 40-50% rocks A1 0-20 cm Dark 7.5YR3/2, medium clay, granular C 20+ cm Hard basalt	
342	635208	7291651	D, C	B5	ASC: Red Rudosol Landform: Deep rocky creek cutting Slope (%): 4 Vegetation: Grey Bloodwood, Mountain Coolibah	Surface: Firm, rocky A1 0-20 cm Dark red, light clay, 50% gravel / smaller rocks (< 30mm diam.) B2 20-100 cm Yellowish red light clay, >70% rocks some > 40 cm diameter. BC100-200 cm Pale gleyed clay, (silty clay), deposited weathered sediments	
343	635329	7291840	O	B5	ASC: Red Rudosol	Very rocky red brown light clay	Appears same as 342
344	635748	7291964	O		Boundary to flats		
345	635906	7291750	D, A	B4	ASC: Black Tenosol Landform: Rocky hill Slope (%): 3-4 Vegetation: Mountain Coolibah, Grey Bloodwood	Surface: >55% surface stone/ rock A1 0-4 cm Dark 10YR3/1, medium clay, strong granular B21 4-30 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 30+ cm Hard basalt	
346	635857	7292229	D, C	A2	ASC: Black Vertosol Landform: creek cutting. Slope (%): 1-2 Land use: Grazing Micro Relief: Nil Vegetation: Mountain Coolibah , Grey Bloodwood Substrate: Weathered basalt	Surface: Cracking and self-mulching A1 0-5 cm Very dark greyish brown 10YR4/1, medium clay granular, field pH 6.5. B21 5-45 cm Very dark grey 10YR3/1, medium heavy clay, coarse angular blocky, field pH 7.5. B22 45-130 cm dark medium heavy clay, well structured, 10% carbonate nodules C 130 - 160+ cm increasing weathered basalt	
347	636635	7292309	D, A	B3	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): <2 Land use: Grazing	Surface: 20% basalt coarse fragments, self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Substrate: Weathered basalt	B21 2-100 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5. C 100+ cm Weathered basalt	
348	636996	7292297	D, A	B1	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): 3-4 Vegetation: Mountain Coolibah, Grey Bloodwood	Surface: Self-mulching, cracking, 15% surface stone A1 0-4 cm Dark 10YR3/1, medium clay, strong granular B21 4-50 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5. C 50+ cm Weathered basalt	
349	637137	7292300	O	B5	ASC: Rudosol Landform: Ridge Vegetation: Grey Bloodwood, Mountain Coolibah	Surface: >50% rock Light clay	
350	637429	7292288			Boundary B3 / B1		
351	638101	7292350	D, A	B3	ASC: Black Vertosol Landform: Mid slope of gently undulating plains. Slope (%): 1 Land use: Grazing Vegetation: open downs mainly	Surface: Strongly self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular B21 2-90 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5 BC 90-110 cm increasing weathered parent material, field pH 7.5 C 110+ cm Weathered basalt	
352	638267	7292333	D, C	A2	ASC: Black Vertosol Landform: Lower slope of undulating plains. Drainage line in downs	Surface: Self-mulching, cracking \ A1 0-5 cm Dark 10YR3/1, medium clay, strong granular B21 5-90 cm Dark 10YR3/1, medium heavy clay, strong angular blocky BC 90-120+ cm slowly increasing weathered parent material, mostly (80% black clay	
353	638770	7292295	D, A	B3	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope (%): <2 Land use: Grazing Vegetation: Downs grasslands Substrate: Weathered basalt	Surface: Strongly self-mulching, cracking A1 0-2 cm Dark 10YR3/2, medium clay, strong granular structure, B21 2-95 cm Dark 10YR3/1, medium heavy clay, strong angular blocky, field pH 7.5. BC 95-110 cm increasing weathered parent material, field pH 7.5. C 110+ cm Weathered basalt	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
354	638035	7292229	D, A	B2	ASC: Black Vertosol Slope (%): 2 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular structure, nil coarse fragments, field pH 7.5. B21 4-55 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5. C 55+ cm Weathered basalt	
355	637647	7292714	D, A	B3	ASC: Black Vertosol Slope (%): 1.5 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: Self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular structure B21 4-95 cm Dark 10YR3/2, medium heavy clay, strong angular blocky C 95+ cm Weathered basalt	
