Strategic Cropping Land Assessment

Saraji East Project BHP Coal Pty Ltd

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1 INTRODUCTION

GT Environmental Pty Ltd (GTE) was commissioned by AECOM Australia Pty Ltd (AECOM) on behalf of BHP Coal Pty Ltd to complete a Strategic Cropping Land (SCL) assessment as part of an Environmental Impact Assessment (EIS) for the Saraji East Mining Lease Project (SEMLP) herein known as 'The Project'.

The project site encompasses areas of the SCL trigger map which fall in Exploration Permit for Coal (EPC) 837 and Mining Lease Application (MLA) 70383 (Figure 1), herein known as the "Project Site". The project site encompasses 2,068 hectares (ha) of land.

1.1 Study Background

The *Regional Planning Interests Act 2014* (RPI Act) regulates impacts from mining activities on identified areas of regional interest, including the strategic cropping area (SCA). The SCA comprises the areas of potential SCL that are shown on the SCL trigger map (Figure 1).

SCL is land that is, or is likely to be, highly suitable for cropping because of a combination of the land's soil, climate and landscape features. The SCL trigger map indicates the location of land that is potentially SCL. The SCL trigger map is maintained and certified by the Department of Natural Resources, Mines and Energy (DNRME).

An assessment of site-specific soil conditions against the SCL criteria listed in Schedule 3, Part 2 of the RPI Act is required to confirm the actual extent of SCL at a local scale. This report presents a site-specific SCL assessment for the project site.

The information presented in this this report is intended to be used by DNRME to review the SCL trigger mapping for the project site.

1.2 Study Scope and Structure

This scope of work for this SCL assessment was developed in accordance with RPI Act Statutory Guideline 08/14 which describes how to demonstrate that land in the SCA does not meet the criteria for SCL (Queensland Government, 2017). The scope of work comprised:

- A desktop study of relevant information for the project site, including satellite imagery, topographic information and regional soils information. This information was used to review the current identified soil types and physical cropping limitations at the project site;
- A SCL field investigation to ground-truth the preliminary soil mapping and collect detailed information on soil distribution, topographic constraints, and physical and chemical soil conditions across the project site;
- Ground-truthed soil mapping at an appropriate scale for SCL assessment; and
- A site-specific assessment of SCL map unit polygons against the SCL criteria.

The following sections are outlined;

• The assessment methodology is presented in Section 2;

- The map units are presented in Section 3;
- SCL assessment for each of the map units is presented in Section 4; and
- Conclusions of the assessment are presented in Section 5.

Appendices A to B provide detailed descriptions of each observation site, Appendix C presents the laboratory analysis and Appendices D and E provide soil water storage assessments and supporting calculations, respectively.

2 SCL METHODOLOGY

2.1 Desktop Study

A desktop study was undertaken prior to the field investigation.

The purpose of the desktop study was to obtain background information on the potential soil types and landscapes likely to occur across the project site, information on the topography of the project site, and to understand potential SCL limitations.

The desktop assessment involved database searches, interpretation of recent high-resolution satellite imagery, a review of unpublished soils report, mapping, and reviews of previous relevant soils resources, including:

- Gunn et al. (1968), Lands of Dawson-Fitzroy Area, Queensland;
- GT Environmental Services (2011), Saraji East Coal Mine Project, Soils and Land Suitability (unpublished) [BHP Billiton Mitsubishi Alliance (2012), Saraji East EIS Project, Chapter 4 Land Resources (unpublished)]; and
- CSIRO land system boundaries showing landscape patterns identified from air photo interpretation with some field descriptions. from Google Earth (accessed on June 2018).

This information was used to develop a map of soils and physical cropping limitations at the project site.

2.2 SCL Field Survey

Field surveys were undertaken between 30 June and 1 July 2018, 3 June and 6 June 2019 and 29 June to 30 June 2019 in accordance with the RPI Act Statutory Guideline 08/14. The field surveys were undertaken by Associate Environmental Scientist Reece McCann and Environmental Consultant Greg Tuck.

The field survey was developed to:

- Target potential soil types and landscapes identified from desktop assessment;
- Collect information to comprehensively map and describe all soil types and landscapes present in the project site (Figure 2); and
- Gather sufficient information on each soil type and each of its component polygons (also known as 'map units') to confirm its SCL status.

A total of 128 observation sites were surveyed throughout the project site comprising:

 65 detailed sites (Figure 2) to allow identification of any physiographic factors or vegetation associations that characterise the site and associated map unit, the pedological characterisation of the soil and identification of soil features of relevance to the SCL assessment criteria;

- 58 analysed sites (i.e. detailed site from which soil samples are collected and subsequently analysed in a laboratory). Where a site is associated with gilgai two sub-sites were undertaken on the mound and depression. For the purposes of this assessment these are considered one site); and
- 63 check sites, including exclusion sites (Figure 2) to collect detail to allocate the site to a specific soil type and map unit.

Naming conventions for observation sites are as follows:

- Detailed sites with "-SCL" suffix indicates this is an existing site location (GT Environmental Solutions [GTES], 2011) with the same site number which was revisited and where required, samples for analysis taken, in order to confirm the accuracy of existing descriptions and to document the site in greater detail as required by RPI Act Statutory Guideline 08/14;
- Detailed sites with prefix "N" indicate this is a new location; and
- Check sites with prefix "NC" indicate this is a new check site.

The field investigation layout is shown on Figure 2. The layout was developed from the desktop study information and refined in the field. The field investigation was based on existing soil survey site locations (GTES, 2011) and free survey techniques (McKenzie et al. 2008 and Gunn et al. 1988) to verify soil types and assign boundaries to each map unit.

Free survey is a commonly used method in broader scale land assessment as it enables flexibility in site selection (compared with more rigid grid mapping techniques), to achieve a more accurate and time effective result. This method is appropriate to detailed-scale surveys and provides a suitable basis for siting check sites, detailed sites and analysis sites.

The field investigation included representative observation sites for each target soil type and map unit. The field investigation exceeded the density and number of observation sites required to support SCL mapping and assessment.

The observation site methodology is described in Sections 2.2.1 to 2.2.3.

2.2.1 Detailed Sites

Detailed sites were undertaken at 65 locations (Figure 2). The detailed sites were used to describe the range of soil profile morphological attributes as per the *National Committee on Soil and Terrain Guidelines* (2009) (including soil colour as per *Munsell Soil Colour Charts* [2009]), in addition to landforms, slope, surface conditions, rock cover and major vegetation (RPI 08/14).

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

The information recorded for detailed sites included:

- site identification code;
- GPS location (GDA94);

- type of soil observation (e.g. erosion exposed cutting or hand auger);
- major vegetation types;
- landform type, position of the site and slope gradient;
- surface condition (e.g. presence of cracks, surface crust, rocks, stones and cobbles, 'erosion status, gilgai);
- types and vertical extent of soil horizons;
- colour (*Munsell Soil Colour Charts*, 2009) and mottling of each horizon;
- observations of field texture, pH, presence and abundance of segregations, coarse fragments, structure, consistence and pedality, moisture content and boundary type for each horizon;
- presence of organic matter, roots and prevalence of biological activity;
- presence of gleyed horizons, iron staining, jarosite presence and field pH; and
- photographs of the soil profile, surface and surrounding landscape.