356	637667	7292845	D, A	B2	ASC: Black Vertosol Slope (%): <1 Vegetation: mainly downs grassland Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/1, medium clay, strong granular structure, field pH 7.5. B21 4-95 cm Dark 10YR3/1, medium heavy clay, strong angular blocky, field pH 8.5. C 95+ cm Weathered basalt	
357	637705	7293046	D, A	B3	ASC: Black Vertosol Slope (%): 2 Vegetation: Mountain Coolibah, Substrate: Weathered basalt	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular structure, nil coarse fragments, field pH 7.5. B21 4-55 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5. C 55+ cm Weathered basalt	
358	637689	7293390	D, A	C2	ASC: Brown Dermosol Slope (%): 1 Land use: Grazing Disturbance: Partial clearing Micro Relief: Nil Drainage: Slow Vegetation: Silver Leaved Ironbark Substrate: Weathered basalt	Surface: <5% coarse fragments, firm, non-cracking A1 0-40 cm Red brown 2.5YR3/4, light clay, weak blocky field pH 6.0 B22 40-80 cm Brown 7.5YR4/6, light clay, weak blocky field pH 7.0 C 80+ cm	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
359	637772	7293588	D, A	C1	ASC: Grey Vertosol Brigalow regrowth, Slope 3% Normal gilgai 20% of surface, 20-30 cm deep	Mounds : Cracking grey clay Depressions: Non-cracking sandy clay, firm Site on mound position A1 0-60 cm Grey 10YR4/2, medium clay, hard / coarse angular blocky, field pH 7.5. B23 60-70 cm Yellowish brown medium clay, some mottles, few carbonate nodules, pH 8.5. 70 cm Weathered material	
360	638147	7293845	D, A	C1	ASC: Grey Vertosol Brigalow and Silver Leaved Ironbark. Slope 1-2% Less gilgai but still present (10% of surface)	Surface: Few mixed gravels 2-15mm diameter, coarse sandy mulch, weak cracking, A1 0-5 cm dark greyish brown 10YR3/2, medium clay, coarse angular blocky structure, few quartz coarse fragments, field pH 7.0 B21 5-75 cm Grey brown 10YR4/2, medium clay, coarse angular blocky, few yellow mottles, 5% nodular carbonate, field pH 8.5. B23 75-90+ cm Yellowish brown light / medium clay	Same appearance as 359
361	638441	7294043	D, A	C2	ASC: Red Dermosol Silver Leaved Ironbark woodlands,	Surface: <5% coarse fragments, firm, non-cracking A1 0-40 cm Red brown 2.5YR3/4, light clay, weak blocky field pH 6.0. B22 40-80 cm Brown 7.5YR4/6 light clay, weak blocky field pH 7.0. C 80+ cm	
362	638615	7294160	D, A	C1	ASC: Grey Vertosol Brigalow and Belah Slope 1-2% Less gilgai but still present (10% of surface)	Surface: Strong granular mulch, cracking, A1 0-5 cm dark greyish brown 10YR3/2, medium clay, coarse angular blocky structure, few quartz coarse fragments, field pH 7.0 B21 5-90+ cm grey brown 10YR4/2, medium clay, well-structured sub-angular blocky, 5% nodular carbonate, field pH 8.5.	Softwood scrub soil Same appearance as 359
363	638061	7294472	O	-	Boundary – C2 and B3		
364	638011	7294297	D, A	C2	ASC: Brown Dermosol Same appearance as 359 Silver Leaved Ironbark, Sally Wattle, Grey Bloodwood	Surface: Firm, non-cracking A1 0-40 cm Red brown 2.5YR3/4, light clay, weak blocky	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					woodlands	field pH 6.0. B22 40-80 cm Brown 7.5YR4/6, light clay, weak blocky field pH 7.0. C 80+ cm	
365	637953	7294057	O	C2	Appears same as 364		
366	637936	7293865	D, A	C2	ASC: Brown Dermosol Silver Leaved Ironbark , Brigalow woodlands	Surface: Firm, non-cracking A1 0-40 cm Red brown 2.5YR3/4, light clay, weak blocky field pH 6.0. B22 40-80 cm brown 7.5YR4/6, light clay, weak blocky field pH 7.0. C 80+ cm	
367	638813	7293851	D, A	C2	ASC: Grey Vertosol Small creek line Brigalow, Emu Apple, Belah, Silver Leaved Ironbark	Surface: Cracking A1 0-5 cm Dark greyish brown 10YR3/2, medium clay, coarse angular blocky structure, few quartz coarse fragments, field pH 7.0 B21 5-70+ cm Grey brown 10YR4/2, medium clay, 5% nodular carbonate, field pH 8.5.	
368	638974	7293625	O	A2	ASC: Grey Vertosol Active creek line Black tea Tree, Belah, Moreton Bay Ash, Wilga, Brigalow, Blue Gum	Grey clay cracking with weak surface crust.	
369	639077	7293394	D, C	B4	ASC: Brown Rudosol Creek cutting (eastern bank) Mountain Coolibah ridge immediately thru boundary fence.	Surface: Stone/ rock A1 0-20 cm Brown 10YR3/3, sandy clay loam, weak structure C 20+ cm Hard basalt	
370	639407	7293125	D, A	C1	ASC: Brown Vertosol Landform: Lower slope of undulating plains. Slope (%) : 2-3 Micro Relief: Nil Drainage: Imperfect Vegetation: Brigalow, Yellowwood. Thick Buffel grass Substrate: Mixed depositional material	Surface: Coarse granular, cracking clay A1 0-3 cm very dark greyish brown 10YR3/1, medium clay, strong angular blocky structure, field pH 6.0 B21 3-35 cm Dark brown 10YR3/3, medium clay, coarse angular blocky, no mottles, some Mn nodules , field pH 6.5. B22 35-110+ cm Brown 10YR4/3, medium heavy clay, moderate sub-angular blocky, few yellow mottles, 5%	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						nodular carbonate, field pH 8.5	
371	639103	7292950	O	C1	ASC: Brown Vertosol Brigalow	Appears same as 370	
372	639261	7292541	D, A	C1	ASC: Brown Dermosol Landform: Ridge of undulating plains. Slope (%): 2-3 Vegetation: Bonewood, Wilga, Brigalow Substrate: Mixed depositional material	Surface: Coarse granular, non-cracking clay. A1 0-3 cm very dark greyish brown 10YR3/1, light medium clay, strong angular blocky structure, field pH 6.0 B21 3-75+ cm Dark brown 10YR3/3, medium clay, coarse angular blocky, , no mottles, some Mn nodules , field pH 6.5.	
373	639920	7292444	D, A	B5	ASC: Brown Rudosol Rocky elevated steep ridge Mixed Bloodwood	Abundant surface stone/ rock A1 0-10 cm Red brown 2.5YR3/3, sandy loam, massive, pH 6.0 C 10+ cm Hard basalt	
374	640149	7292146	D, A	B5	ASC: Brown Rudosol Same position as 373	Significant surface stone/ rock A1 0-20 cm Brown 10YR3/3, sandy clay loam, weak structure, C 20+ cm Hard basalt	
375	638689	7293538	D, A	C2	ASC: Red Dermosol Silver Leaved Ironbark , Brigalow, Moreton Bay Ash, Wilga, Currant Bush, Thin grass cover here.	Surface: Firm, non-cracking, 5% coarse fragments A1 0-40 cm Red brown 2.5YR3/4, light clay, weak blocky field pH 6.0 B22 40-60 cm Brown 7.5YR4/6, light clay, weak blocky field pH 7.0. C 60+ cm	
376	638513	7293350	O	A2	ASC: Black Vertosol Active drainage line. Black Tea Tree, Silver Leaved Ironbark , Moreton Bay Ash	Black clay > 120 cm deep (cutting)	
377	638218	7293096	D, A	B2	ASC: Black Vertosol Ridge of undulating plains. Slope (%): 2 Land use: Grazing Vegetation: Mountain Coolibah, Silver Leaved Ironbark,	Surface: No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular structure, field pH 7.5. B21 4-75 cm Dark 10YR3/2, medium heavy clay, strong	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Bloodwood Substrate: Weathered basalt	angular blocky, no mottles, field pH 7.5. C 75+ cm Weathered basalt	
378	638468	7292292	O	A2	ASC: Black Vertosol Active drainage line. Black Tea Tree, Silver Leaved Ironbark , Moreton Bay Ash	Black clay> 120 cm deep (cutting)	
379	637995	7292904	D, A	B2	ASC: Black Vertosol Ridge top of undulating plains. Slope (%) : 2 Micro Relief : Nil Vegetation : Mountain Coolibah, Silver Leaved Ironbark, Bloodwood Substrate : Weathered basalt	Surface : No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular structure, nil coarse fragments, field pH 7.5. B21 4-60 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5. B22 60-85 cm Dark 10YR3/1, medium heavy clay, strong angular blocky, increasing weathered parent material, field pH 7.5. C 85+ cm Weathered basalt	
380	638201	7292076	D, C	B3	ASC: Black Vertosol Landform : Lower slope of undulating plains. Drainage line in downs. Black tea Tree	Surface : No coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-90+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
381	638551	7291805	D,C	B3	ASC: Black Vertosol Lower slope of Open downs country	Surface : Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-90+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
382	638223	7291106	D, A	B2	ASC: Black Vertosol Landform : Mid slope of undulating plains. Mountain Coolibah , Grey Bloodwood	Surface : Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-80 cm Dark 10YR3/1, medium heavy clay, strong angular blocky. C 80+ cm Weathered basalt	
383	638563	7291802	D, A	B3	ASC: Black Vertosol	Surface : No coarse fragments, self-mulching, cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Landform: Lower slope of undulating plains. Open downs country	A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-95+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
384	638699	7291848	D, A	C1	ASC: Brown Vertosol Landform: Ridge of undulating plains. Slope (%): 2-3 Vegetation: Bonewood, Wilga, Yellowwood Substrate: Mixed depositional material	Surface: Coarse granular, cracking clay A1 0-3 cm very dark greyish brown 10YR3/1, light medium clay, field pH 6.0 B21 3-85+ cm Dark brown 10YR3/3, medium clay, coarse angular blocky, field pH 7.5.	