Detailed site descriptions for the project are presented in Appendix A.

2.2.2 Analysed Sites

Detailed sites were selected for chemical analysis based on the density and map unit distribution.

Soil samples were collected from detailed sites for chemical analysis. Soil sampling of profiles was conducted as per McKenzie et al. (2008), with samples taken at standard depths incorporating the surface and every horizon change in the soil profile (typically at depths of 0.0-0.10 metres (m), 0.20-0.30 m, 0.50-0.60 m, 0.7-0.8 m and 0.90-1.00 m).

Where appropriate, these depths were modified for sites where field observations revealed soil horizons intersecting at these nominated depths, to ensure samples were collected in each separate horizon, and not across multiple horizons or in sub-horizon boundaries.

The detailed sites were analysed based on the western cropping zone requirements (RPI 08/14) for field identified rigid and non-rigid soils including:

- pH_{1:5};
- chloride;
- cation exchange capacity, (rigid soils only);
- exchangeable sodium percentage (rigid soils only);
- calcium and magnesium ratio (Ca:Mg ratio) (rigid soils only);
- particle size analysis; and
- soil moisture content at-1.5Mpa (where required).

Laboratory results are presented in Appendix E.

2.2.3 Check Sites

Check sites were undertaken at 63 locations (Figure 2). These sites are used where defining attributes of the characteristic soil in a map unit could not be readily identified. Site attributes recorded include surface soil colour, texture, condition, presence of gilgai, vegetation, landform, site identification code, GPS coordinates, and where necessary for reference, photographs taken.

These sites record information and data for each site including a site identification code, GPS coordinates and SCL assessment criteria for slope, rockiness and/or gilgai (RPI 08/14). These sites may be used for the verification of slope, surface cover of rocks, gilgai coverage and depth.

Check site descriptions for the project site are presented in Appendix B.

2.3 SCL Mapping

The findings of the field investigation were used to produce a ground-truthed map of soil types (Figure 2) in the project site. The properties of each map unit have been assessed against the SCL assessment criteria.

2.4 SCL Assessment

The SCL assessment criteria thresholds for the SCA Western Cropping Zone are listed in Table 2-1.

Criteria	Thresholds for Western Cropping Zone
Slope	Equal to or less than 3%
Rockiness	Equal to or less than 20% for rocks greater than 60mm in diameter
Gilgai	Less than 50% of land surface being gilgai of greater than 500mm in depth
Soil depth	Equal to or greater than 600mm
Soil wetness	Has favourable drainage
Soil pH	For rigid soils, the soil at 300mm and 600mm soil depth must be within the range of pH1:5 5.1 to pH1:5 8.9 inclusive For non-rigid soils, the soil at 300mm and 600mm soil depth must be greater than pH1:5 5.0.
Salinity	Chloride content is less than 800mg/kg at 600mm soil depth
Soil water storage	Equal to or greater than 100mm to a soil depth or soil physico-chemical limitation of equal to or less than 1000mm

Table 2-1: SCL Assessment Criteria

Each map unit has been assessed against the SCL criteria thresholds for the SCA's Western Cropping Zone. This assessment was undertaken in accordance with the specific assessment techniques for each criterion described in RPI Act Statutory Guideline 08/14 Appendix 1: Measurement methods and reporting requirements. Map units must be within all SCL criteria to be considered SCL. Map units that do not meet one or more of the SCL criteria are not SCL.

The assessment techniques undertaken for each criterion are described below.

2.4.1 Slope

Slope was primarily assessed during fieldworks using a hand-held clinometer for on-ground measurements. The following procedures were applied to demonstrate either compliance or non-compliance with the slope criterion:

- Observation sites within exclusion areas were selected on an unbiased basis;
- Slope was measured over a minimum distance of 20m up to 50m with at least two measurements, an up and down gradient spanning the observation site;
- The site being assessed for slope did not include any significant changes or breaks of slope; and
- Artificial features such as contour banks and tracks were excluded.

A minimum of three detailed sites and two check sites within each map unit were obtained with the average of recorded slope values determined to two decimal points and compared to the threshold values in A1.1 of the RPI Act Statutory Guideline 08/14.

GTE reviewed available soil survey information to highlight potential areas of concern to target during fieldwork and to assist in giving confidence that field observation sites accurately represent areas less than, equal to or more than 3.0% slope.

2.4.2 Rockiness

Rockiness was assessed by visually estimating the surface cover of coarse fragments (average maximum dimension larger than 60 mm) and rock outcrops within a ten-metre radius. Where rockiness was present and visually observed either at or above criterion, measurement tape was used over a random selected line in the site, with individual photos taken of each 1.0m² area for further assessment.

2.4.3 Gilgai

Gilgai was assessed during fieldworks by determining the depth of the gilgai (greater than 500 mm) and density of the gilgai depressions (greater than 50% of the land surface). Where sites may have been considered an exclusion site or where initial assessment required further measurement, the following would be completed.

• A horizontal tape was used between adjacent mounds and the height measured from the tape to the lowest part of the intervening depression.; and

• GPS coordinates were recorded for the ten measurements to assist in assessing the density.

2.4.4 Soil depth

Soil depth was determined primarily by use of hand auger to expose the soil profile. The description of detailed sites soil profiles (Appendix A) includes any physical barrier encountered such as hard pans, gravel layers or bedrock.

2.4.5 Soil wetness

Soil wetness was determined by examining the soil profile for characteristics indicating severely impaired soil drainage. This was assessed by reviewing the soil horizons and mottle colours using a standard soil colour chart (Munsell Soil Colour Charts, 2009).

Colours of the soil matrix and all mottles have been identified for each soil horizon. All colours have been reported in a moist soil state other than conspicuously bleached horizons, where dry soil colour has been reported.

2.4.6 Soil pH

Determination of soil pH was measured by a National Association of Testing Authorities (NATA) accredited and Australasian Soil and Plant Analysis Council (ASPAC) certified laboratory using suitable methods (4A1 in Raymont & Lyons [2011]). pH 1:5 values were tested at all sampling depths including 300 mm and 600 mm soil depths.

2.4.7 Soil salinity

Soil salinity was determined by measurement of chloride by an accredited NATA and ASPAC accredited laboratory using suitable methods (5A2 in Raymont & Lyons [2011]). Chloride values were tested at all sampling depths including 300 mm and 600 mm soil depths.

2.4.8 Soil water storage

Soil water storage was determined by calculating the amount of water that is capable of being stored in a soil horizon layer within the effective rooting depth (ERD) in a soil profile and that is available for plant use. The ERD is whichever represents the lesser of the following:

- A depth of 1000 mm; or
- The depth at which a physio-chemical limitation is encountered; or
- The depth of a physical barrier.

Physico-chemical limitation on effective rooting depth is represented by the following:

- a chloride content of more than 800mg/kg for any soil in the Western Cropping zone or Eastern Darling Downs zone; or
- a pH1:5 value of 5.0 or less for any soil in any zone; or
- for rigid soils in any zone that are (1) not sandy loam or lighter textured soils, and (2) have a Cation Exchange Capacity (CEC) value greater than 3 cmol+/kg and have:

- o a pH1:5 of more than 8.9; or
- \circ an exchangeable sodium percentage value of more than 15; or
- a calcium to magnesium ratio of 0.1 or less.