385	638884	7291630	D, A	B2	ASC: Black Vertosol Landform: Mid slope of undulating plains. Slope 3-4% Mountain Coolibah, Grey Bloodwood	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-80 cm Dark 10YR3/1, medium heavy clay, strong angular blocky. C 80+ cm Weathered basalt	
386	639170	7291571	D, A	C1	ASC: Brown Vertosol Landform: midslope of undulating plains. Slope (%): 2-4 Vegetation: Brigalow starts here	Surface: Coarse granular, non-cracking clay A1 0-3 cm very dark greyish brown 10YR3/1, light medium clay, strong angular blocky structure, field pH 6.0 B21 3-75+ cm Brown 10YR4/3, medium clay, coarse angular blocky, few yellow mottles, field pH 8.5.	•
387	638568	7291267	D, C	C1	ASC: Brown Vertosol Landform: Ridge of undulating plains. Slope (%): 2-3 Vegetation: Brigalow, Wilga, Some normal gilgai (not significant)	Surface: Coarse granular, non-cracking clay A1 0-3 cm very dark greyish brown 10YR3/1, light medium clay, strong angular blocky structure, field pH 6.0 B21 3-55+ cm Dark brown 10YR3/3, medium clay, coarse angular blocky, , no mottles, some Mn nodules, field pH 6.5.	
388	638410	7290922	D	B5	ASC: Brown Rudosol Ridge-top with Bonewood, Bottle Tree,	Significant surface stone/ rock A1 0-20 cm Brown 10YR3/3, sandy clay loam, weak structure	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						C 20+ cm Hard rock	
389	638284	7290639	D, A	B2	ASC: Black Vertosol Slope (%) : 2 Land use : Grazing Substrate : Weathered basalt	Surface : No coarse fragments, self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular structure, nil coarse fragments, field pH 7.5. B21 4-75 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5. C 75+ cm Weathered basalt	
390	638153	7290374	D, A	B3	ASC: Black Vertosol Landform : gentle slope of undulating plains. Slope <2% Open downs country	Surface : No coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-95 cm Dark 10YR3/1, medium heavy clay, strong angular blocky. C 95 cm Weathered rock	
391	637743	7290530	D, A	B3	ASC: Black Vertosol Landform : Lower slope of undulating plains. Open downs country	Surface : No coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-95+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
392	637393	7290663	D, A	B2	ASC: Black Vertosol Landform : slight ridge on undulating plains. Slope (%) : 2 Land use : Grazing Micro Relief : Nil Drainage : Slow Vegetation : Mountain Coolibah, Substrate : Weathered basalt	Surface : self-mulching, cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular structure, nil coarse fragments, field pH 7.5. B21 4-80 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, no mottles, field pH 7.5. C 80+ cm Weathered basalt	
393	637122	7290759	D, A	B3	ASC: Black Vertosol Landform : Lower slope of undulating plains. Open downs country	Surface : Few coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-95+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
394	636899	7290847	D, A	B3	ASC: Black Vertosol	Surface : Self-mulching, cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Open downs country	A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure B21 5-95+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky	
395	636694	7290851		B3	ASC: Black Vertosol Open downs country	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/2, medium clay, strong granular structure, B21 5-100 cm Dark 10YR3/1, medium heavy clay, strong angular blocky. C 100 cm	
396	636301	7290436		B3	ASC: Black Vertosol Open downs country	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-90+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
397	636562	7290116	D, A	B2	ASC: Black Vertosol Landform: gentle slope of undulating plains. Slope <2% Open downs country	Surface: 10% coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-65 cm Dark 10YR3/1, medium heavy clay, strong angular blocky C 65 cm Weathered rock	
398	636507	7291036		A2	ASC: Black Vertosol Landform: Drainage line in downs. Black tea Tree, Moreton Bay Ash	Surface: No coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-90+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
399	636667	7291338	D, A	B2	ASC: Black Vertosol Landform: gentle slope of undulating plains. Slope <2% Open downs country	Surface: No coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-65 cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						C 65 cm Weathered rock	
400	637109	7291825	D, A	B3	ASC: Black Vertosol Open downs country	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-90+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
401	636890	7291947	D, A	B4	ASC: Black Rudosol Ridge with Silver Leaved Ironbark	20% surface stone/ rock A1 0-20 cm Dark 10YR3/2, sandy clay loam, weak structure, C 20+ cm Hard rock	
402	636647	7291765	D, A	B2	ASC: Black Vertosol Open downs country	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-70 cm Dark 10YR3/1, medium heavy clay, strong angular blocky. BC 70-85 cm then bedrock	
403	636818	7291744	D, C	B3	ASC: Black Vertosol Open downs country	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-125 cm Dark 10YR3/1, medium heavy clay, strong angular blocky. 125 cm Weathered material increasing	
404	636433	7291660	D, C	B4	ASC: Black Rudosol Ridge with Mountain Coolibah , Grey Bloodwood	20% surface stone/ rock A1 0-20 cm Dark 10YR3/2, sandy clay loam, weak structure, C 20+ cm Hard rock	
405	636381	7292150	D, A	B3	ASC: Black Vertosol Open downs country	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular B21 5-125 cm Dark 10YR3/1, medium heavy clay, strong angular blocky	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						125 cm Weathered material increasing	
406	635720	7292628	O	B4	ASC: Rudosol Ridge with Mountain Coolibah , Grey Bloodwood	20% surface stone/ rock	
407	633276	7290180	D,C	B3	ASC: Black Vertosol Landform: Lower slope of undulating plains. Open downs country	Surface: Few coarse fragments, self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular B21 5-95+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky	
408	633009	7290164	D, A	B3	ASC: Black Vertosol Landform: Open downs country	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-95+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
409	633012	7290450	D	B4	ASC: Black Rudosol Ridge with Mountain Coolibah , Grey Bloodwood	20% surface stone/ rock A1 0-20 cm Dark 10YR3/2, sandy clay loam, weak C 20+ cm Hard rock	
410	632761	7290178	D,C	B3	ASC: Black Vertosol Landform: Drainage line on open downs country	Surface: Self-mulching, cracking A1 0-5 cm Dark 10YR3/1, medium clay, strong granular structure, B21 5-95+ cm Dark 10YR3/1, medium heavy clay, strong angular blocky.	