The RPI Act Statutory Guideline 08/14 provides a two-stage method for estimating soil water storage:

- Stage 1 uses a soil texture lookup table (Table A1.2 of the RPI Act Statutory Guideline 08/14; and
- Stage 2 uses the PAWCER pedotransfer function (gravimetric water content, -1.5 MPa), herein referred to as PAWCER.

Stage 1 assessment is suitable where particle size analysis and soil texture lookup values are more than 15% below the SCL criterion threshold. If the Stage 1 assessment indicates marginal soil water storage (i.e. within 15% below the SCL criterion threshold) it is necessary to undertake a Stage 2 assessment.

The PAWCER calculation and assessments are presented in Appendix D.

3 SOIL MAPPING AND DESCRIPTIONS

A total of 17 map units were identified in the project site with spatial distribution shown on Figure 2. Table 3-1 provides a summary of each map unit including its concept and Australian Soil Classification (ASC).

The soil type mapping shown on Figure 2 was compared with the SCL mapping criteria. The purpose of the SCL mapping criteria is to ensure that ground-truthed soil mapping is produced at a suitable scale. Soil types therefore meet the minimum SCL mapping criteria and are large enough to be mapped as map units on Figure 3.

A detailed description of each map unit based on the field investigation is provided in Sections 3.1 to 3.17.

Map Unit	Concept	Australian Soil Classification
1	Mixed brigalow scrub on black cracking clays	Black Dermosol
2	Dark black sands with sandy loam subsoils near drainage lines	Black Dermosol
3	Dark black clay soils on cleared gently undulating plains	Black Vertosol
4	Dark grey, greyish brown sandy loams to sandy clay loams near drainage lines	Black Dermosol
5	Black duplex sandy loam to clay soils on gently undulating plains with mixed tall to medium spares eucalyptus species	Black dermosol (with minor grey dermosol variant)
6	Dark sandy clay with coarser structured clay subsoils on gently undulating plains	Black Dermosol
7	Crusting grey clay with subdominant black soils on gently undulating plains with mixed shrubbery	Crusting Grey Vertosol (with minor black vertosol variant)
8	Dark greyish brown weak to moderately structured clay soils on cleared gently undulating plains	Black Dermosol
9	Uniform to slightly gradational black vertosol on gently undulating plains used for cropping	Black Vertosol
10	Deep sandy clay loams with clay subsoils on gently undulating plains of tall woodlands	Black Dermosol
11	Dark grey clay loams to grey brown clays within forested drainage line areas.	Grey Dermosol
12	Black, well-structured clays on gently undulating cropping land	Black Vertosol
13	Black, well-structured clays on gently undulating cropping land	Black Vertosol
14	Texture contrast sandy loams over red clay subsoils on cleared gently undulating plains	Red Chromosol

Table 3-1: Summary of Map Units

Map Unit	Concept	Australian Soil Classification
15	Dark uniform to gradational clay soils on lower sloped plains and open depression	Black Vertosol
16	Dark brown clay soils with gilgai microrelief on gently undulating plains of mixed regrowth	Black Vertosol
17	Dark cracking clays on basalt with cropping on undulating plains	Black Vertosol

3.1 Map Unit 1

Overview

Map Unit 1 consists of light black clay with coarser structured subsoils on uplands of mixed brigalow scrub. This map unit is in the north-east portion of the project site and covers an area within the SCL trigger map of 70.6 ha.

Observation Sites

A total of 6 observation sites were completed within this map unit and are summarised in Table 3-2. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 11.76 ha.

Table 3-2: Observation Sites for Map Unit 1

Observation Sites				
Check	Detailed (analysed)			
3	3 (3)			

A land summary of detailed Site N6 is presented in Table 3-3, soil profile description in Table 3-4 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N6, Site N7 and Site N8, were selected to undergo chemical analysis for Map Unit 1. The soil chemistry results for the three selected detailed sites are presented in Tables 3-5 to 3-7.

ltem	Description				
Representative Site	N6				
Representative Site photograph	<image/>				
Location	643271mE 7514881mN				
Current Use	Grazing				
Site survey type	Detailed, 50 mm hand auger.				
Vegetation	Buffel grass				
Disturbance	Semi-disturbed				
Landform element /pattern	Very gently undulating plain midslope				
Micro relief	Nil microrelief				
Erosion	Nil erosion				
Slope (%)	3.0/3.0				
Drainage	Imperfect				
Surface coarse fragments	Nil coarse fragments				
Surface condition	Cracking, soft				
ASC Order (s)	Black dermosol				
Total area (ha)	70.6				

Table 3-3: Map Unit 1

Site N6 (Previou sly N6- SCL as per photo)									
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A1 0.00-0.17 Abrupt	Clay Loam	Moderate, firm<30mm sub- angular	Nil	10YR3/2 Very dark greyish brown Nil mottles/ bleach	Moderate moist, rapid	Few fine	0.10 / 7.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.90-1.00	Nil
B21 0.17-0.89 Abrupt	Medium clay	Moderate, firm < 50mm sub- angular	5% calcium carbonate nodules	10YR3/1 Very dark grey Very dark grey Nil mottles/ bleach	Dry, moderate	Very fine, very few	0.30 / 7.0 0.60 / 8.0		
B22 0.89-1.00	Medium clay	Moderate, firm < 50mm sub- angular	5% calcium carbonate nodules	10YR3/2 Very dark greyish brown Nil mottles/ bleach	Dry, moderate	Very fine, very few	0.90 / 8.5		

Table 3-4: Soil Profile Morphology Summary Map Unit 1

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Table 3-5: Soil Chemistry Results for Detailed Site N6

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.77-0.87	0.90-1.00	
Soil pH	7.15	8.27	8.94	8.66	8.68	
Soil Cl (mg/kg)	9	7	320	1429	1213	
PSA-Sand (>20µm %)	54.4	56.7	29.0	36.9	47.5	
PSA-Fine Silt (2-20µm %)	19.3	13.1	20.1	25.9	16.3	
PSA-Clay (<2µm%)	26.2	30.2	51.0	37.2	36.3	
15 Bar (%)	22	23	31	26	22	
CEC (meq/100g)	38.0	36.2	41.9	43.7	40.0	
Ca/Mg (ratio)	2.0	1.8	1.2	1.0	1.0	
ESP (%NaCEC)	1	5	12	14	13	

Table 3-6: Soil Chemistry Results for Detailed Site N7

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	7.61	8.52	9.15	8.90	8.80	
Soil CI (mg/kg)	21	50	306	980	1014	
PSA-Sand (>20µm %)	64.1	66.7	59.9	53.7	49.6	
PSA-Fine Silt (2-20µm %)	12.4	9.9	4.3	11.3	11.3	
PSA-Clay (<2µm%)	23.5	23.3	35.8	35.1	39.1	
15 Bar (%)	14	17	20	23	22	
CEC (meq/100g)	24.1	26.4	31.1	35.9	40.5	
Ca/Mg (ratio)	2.7	2.2	0.8	0.6	0.6	
ESP (%NaCEC)	1	2	9	13	13	

Table 3-7: Soil Chemistry Results for Detailed Site N8

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.80-0.90	0.90-1.00			
Soil pH	7.29	8.87	9.37	9.16	8.98	
Soil Cl (mg/kg)	15	82	166	643	949	
PSA-Sand (>20µm %)	77.3	69.9	58.5	53.2	47.2	
PSA-Fine Silt (2-20µm %)	6.0	10.7	7.4	7.3	9.9	
PSA-Clay (<2µm%)	16.7	19.4	34.1	39.6	42.9	
15 Bar (%)	13	17	24	26	26	
CEC (meq/100g)	25.5	32.1	40.8	40.6	48.1	
Ca/Mg (ratio)	1.6	1.0	0.6	0.5	0.5	
ESP (%NaCEC)	0	4	11	13	13	

3.2 Map Unit 2

Overview

Map Unit 2 consists of black sands with sandy loam subsoils near drainage lines. This map unit is in the north portion of the project site and covers an area within the SCL trigger map of 9.6 ha.

Observation Sites

A total of 7 observation sites were completed within this map unit and are summarised in Table 3-8. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 1.37 ha.

Table 3-8: Observation Sites for Map Unit 2

Observation Sites					
Check	Detailed (analysed)				
4	3 (3)				

A land summary of detailed Site N17 is presented in Table 3-9, soil profile description in Table 3-10 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N17, Site N18 and Site N19, were selected to undergo chemical analysis for Map Unit 2. The soil chemistry results for the three selected detailed sites are presented in Tables 3-11 to 3-13.

Item	Description
Representative Site	N17
Representative Site photograph	
Location	643797mE 7514822mN
Current Use	Grazing
Site survey type	Detailed, 50 mm hand auger.
Vegetation	Brigalow, Mount Coolibah
Disturbance	Nil disturbance
Landform element /pattern	Gently undulating plain, stream channel / depression
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	<2% / <2%
Drainage	Well-moderate
Surface coarse fragments	No coarse fragments
Surface condition	Soft
ASC Order (s)	Black Dermosol
Total area (ha)	9.6 (Extends outside the project site >10 ha)

Table 3-9: Map Unit 2

Site N17									
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A1 0.00-0.10 Abrupt	Loamy sand	Massive, loose	<1% coarse fragments	10YR3/1 Nil mottles / bleaching	Dry, well	Yes	0.10 / 8.5	0.00-0.10 0.10-0.20 0.20-0.30	Nil
B21 0.10-0.20 Abrupt	Sandy Ioam	Moderate, very firm sub- angular <20mm	<1% coarse fragments	10YR3/1 Nil mottles / bleaching	Dry, well – moderate	Yes	0.20 / 8.5	0.50-0.60 0.80-0.88	
B21 0.20-0.47 Abrupt	Sandy Ioam	Moderate, very firm sub- angular <10mm	< 10% coarse fragments	10YR3/1 Nil mottles / bleaching	Dry, well – moderate	Yes	0.30 / 8.5		
B21 0.47-0.88 End of Borehole (EOBH)	Sandy Ioam	Moderate, very firm sub- angular <10mm	<20% coarse fragments	10YR4/2 Nil mottles / bleaching	Dry, well – moderate	Yes – 0.60m bgl	0.60 / 8.5		

 Table 3-10: Soil Profile Morphology Summary Map Unit 2

Table 3-11: Soil Chemistry Results for Detailed Site N17

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.10-0.20	0.20-0.30	0.50-0.60	0.80-0.88		
Soil pH	6.75	8.62	9.25	9.43	9.31		
Soil Cl (mg/kg)	9	39	186	540	800		
PSA-Sand (>20µm %)	76.4%	67.4%	69.6%	65.7%	57.3%		
PSA-Fine Silt (2-20µm %)	6.0%	3.3%	1.5%	5.9%	9.4%		
PSA-Clay (<2µm%)	17.6%	29.3%	28.9%	28.4%	33.4%		
CEC (meq/100g)	16.28	22.08	23.15	20.55	19.97		
Ca/Mg (ratio)	2.5	10.4	14.2	20.5	23.2		
ESP (%NaCEC)	2.7	1.2	0.9	0.6	0.6		

Table 3-12: Soil Chemistry Results for Detailed Site N18

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00		
Soil pH	7.26	8.94	9.34	9.51	8.94		
Soil Cl (mg/kg)	9	112	508	916	1194		
PSA-Sand (>20µm %)	73.6	62.3	55.0	49.8	51.4		
PSA-Fine Silt (2-20µm %)	4.9	3.2	4.5	12.9	11.2		
PSA-Clay (<2µm%)	21.5	34.6	40.6	37.4	37.5		
CEC (meq/100g)	14.54	20.26	21.74	24.98	29.45		
Ca/Mg (ratio)	1.4	13.4	20.7	23.5	24.7		
ESP (%NaCEC)	3.0	0.9	0.6	0.5	0.4		

Table 3-13: Soil Chemistry Results for Detailed Site N19

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-0.95		
Soil pH	8.28	8.78	9.25	9.39	9.42		
Soil CI (mg/kg)	22	20	147	258	461		
PSA-Sand (>20µm %)	87.8%	65.5%	73.2%	70.7%	65.6%		
PSA-Fine Silt (2-20µm %)	5.9%	3.7%	-1.5%	5.8%	7.0%		
PSA-Clay (<2µm%)	6.3%	30.8%	28.2%	23.5%	27.4%		
CEC (meq/100g)	15.09	18.99	17.52	16.55	17.69		
Ca/Mg (ratio)	1.6	5.6	12.6	16.6	19.4		
ESP (%NaCEC)	3.8	1.6	0.8	0.7	0.6		

3.3 Map Unit 3

Overview

Map Unit 3 consists of black clay soils on cleared gently undulating plains. This map unit is in the north-east portion of the project site and covers an area within the SCL trigger map of 59.3 ha.

Observation Sites

A total of 5 observation sites were completed within this map unit and are summarised in Table 3-14. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 11.86 ha.

Table 3-14: Observation Sites for Map Unit 3

Observation Sites				
Check	Detailed (analysed)			
2	3 (3)			

A land summary of detailed site 60-SCL is presented in Table 3-15, soil profile description in Table 3-16 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site 60-SCL, Site N15 and Site N16, were selected to undergo chemical analysis for Map Unit 3. The soil chemistry results for the three selected detailed sites are presented in Tables 3-17 to 3-19.