411	632629	7290594	D, A	B4	ASC: Black Rudosol Ridge with Mountain Coolibah ,	30% surface stone/ rock A1 0-30 cm Blackn 10YR3/2, sandy clay loam, weak structure C 30+ cm Hard rock	
422	643640	7291130	D,P	A1	ASC: Black Vertosol Landform: Flat alluvial plain Slope (%): <1 Land use: Grazing Micro Relief: Nil Drainage: Imperfect Vegetation: Cleared	Surface: No coarse fragments, cracking, A1 0-25 cm Dark greyish brown 10YR3/2, medium clay strong sub angular blocky, field pH 6.0 B21 25-70 cm Very dark grey 10YR3/1, medium heavy clay, strong blocky field pH 8.0. B22 70-100+ cm Very dark grey 10YR3/1, medium heavy clay, strong blocky, trace nodular carbonate field pH 8.5.	Pit H17

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Substrate: alluvial depositional material		
423	643428	7291126	D,P	A5	ASC: Black Chromosol Landform: Slightly elevated levee on old alluvial plain. Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Mostly cleared, Poplar Box	Surface: No coarse fragments, non-cracking, firm sandy A1 0-15 cm Dark 10YR4/2, clay loam, weak granular structure, field pH 6.5 B21 15-80 cm Dark, 10YR3/2, coarse angular blocky, B22 80-120+ cm Yellowish brown 10YR4/4, light sandy clay, weak blocky structure, few yellow and grey mottles, field pH 8.0.	Pit Q02
424	643412	7290942	O	A5	Same as 423		
425	643361	7290760		A5	Same veg & surface as 423		
426	643194	7290734	D,P	A1	ASC: Black Vertosol Next to active creek channel. Vegetation: Flooded Coolibah, Blue Gum. Blue grass and Buffel Substrate: recent alluvial	Surface: No coarse fragments, cracking A1 0-25 cm Dark greyish brown 10YR3/2, medium clay strong sub angular blocky, field pH 6.0 B21 25-70 cm Very dark grey 10YR3/1, medium heavy clay, strong blocky field pH 8.0. B22 70-100+ cm Very dark grey 10YR3/1, medium heavy clay, strong blocky, trace nodular carbonate field pH 8.5.	H25
427	643002	7290741	D,P	A1	ASC: Black Vertosol Flooded Coolibah, Blue Gum. Blue grass and Buffel	Surface: Cracking, coarse mulch A1 0-5 cm Dark greyish brown 10YR3/2, sandy clay weak blocky, B21 5-70 cm Very dark grey 10YR3/1, medium heavy clay, very hard strong blocky. B22 70-100+ cm Very dark grey 10YR3/1, medium heavy clay, strong blocky,	GT04
428	642600	7290687	D,P	A5	ASC: Black Chromosol Slightly elevated levee on old alluvial plain. Slope (%): <1 Land use: Grazing Micro Relief: occasional sink holes to 2-0 cm deep Vegetation: Mostly cleared Poplar Box	Surface: Non-cracking, firm sandy (slight crust) A1 0-10 cm Brown 10YR4/2, clay loam, weak granular structure, field pH 6.5 B21 10-80 cm Dark, 10YR3/2, coarse angular blocky, B22 80+ cm Yellowish brown 10YR4/4, light sandy clay,	Q04
429	641741	7290067	D,C	A1	ASC: Black Vertosol Flooded Coolibah flat, Blue grass and Buffel	Surface: Cracking, crusting A1 0-10 cm greyish brown 10YR4/3, silty medium clay	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
						weak blocky, B21 10- 90+ cm Very dark grey 10YR3/1, medium heavy clay, very hard, blocky, no mottles	
430	642032	7289679	D, A	A5	ASC: Black Vertosol Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Poplar Box , Moreton Bay Ash, Wilga, Sally Wattle	Surface: Thin veneer silty clay over hard clay, weak cracking A1 0-3 cm Brown 10YR4/2, silty clay loam, weak granular structure, field pH 6.5 B21 3-80+ cm Dark, 10YR3/2, coarse angular blocky, sandy clay,	
431	641760	7289531	O	A1	Extrapolation through fence into Springwood. (no entry permitted)	Cultivation of dark clay. Flooded Coolibah trees	
432	642215	7289882	O	A1	ASC: Black Vertosol Lower landscape position than A5.	Flooded coolibah cracking clay adjacent to creek channel	
433	642260	7289381	O	A1	ASC: Black Vertosol Flooded Coolibah	Dark clay	
434	641785	7289280	O	A1	ASC: Black Vertosol Springwood boundary	Dark clay same as 433	
435	645210	7300867	D,C	B2	ASC: Black Vertosol Mountain Coolibah woodland Slope 3%	Surface: 5% surface fragments. Cracking A1 0-3 cm dark 10YR3/1, medium clay, strong granular structure, pH 7.0 B21 4-70 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, C 70+ cm Weathered basalt	