Table	3-15:	Map	Unit 3	
			•	

ltem	Description
Representative Site	60-SCL
Representative Site photograph	
Location	643839mE 7514447mN
Current Use	Cropping, Grazing
Site survey type	Detailed, 50 mm hand auger.
Vegetation	Grasses
Disturbance	Extensively disturbed
Landform element /pattern	Very gently undulating plains, upper slope
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	0/2
Drainage	Well to well moderate
Surface coarse fragments	Nil coarse fragments
Surface condition	Self-mulching with cracking
ASC Order (s)	Black Vertosol
Total area (ha)	59.3

Site 60-SCL							60		
Horizon Depth (m), Boundar -v (Bdv)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH	Samples (m)	Observati -ons
A1 0.0 – 0.13 Abrupt	Light clay	Moderate, Sub- rounded, peds <10 mm, soft	Nil	10YR3/2 Nil mottle / bleaching	Dry, well drained	Fine, very few	0.10 / 7.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.90-1.00	Nil
B21 0.13 – 0.41 Abrupt	Medium clay	Moderate, Subangular blocky, peds <20 mm, firm	Nil	10YR2/1 Nil mottle / bleaching	Dry, well drained	Very fine, very few	0.30 / 7.5		
B22 0.41 - 1.00	Medium clay	Moderate, Subangular blocky, peds <20 mm, firm	<2% calcium carbonate	10YR2/1 Nil mottle / bleaching	Dry, moderately well drained	Nil roots	0.60 / 7.0 0.90 / 7.0		

Table 3-16: Soil Profile Morphology Summary Map Unit 3

Table 3-17: Soil Chemistry Results for Detailed Site 60-SCL

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.				0.90-1.00		
Soil pH	7.72	8.90	8.38	8.72	8.73		
Soil Cl (mg/kg)	9	17	163	458	633		
PSA-Sand (>20µm %)	56.8	48.3	42.8	40.9	40.4		
PSA-Fine Silt (2-20µm %)	6.6	10.4	10.2	9.0	5.9		
PSA-Clay (<2µm %)	36.6	41.4	47.0	50.2	53.7		

Table 3-18: Soil Chemistry Results for Detailed Site N15

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10 0.20-0.30 0.55-0.60 0.80-0.5				0.90-1.00	
Soil pH	8.13	8.64	8.97	8.55	8.76	
Soil CI (mg/kg)	24	27	196	409	634	
PSA-Sand (>20µm %)	59.9%	47.5%	46.2%	48.1%	39.9%	
PSA-Fine Silt (2-20µm %)	2.8%	6.4%	7.5%	8.5%	8.0%	
PSA-Clay (<2µm%)	37.2%	46.0%	46.3%	43.4%	52.1%	

Table 3-19: Soil Chemistry Results for Detailed Site N16

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00		
Soil pH	7.92	8.67	8.74	8.72	8.78		
Soil Cl (mg/kg)	9	38	120	255	354		
PSA-Sand (>20µm %)	59.5%	58.1%	53.3%	44.6%	46.7%		
PSA-Fine Silt (2-20µm %)	7.9%	4.8%	7.5%	12.2%	5.2%		
PSA-Clay (<2µm%)	32.6%	37.1%	39.2%	43.2%	48.1%		

3.4 Map Unit 4

Overview

Map Unit 4 consists of dark grey, greyish brown sandy loams to sandy clay loams near drainage lines. This map unit is in the north-east portion of the project site and covers an area within the SCL trigger map of 8.3 ha.

Observation Sites

A total of 6 observation sites were completed within this map unit and are summarised in Table 3-20. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 1.38 ha.

Table 3-20: Observation Sites for Map Unit 4

Observation Sites				
Check	Detailed (analysed)			
3	3 (3)			

A land summary of detailed Site N20 is presented in Table 3-21, soil profile description in Table 3-22 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N20, Site N21 and Site N22, were selected to undergo chemical analysis for Map Unit 4. The soil chemistry results for the three selected detailed sites are presented in Tables 3-23 to 3-25.

Table 3-21: Map Unit 4

Item	Description
Representative Site	N20
Representative Site photograph	<image/>
Location	642943mE 7513907mN
Current Use	Grazing
Site survey type	Detailed, 50 mm hand auger.
Vegetation	Brigalow
Disturbance	Nil disturbance, clearing nearby outside the immediate drainage line area
Landform element /pattern	Very gently undulating plain, Alluvial depression, stream channel
Micro relief	Nil microrelief
Erosion	Nearby sheet and gully erosion
Slope (%)	1.0 / 0.0
Drainage	Well to well and moderate
Surface coarse fragments	<10% <5mm
Surface condition	Soft, minor cracking
ASC Order (s)	Black Dermosol
Total area (ha)	8.3 (Extends outside the project site >10 ha)

Site N20							N2(
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A1 0.00-0.12 Abrupt	Sandy Ioam	Weak to moderate, soft sub- rounded <10mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well	Yes	0.10 / 8.5	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.9-1.00	Nil
B21 0.12-0.37 Abrupt	Sandy Ioam	Moderate, firm sub- rounded <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well – moderate	Yes	0.20 / 8.5		
B22 0.37-0.68 Abrupt	Sandy Ioam	Moderate, firm sub- rounded <20mm	<2% calcium carbonate	7.5YR3/2 Dark brown Nil mottle / bleaching	Dry, well – moderate	Yes	0.30 / 8.5		
B23 0.68-0.85 Abrupt	Sandy clay loam	Moderate, very firm sub- rounded <20mm	<20% calcium carbonate	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well – moderate	Yes	-		
B24 0.85-1.00 EOBH	Sandy clay loam	Moderate, very firm sub- rounded <20mm	<5% calcium carbonate	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well – moderate	Nil	0.90 / 8.5		

Table 3-22: Soil Profile Morphology Summary Map Unit 4

Table 3-23: Soil Chemistry Results for Detailed Site N20

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.75-0.85	0.90-1.00		
Soil pH	7.37	8.13	8.90	9.24	9.18		
Soil Cl (mg/kg)	4	4	22	148	420		
PSA-Sand (>20µm %)	60.6%	68.0%	67.3%	55.9%	48.7%		
PSA-Fine Silt (2-20µm %)	12.2%	6.0%	4.3%	8.2%	5.2%		
PSA-Clay (<2µm%)	27.2%	25.9%	28.4%	35.8%	46.1%		
CEC (meq/100g)	21.70	21.01	22.18	31.82	37.84		
Ca/Mg (ratio)	0.7	1.7	7.4	13.2	17.0		
ESP (%NaCEC)	3.0	2.0	1.1	0.7	0.6		

Table 3-24: Soil Chemistry Results for Detailed Site N21

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.58	0.80-0.90	0.90-1.00		
Soil pH	7.19	8.10	9.08	9.23	9.04		
Soil Cl (mg/kg)	3	27	87	304	591		
PSA-Sand (>20µm %)	66.6%	61.9%	58.1%	51.8%	41.2%		
PSA-Fine Silt (2-20µm %)	4.0%	6.7%	5.1%	5.9%	7.2%		
PSA-Clay (<2µm%)	29.4%	31.4%	36.8%	42.3%	51.6%		
CEC (meq/100g)	24.20	22.93	28.42	26.27	42.90		
Ca/Mg (ratio)	0.6	3.1	10.5	10.7	15.8		
ESP (%NaCEC)	2.2	1.6	0.9	0.8	0.6		

Table 3-25: Soil Chemistry Results for Detailed Site N22

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00		
Soil pH	7.41	8.35	8.96	9.04	8.98		
Soil CI (mg/kg)	11	22	83	182	359		
PSA-Sand (>20µm %)	64.9%	62.1%	61.9%	60.7%	55.5%		
PSA-Fine Silt (2-20µm %)	8.3%	7.4%	8.7%	2.1%	3.7%		
PSA-Clay (<2µm%)	26.8%	30.4%	29.4%	37.3%	40.8%		
CEC (meq/100g)	23.12	28.16	28.48	27.22	34.80		
Ca/Mg (ratio)	1.0	4.3	8.9	12.4	14.1		
ESP (%NaCEC)	2.7	1.8	1.1	0.8	0.7		

3.5 Map Unit 5

Overview

Map Unit 5 consists of a black and grey duplex sandy loam to clay soils on gently undulating plains with mixed eucalyptus species. It was observed a minor sub-dominant colour of brown duplex soils within the map unit with check site to the north indicating that the area is small. Map Unit 5 is in the northern portion of the project site and covers an area within the SCL trigger map of 18.3 ha.

Observation Sites

A total of 5 observation sites were identified within this map unit which are summarised in Table 3-26. Check site to the south (NC-13) indicates that the minor grey dermosol site observed is a very minor sub-dominant soil type in the map unit. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 3.66 ha.

Table 3-26: Observation Sites for Map Unit 5

Observation Sites					
Check	Detailed (analysed)				
2 (Outside the map unit)	3 (3)				

A land summary of Detailed Site N5 for the map unit is presented in Table 3-27, soil profile description in Table 3-28 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N4, Site N5 and Site N9, were selected to undergo chemical analysis. The soil chemistry results for the three selected detailed sites are presented in Tables 3-29 to 3-31.

ltem	Description
Representative Site	N5
Representative Site photograph	
Location	641792mE 7513825mN
Current Use	Grazing
Site survey type	Detailed, 50 mm hand auger.
Vegetation	Eucalyptus species
Disturbance	Semi-disturbed
Landform element /pattern	Very gently undulating plain mid-slope
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	3.0/3.0
Drainage	Moderate
Surface coarse fragments	Nil
Surface condition	Soft
ASC Order (s)	Black dermosol (with minor grey dermosol variant, site N4)
Total area (ha)	18.3

Table 3-27: Map Unit 5

Site N5 (Previou sly N5- SCL as per photo)						NS	s-sa		
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A1 0.00-0.12 Abrupt	Sandy Ioam	Weak, soft <10mm sub- rounded	Nil	10YR3/1 Very dark grey Nil mottles/ble ach	Moderate moist, rapid	Few fine	0.10 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.90-1.00	Nil
B21 0.12-0.45 Abrupt	Light clay with minor sand	Moderate, firm <30mm sub- angular	Nil	10YR2/1 Black Nil mottles/ble ach	Moderately moist, moderate	Very fine, very few	0.30 / 7.5		
B22 0.45-0.80 Abrupt	Medium clay	Moderate, firm <30mm sub- angular	2% calcium carbonate nodules	10YR2/1 Black Nil mottles/ble ach	Dry, moderate	Very fine, very few	0.60 / 8.0		
B23 0.80-1.00 EOBH	Medium clay	Moderate, strong <30mm sub- angular	2% calcium carbonate nodules	10YR3/3 Dark brown Nil mottles/ble ach	Dry, moderate	Very fine, very few	0.90 / 8.0		

Table 3-28: Soil Profile Morphology Summary Map Unit 5

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Table 3-29: Soil Chemistry Results for Detailed Site N4

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00		
Soil pH	7.57	8.06	9.23	9.24	9.18		
Soil CI (mg/kg)	28	30	140	280	514		
PSA-Sand (>20µm %)	93.2	66.2	65.6	60.7	59.3		
PSA-Fine Silt (2-20µm %)	1.1	7.5	12.0	16.0	17.6		
PSA-Clay (<2µm%)	5.7	26.3	22.5	23.3	23.1		
15 Bar (%)	11	16	14	15	14		
CEC (meq/100g)	14.6	21.9	20.9	21.0	22.6		
Ca/Mg (ratio)	2.0	1.6	0.9	0.7	0.6		
ESP (%NaCEC)	1	3	5	8	9		

Table 3-30: Soil Chemistry Results for Detailed Site N5

	Sample Depth (m)						
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00		
Soil pH	6.82	8.05	9.03	9.04	9.03		
Soil Cl (mg/kg)	63	15	201	649	918		
PSA-Sand (>20µm %)	78.6	67.0	65.0	62.2	61.6		
PSA-Fine Silt (2-20µm %)	7.3	10.3	7.5	5.0	9.3		
PSA-Clay (<2µm%)	14.1	22.6	27.5	32.9	29.1		
15 Bar (%)	14	18	20	20	21		
CEC (meq/100g)	18.6	27.8	36.6	33.8	32.0		
Ca/Mg (ratio)	2.0	1.6	0.9	0.7	0.6		
ESP (%NaCEC)	1	3	9	11	10		

Table 3-31: Soil Chemistry Results for Detailed Site N9

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.77	7.90	9.20	9.14	9.01
Soil Cl (mg/kg)	12	6	235	543	929
PSA-Sand (>20µm %)	81.8	76.4	65.1	59.9	55.5
PSA-Fine Silt (2-20µm %)	7.0	4.1	6.4	15.9	17.1
PSA-Clay (<2µm%)	11.2	19.5	28.5	24.2	27.4
15 Bar (%)	12	13	19	17	18
CEC (meq/100g)	17.0	18.8	32.9	25.4	29.8
Ca/Mg (ratio)	2.0	1.6	0.8	0.6	0.6
ESP (%NaCEC)	2	4	10	11	11
3.6 Map Unit 6

Overview

Map Unit 6 consists of dark sandy clay with coarser structured clay subsoils on gently undulating plains. This map unit is in the northern portion of the project site and covers an area within the SCL trigger map of 470.4 ha.

Observation Sites

A total of 19 observation sites were completed within this map unit and are summarised in Table 3-32. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 24.76 ha.

Table 3-32: Observation Sites for Map Unit 6

Observation Sites				
Check	Detailed (analysed)			
12	7 (6)			

A land summary of detailed site 91-SCL is presented in Table 3-33, soil profile description in Table 3-34 and detailed site descriptions are presented in Appendix A.

Six representative detailed sites, Site N26, Site N27, Site 32-SCL, Site 77-SCL, Site 80-SCL and Site 91-SCL, were selected to undergo chemical analysis for Map Unit 6. The soil chemistry results for the three selected detailed sites are presented in Tables 3-35 to 3-40.

Item	Description
Representative Site	91-SCL
Representative Site photograph	<image/>
Location	643899mE 7510777mN
Current Use	Grazing
Site survey type	Detailed - 50mm hand auger
Vegetation	Cleared, nearby remnant Belah
Disturbance	Extensive disturbance
Landform element /pattern	Very gently undulating plain, mid-slope
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	2.0/1.0
Drainage	Moderate
Surface coarse fragments	Nil coarse fragments
Surface condition	Minor cracking, firm
ASC Order (s)	Black Dermosol
Total area (ha)	470.4

Table 3-33: Map Unit 6

Site 91-SCL							91-3		
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A1 0.00-0.12 Abrupt	Sandy Clay	Moderate, weak <20mm sub- angular	Nil	10YR2/1 Black Nil mottles/ble ach	Dry, moderate	Few, fine	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.9-1.00	Nil
B21 0.12-0.50 Clear	Light sandy clay	Moderate, firm 20- 50mm sub- angular	Nil	10YR2/2 Very dark brown Nil mottles/ble ach	Dry, moderate	Few, fine	0.30 / 6.5		
B22 0.50-1.00 EOBH	Light clay	Moderate, firm 20- 50mm sub- angular blocky	<2% calcium carbonate nodules	10YR3/3 Dark brown Mottles <2% 10YR5/3 Brown Nil bleach	Dry, moderate	Very few, very fine	0.60 / 7.0 0.60 / 7.5		