436	645193	7300102	D, A	B3	ASC: Black Vertosol Old cultivation with contour banks. Slope 1-2%.	Surface: 5% surface fragments. Cracking A1 0-4 cm Dark 10YR3/2, medium clay, strong granular structure, B21 4-100 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, C 100+ cm Weathered basalt	
Site No.	Easting	Northing	Type*	Soil	Landform / Vegetation	Soil Profile	Comments
SPR001	641094	7288071	D, A	A5	ASC: Black Sodosol	A1 0-15 cm Brown 7.5YR3/2, Fine sandy loam, massive	Profile 1228, 1229

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Slope (%): <1 Land use: Grazing Micro Relief: Nil Vegetation: Poplar Box ,	structure, field pH 5.5 B21 15-50+ cm Brown, 7.5YR3/2, medium coarse sub angular blocky, light clay. B22 50-100 Brown 10YR 3/1 subangular blocky medium clay	Samples 0-10, 10-30, 30-60, 60-90
SPR002	641948	7287877	D, A	C1	ASC: Black Dermosol Landform: undulating plains. Slope (%): 2-3 Vegetation: Brigalow, Wilga, Bottle trees	Surface: Coarse fragments 15%, 6-10 mm. Coarse granular, non-cracking clay. A1 0-10 cm Very dark greyish brown 10YR3/1, medium clay, medium subangular blocky, field pH 6.5 B21 10-60 cm Black 10YR2/1, medium clay, coarse angular blocky, field pH 8 .C 60+ cm weathered material, pH8.5	Photos 1230, 1231, 1232 Samples 0-10, 10-30, 30-60
SPR003	641940	7287814	O	C1	ASC: Black Vertosol	Surface fragments 15% , 5-10 cm	Photos 1233, 1234
SPR004	641783	7287918	O	C1	ASC: Black Vertosol		
SPR005	641691	7288012	A, O	C1	ASC: Sodosol? Landform: Alluvial plain	Surface: Sandy loam,, firm	
SPR006	641570	7288198	C, O	A5	Creek bank		Photo 1235
SPR007	641502	7288322	C, O	A4	Active channel		
SPR009	641123	7289184	D, A	A1	ASC: Black Vertosol Landform: Alluvial plain Slope (%): <1 Vegetation: Cleared cultivation	Surface: cracking, medium self-mulching A1 0-5 cm Very dark greyish brown 10YR3/2, sandy clay weak sub angular blocky, pH 7.5 B21 5-100+ cm Very dark grey 10YR3/1, medium heavy clay, very hard, strong blocky, pH 8.5	Photo 1236, 1237
SPR010	638104	7285571	D, A	A5	ASC: Brown Chromosol Landform: Elevated levee Slope (%): 2 Vegetation: P. Box, Wilga	Surface: non-cracking, firm, massive (slight crust) A1 0-15 cm Brown 10YR3/3, clay loam, weak granular structure, field pH 5.5 B21 15-35 cm Dark brown, 10YR3/3, polyhedral , pH 6.5 B22 35-100+ cm Dark yellowish brown 10YR3/4, polyhedral pH 7.5	Photos 1238, 1239, 1240
SPR011	638226	7285422	C	A5	ASC: Brown Tenosol Landform: Creek bank Slope (%): 1-2	Surface: Massive, hard-set A1 0-15 FSL 10YR 5/4 Massive, pH 7.5 B21 15-100+ cm CL 10YR 4/3 Weak polyhedral structure pH 7.0	Photos 1241, 1242
SPR012	635529	7286888	D, A	A1	ASC: Brown Vertosol	Surface: cracking, medium coarse self-mulching	Photos 1243, 1244

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Landform: Level plain; melonhole depression Slope (%): <1 Vegetation: Cleared cultivation	A1 0-15 cm Dark greyish brown 7.5 YR 3/1, medium sub angular blocky, pH 7.0 B2115-100+ cm Very dark grey 7.5 YR 2.5/1, medium heavy clay, very hard angular blocky. pH 8.0	
SPR013	636444	7289917	O	B3	ASC: Black Vertosol Landform: Undulating plain	Black Vertosol	Photo 1246, 1247, 1248
SPR014	636564	7289221	O	B4	ASC: Brown Rudosol Landform: Hillside/crest Slope (%): >6 Vegetation: Wilga, bottle tree, Silver-leaved ironbark	Brown Rudosol > 20 % coarse fragments, very stony	Photo 1249
SPR015	636522	7288800	O, C	B2	Landform: Undulating plain Slope (%): 3-4 Vegetation: Brigalow	Black Vertosol, medium self-mulching, carbonate nodules at 60 cm	Photo 1250, 1251
SPR016	636054	7287262	O	B2	ASC: Brown Rudosol Landform: Undulating plain Slope (%): 3-4 Vegetation: Brigalow	Rocky surface	
SPR017	635975	7286922	O	A1	ASC: Black Vertosol Landform: Old alluvial terrace		
SPR018	636374	7286497	O	A4	ASC: Black Vertosol Landform: Active alluvial channel Vegetation: Wilga, Bauhinia Substrate: recent alluvium	Surface: No coarse fragments, cracking, firm A1 0-10 cm Greyish brown 10YR4/2, silty clay loam, weak granular structure, field pH 6.5 B21 10-120 cm Black 10YR3/1, med heavy clay, coarse weak blocky, prominent (10-15%) soft carbonate and grey mottles,	Variable soils within the active alluvial channels