Table 3-34: Soil Profile Morphology Summary Map Unit 6

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Table 3-35: Soil Chemistry Results for Detailed Site 91-SCL

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	6.99	8.02	9.13	9.07	8.95	
Soil Cl (mg/kg)	12 12		211	701	1026	
PSA-Sand (>20µm %)	82.0	74.5	59.6	58.7	47.3	
PSA-Fine Silt (2-20µm %)	4.0	8.1	6.4	4.4	15.2	
PSA-Clay (<2µm%)	13.9	17.4	34.0	36.9	37.5	
15 Bar (%)	12	14	19	21	22	

Table 3-36: Soil Chemistry Results for Detailed Site N26

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.83-0.90	0.90-1.00	
Soil pH	8.47	8.58	8.93	9.21	8.98	
Soil Cl (mg/kg)	5	19	125	252	307	
PSA-Sand (>20µm %)	67.4	59.8	50.3	46.3	54.1	
PSA-Fine Silt (2-20µm %)	3.0	5.2	5.4	10.0	6.7	
PSA-Clay (<2µm%)	29.6	35.0	44.3	43.8	39.1	
CEC (meq/100g)	26.74	30.53	37.34	42.10	34.73	
Ca/Mg (ratio)	0.8	5.9	15.7	19.1	18.4	
ESP (%NaCEC)	4.6	1.6	0.8	0.7	0.7	

Table 3-37: Soil Chemistry Results for Detailed Site N27

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.27	8.54	9.10	9.02	8.85	
Soil Cl (mg/kg)	15	28	230	393	447	
PSA-Sand (>20µm %)	71.2% 71.0%		54.0%	50.0%	44.4%	
PSA-Fine Silt (2-20µm %)	2.2%	2.7%	5.0%	9.6%	11.3%	
PSA-Clay (<2µm%)	26.6%	26.3%	41.0%	40.4%	44.3%	
CEC (meq/100g)	21.28	20.20	31.88	31.67	26.34	
Ca/Mg (ratio)	0.3	4.0	13.6	15.5	12.4	
ESP (%NaCEC)	4.7	1.8	1.0	1.0	1.2	

Table 3-38: Soil Chemistry Results for Detailed Site 32-SCL

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.83-0.90	0.90-1.00	
Soil pH	7.73	8.69	9.25	9.31	9.27	
Soil CI (mg/kg)	14	15	64	225	321	
PSA-Sand (>20µm %)	68.0%	55.9%	60.6%	57.5%	60.2%	
PSA-Fine Silt (2-20µm %)	8.4%	5.9%	8.2%	13.6%	7.2%	
PSA-Clay (<2µm%)	23.7%	38.2%	31.3%	29.0%	32.6%	
CEC (meq/100g)	14.30	21.03	15.64	16.48	17.98	
Ca/Mg (ratio)	1.0	2.9	8.0	12.7	14.9	
ESP (%NaCEC)	3.0	1.7	0.9	0.7	0.6	

Table 3-39: Soil Chemistry Results for Detailed Site 77-SCL

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	7.71	8.47	8.71	8.71	8.48	
Soil Cl (mg/kg)	8	6	75	404	759	
PSA-Sand (>20µm %)	61.8	52.3	58.2	46.7	44.2	
PSA-Fine Silt (2-20µm %)	7.6	7.3	4.3	8.8	8.0	
PSA-Clay (<2µm%)	30.6	40.4	37.6	44.5	47.7	
CEC (meq/100g)	27.26	33.68	32.53	39.41	42.78	
Ca/Mg (ratio)	0.5	2.6	7.7	11.9	14.2	
ESP (%NaCEC)	3.2	2.2	1.3	1.0	0.9	

Table 3-40: Soil Chemistry Results for Detailed Site 80-SCL

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.22-0.30	0.50-0.60	0.83-0.90	0.90-1.00	
Soil pH	7.09	7.82	9.24	9.40	9.29	
Soil Cl (mg/kg)	17	16	62	257	358	
PSA-Sand (>20µm %)	79.7%	68.1%	63.3%	60.8%	63.3%	
PSA-Fine Silt (2-20µm %)	1.9%	9.2%	5.8%	5.7%	6.2%	
PSA-Clay (<2µm%)	18.4%	22.7%	30.9%	33.5%	30.5%	
CEC (meq/100g)	13.57	14.57	19.82	21.29	21.16	
Ca/Mg (ratio)	0.6	2.9	10.0	20.2	20.7	
ESP (%NaCEC)	2.4	2.2	0.8	0.6	0.5	

3.7 Map Unit 7

Overview

Map Unit 7 consists of a crusting grey clay soils on gently undulating alluvial plains with mixed shrubbery and woodlands. It was observed a minor sub-dominant colour of black soils within the map unit; however, this was aggregated within the larger dominant observed grey vertosol.

This map unit is in the north-west portion of the project site and covers an area within the SCL trigger map of 5.1 ha.

Observation Sites

A total of 5 observation sites were identified within Map Unit 7 and are summarised in Table 3-41. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 1.02 ha.

Table 3-41: Observation Sites for Map Unit 7

Observation Sites				
Check	Detailed (analysed)			
2	3 (3)			

A land summary of detailed site N1 for Map Unit 7 is presented in Table 3-42, soil profile description in Table 3-43 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N1, Site N2 and Site N3, were selected to undergo chemical analysis. The soil chemistry results for the three selected detailed sites are presented in Tables 3-44 to 3-45.

ltem	Description
Representative Site	N2
Representative Site photograph	<image/>
Location	641096mE 7512914mN
Current Use	Grazing
Site survey type	Detailed, 50 mm hand auger.
Vegetation	Various shrubs
Disturbance	Nil to semi-cleared
Landform element / pattern	Very gently undulating plain
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	2.0/1.0
Drainage	Moderate
Surface coarse fragments	Nil coarse fragments
Surface condition	Firm <10mm peds, cracking 2-6mm, crust
ASC Order (s)	Crusting Grey Vertosol (minor sub-dominant black vertosol [Site N1])
Total area (ha)	5.1 (Extends outside the project site >10 ha)

Table 3-42: Map Unit 7

Site N2 (Previou sly N2- SCL as per photo)							2-50			
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons	
A1 0.00-0.14	Light clay	Moderate, soft	Nil	10YR3/1 Verv dark	Moderate moist.	Few fine	0.10 / 6.0	0.00-0.10	Nil	
Abrupt		<10mm		grey	moderate			0.50-0.60		
		sub- angular		Nil mottles/ble ach				0.80-0.90 0.09-1.00		
B2	Medium	Moderate,	<2% black	10YR4/2	Dry,	Very	0.30 / 6.5			