SPR019	636585	7286021	O	B5	Ridge, coarse fragments	Rudosol	
SPR020	635994	7285442	O	B3	Landform: Undulating plain Slope (%): 3 Vegetation: Brigalow	Medium self-mulching black clay	
SPR021	638663	7286352	D, C	A4	ASC: Dermosol Landform: Active alluvial channel Vegetation: Wilga, Bauhinia, Poplar Box	Surface: No coarse fragments, non-cracking, firm sandy A1 0-10 cm Greyish brown 10YR4/2, light clay, weak, field pH 6.0	Variable soils within the active alluvial channels

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Substrate: recent alluvium	B21 10-45 cm light clay , 7.5 YR 3/3 pH 8.0 B22 45-100+ cm 7.5 YR 4/4, clay loam, prominent (10-15%) soft carbonate and grey mottles,	
SPR022	640923	7290058	O	A1	ASC: Black Vertosol Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark cracking clay	
SPR023	640025	7289908	D, A	A1	ASC: Black Vertosol Landform: Level plain Slope (%): < 1 Vegetation: Cleared cultivation	Surface: cracking, medium coarse self-mulching A1 0-10 cm Dark greyish brown 10 YR 3/1, medium clay, medium subangular blocky, pH 6.5 B21 10-100 cm +Very dark grey 10 YR 3/1, medium heavy clay, very hard angular blocky. pH 8.0	Photos 1270, 1271, 1272, 1273
SPR024	639828	7290011	O	B3	ASC: Black Vertosol Landform: Undulating plain Slope (%): 2-3 Vegetation: Brigalow	Medium self-mulching black clay	
SPR025	640444	7290210	O	A1	ASC: Black Vertosol Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark grey cracking clay	
SPR026	640070	7290577	A,O	B3	ASC: Black Vertosol Landform: Undulating plain Slope (%): 3 Vegetation: Brigalow	Medium self-mulching black clay	
SPR027	639667	7290203	O	B3	ASC: Black Vertosol Landform: Undulating plain Slope (%): 3 Vegetation: Brigalow	Medium self-mulching black clay	
SPR028	639943	7290184	O	B3	ASC: Black Vertosol Landform: Undulating plain Slope (%): 3 Vegetation: Brigalow	Medium self-mulching black clay	
SPR029	640178	7290701	O	B3	ASC: Black Vertosol Landform: Undulating plain	Medium self-mulching black clay	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Slope (%): 3 Vegetation: Brigalow		
SPR030	640549	7290819	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR031	639596	7290665	C, D	B1	Slope (%): 4-5 Vegetation: Mountain Coolibah, Silver-leaved Ironbark,	A1 0-4 cm Dark 10YR3/2, medium clay, strong granular, nil coarse fragments, field pH 7.5. B21 4-40 cm Dark 10YR3/2, medium heavy clay, strong angular blocky, field pH 7.5. C 40+ cm Weathered basalt	Colluvium
SPR032	639446	7290654	O	B4	Landform: Hillside/crest Slope (%): >6 Vegetation: Wilga, bottle tree, Silver-leaved ironbark	Brown Rudosol > 20 % coarse fragments, very stony	Rockiness 40 – 50% Photos 1284, 1285
SPR033	639564	7290914	O	B4	Landform: Hillside/crest Slope (%): 4-5 Vegetation: Wilga, bottle tree, silver-leaved ironbark	Brown Rudosol > 40 % coarse fragments, very stony	Rockiness 40 – 50% Iron stone
SPR034	640834	7289698	O,C	A4	ASC: Vertosol Landform: Active alluvial channel Vegetation: Wilga, Bauhinia, Substrate: recent alluvium	Surface: No coarse fragments, non-cracking, firm sandy Carbonate layer at 90 cm	Variable soils within the active alluvial channels Photo 1288, 1289
SPR035	640569	7289380	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR036	640338	7289134	A,O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR037	639978	7288972	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR038	639974	7288721	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
SPR039	640079	7288555	A,O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR040	640652	7288270	A,O	A5	Landform: Levee Slope (%): 1-2	Surface: Massive, hard-set	
SPR041	640653	7288723	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared	Grey Vertosol	
SPR042	637302	7285756	A,O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared	Grey Vertosol	
SPR043	634624	7286908	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Grey Vertosol	
SPR044	634351	7287265	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Grey Vertosol	