Table 3-43: Soil Profile Morphology Summary Map Unit 7

Table 3-44: Soil Chemistry Results for Detailed Site N1

nodules

firm

sub-

<10mm

angular

0.14-1.00

EOBH

clay

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.96	8.23	8.29	8.25	8.22
Soil Cl (mg/kg)	23	82	384	582	669
PSA-Sand (>20µm %)	23.4	24.0	12.5	13.6	13.1
PSA-Fine Silt (2-20µm %)	18.1	11.8	24.3	19.2	24.2
PSA-Clay (<2µm%)	58.5	64.2	63.1	67.2	62.7
15 Bar (%)	31	33	34	34	34

Dark greyish

mottles/ble ach

brown

Nil

moderate

fine,

very

few

0.60 / 7.0

0.90 / 7.5

Table 3-45: Soil Chemistry Results for Detailed Site N2

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.67	8.23	8.52	8.47	8.48
Soil CI (mg/kg)	39	59	50	73	114
PSA-Sand (>20µm %)	42.2	32.2	27.7	36.0	32.1
PSA-Fine Silt (2-20µm %)	11.6	18.1	18.7	12.6	16.9
PSA-Clay (<2µm%)	46.1	49.7	53.7	51.4	51.0
15 Bar (%)	30	30	31	31	31

Table 3-46: Soil Chemistry Results for Detailed Site N3

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.78	8.34	8.52	8.61	8.66
Soil Cl (mg/kg)	35	15	14	14	21
PSA-Sand (>20µm %)	38.0	32.4	40.5	37.8	33.2
PSA-Fine Silt (2-20µm %)	9.7	16.9	11.3	9.7	16.8
PSA-Clay (<2µm%)	52.3	50.8	48.2	52.6	50.0
15 Bar (%)	30	29	29	29	29

3.8 Map Unit 8

Overview

Map Unit 8 consists of dark greyish brown weak to moderately structured clay soils on cleared gently undulating plains. This map unit is in the north-east portion of the project site and covers an area within the SCL trigger map of 3.3 ha.

Observation Sites

A total of 5 observation sites were completed within this map unit and are summarised in Table 3-47. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 0.66 ha.

Table 3-47: Observation Sites for Map Unit 8

Observation Sites				
Check	Detailed (analysed)			
2	3 (3)			

A land summary of detailed site N13 is presented in Table 3-48, soil profile description in Table 3-49 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N12, Site N13 and Site N14, were selected to undergo chemical analysis for Map Unit 8. The soil chemistry results for the three selected detailed sites are presented in Tables 3-50 to 3-52.

Item	Description
Representative Site	N13
Representative Site photograph	
Location	640940mE 7512735mN
Current Use	Grazing
Site survey type	Detailed - 50mm hand auger
Vegetation	Grasses
Disturbance	Extensive disturbance
Landform element / pattern	Gently undulating plains, mid-slope
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	<2.0/<2.0
Drainage	Moderate – well
Surface coarse fragments	Nil
Surface condition	Firm, cracking
ASC Order (s)	Black Dermosol
Total area (ha)	3.3 (Extends outside the project site >10 ha)

Table 3-48: Map Unit 8

Site N13									
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A1 0.00-0.15 Abrupt	Sandy clay loam	Weak to moderate. Soft, sub rounded <10mm	Nil	10YR3/2 Nil mottles/ bleaching	Dry, well	Present	0.10 / 7.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.9-1.00	Nil
B21 0.15-0.75 gradual	Light clay	Weak to moderate. Firm, sub rounded <20mm	Nil	10YR3/2 Nil mottles/ bleaching	Dry, moderate – well	Present	0.30 / 7.5 0.60 / 7.5		
B22	Light clay	Weak to	Nil	10VR3/2	Dry	Procent	090/75	1	

Table 3-49: Soil Profile Morphology Summary Map Unit 8

Table 3-50: Soil Chemistry Results for Detailed Site N12

Firm, sub

rounded <20mm

EOBH

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.23	7.93	8.63	8.59	8.53
Soil Cl (mg/kg)	22	155	481	793	747
PSA-Sand (>20µm %)	66.3%	57.5%	44.2%	45.2%	50.6%
PSA-Fine Silt (2-20µm %)	10.6%	6.0%	9.4%	10.0%	9.3%
PSA-Clay (<2µm%)	23.1%	36.5%	46.3%	44.8%	40.0%
CEC (meq/100g)	15.52	23.08	30.45	30.79	32.41
Ca/Mg (ratio)	2.2	6.9	8.3	9.2	9.8
ESP (%NaCEC)	1.6	1.3	0.9	0.8	0.8

bleaching

well

Table 3-51: Soil Chemistry Results for Detailed Site N13

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.01	8.03	8.48	8.57	8.50
Soil Cl (mg/kg)	9	163	355	683	826
PSA-Sand (>20µm %)	70.7	49.2	48.1	47.0	47.9
PSA-Fine Silt (2-20µm %)	2.8	5.8	5.6	8.2	5.1
PSA-Clay (<2µm%)	26.5	44.9	46.3	44.7	47.1
CEC (meq/100g)	14.92	26.15	26.77	28.40	30.66
Ca/Mg (ratio)	1.8	6.8	7.3	8.3	8.6
ESP (%NaCEC)	1.7	1.1	1.0	0.8	0.7

Table 3-52: Soil Chemistry Results for Detailed Site N14

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	6.85	8.29	8.78	8.62	8.57	
Soil Cl (mg/kg)	9	86	368	671	768	
PSA-Sand (>20µm %)	72.3%	47.1%	47.4%	49.1%	44.7%	
PSA-Fine Silt (2-20µm %)	10.6%	6.1%	8.6%	8.1%	9.2%	
PSA-Clay (<2µm%)	17.1%	46.8%	44.0%	42.7%	46.1%	
CEC (meq/100g)	10.26	23.98	29.98	27.95	27.41	
Ca/Mg (ratio)	1.6	7.0	8.2	9.0	9.1	
ESP (%NaCEC)	1.7	1.2	0.9	0.8	0.8	

3.9 Map Unit 9

Overview

Map Unit 9 consists of uniform to slightly gradational black vertosol on gently undulating plains used for cropping. This map unit is in the centre-north portion of the project site and covers an area within the SCL trigger map of 142.3 ha.

Observation Sites

A total of 13 observation sites were completed within this map unit and are summarised in Table 3.53. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 10.95 ha.

Table 3-53: Observation Sites for Map Unit 9

Observation Sites				
Check	Detailed (analysed)			
6	7 (7)			

A land summary of detailed Site 65-SCL is presented in Table 3-54, soil profile description in Table 3-55 and detailed site descriptions are presented in Appendix A.

Seven representative detailed sites, Site 65-SCL, Site N29, Site N30, Site N31, Site N32, Site N33 and Site N34 were selected to undergo chemical analysis for Map Unit 9. The soil chemistry results for the seven selected detailed sites are presented in Tables 3-56 to 3-62.

Table 3-54: Map Unit 9

ltem	Description
Representative Site	65-SCL
Representative Site photograph	
Location	643019mE 7513552mN
Current Use	Cropping
Site survey type	Detailed - 50mm hand auger
Vegetation	Cropping
Disturbance	Extensive disturbance
Landform element /pattern	Very gently undulating plain Flat plain
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	1.0/1.0
Drainage	Moderate
Surface coarse fragments	Nil coarse fragments
Surface condition	Soft, loose
ASC Order (s)	Black Vertosol
Total area (ha)	142.3



Table 3-55: Soil Profile Morphology