SPR045	634571	7287430	A,O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR046	634226	7287460	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR047	633624	7288323	C, O	B1	Landform: upper slope Slope (%): >5%	Non-cracking >20% surface cobble A1 0-35 cm dark 10YR3/2, medium heavy clay, strong granular, C 35+ cm Hard basalt	
SPR048	633456	7288533	O	B4	Landform: Hillside/crest Slope (%): >6 Vegetation: Wilga, bottle tree, Silver-leaved ironbark	Brown Rudosol > 20 % coarse fragments, very stony	
SPR049	633414	7289058	O, A	B4	Landform: Hillside/crest Slope (%): >6	Brown Rudosol > 20 % coarse fragments, very stony	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Vegetation: Wilga, bottle tree, Silver-leaved ironbark		
SPR050	638399	7286492	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR051	638248	7286659	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR052	637937	7286774	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR053	638222	7287530	O, A	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR054	638374	7287749	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR055	638615	7287663	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR056	638862	7287580	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR057	639106	7287744	O,A	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR058	639217	7288038	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR059	639205	7288782	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR060	638649	7287860	O	A1	Landform: Level plain Slope (%): 1	Dark Grey Vertosol	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
					Vegetation: Cleared cultivation		
SPR061	638341	7286437	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR062	638833	7286653	A,D	A5	Landform: Elevated levee Slope (%): 2 Vegetation: Poplar Box, Wilga	Surface: non-cracking, firm sandy, massive (slight crust) A1 0-15 cm Dark greyish brown 10YR4/2, clay loam, weak granular, field pH 5.5 B21 15-35 cm Dark brown, 10YR3/3, polyhedral, pH 6.5 B22 35-100+ cm Dark yellowish brown 10YR4/4, polyhedral pH 7.5	
SPR063	639190	7286870	A,O	A5	Landform: Levee Slope (%): 1-2	Surface: Massive, hard-set	
SPR064	639479	7287133	O	A5	Landform: Levee Slope (%): 1-2	Surface: Massive, hard-set	
SPR065	639548	7287350	O,A	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR066	639693	7287535	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR067	639532	7287956	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR068	639562	7288424	O,A	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR069	639598	7288771	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR070	639982	7288046	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
SPR071	640082	7288054	O,A	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR072	640209	7287988	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR073	640144	7287687	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR074	639849	7287404	A,O	A5	Landform: Levee Slope (%): 1-2	Surface: Massive, hard-set	
SPR075	639601	7286880	O	A5	Landform: Levee Slope (%): 1-2	Surface: Massive, hard-set	
SPR076	639346	7286618	O	A5	Landform: Levee Slope (%): 1-2	Surface: Massive, hard-set	
SPR077	639083	7286538	A,O	A5	Landform: Levee Slope (%): 1-2	Surface: Massive, hard-set	
SPR078	634911	7286858	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR079	635474	7286645	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR080	635169	7286579	O	A1	Landform: Level plain Slope (%): 1 Vegetation: Cleared cultivation	Dark Grey Vertosol	
SPR081	636621	7288445	D, A	B2	Landform: Mid slope of undulating plains. Mountain Coolibah, Grey Bloodwood	Surface: self-mulching, cracking A1 0-5 cm Very dark grey 10YR3/1, medium clay, strong granular B21 5-80 cm Very dark grey 10YR3/1, medium heavy clay, strong angular blocky. C 80+ cm Weathered basalt	
SPR082	636429	7288071	O	B2	Landform: Mid slope of undulating plains.	Surface: self-mulching, cracking	

Site No.	Easting	Northing	Type ¹	Soil	Landform / Vegetation	Soil Profile	Comments
SPR083	636147	7287405	O	B5	Landform: ridge Vegetation: Silver-leaved Ironbark	Hard setting, brown sandy surface, Non-cracking.	

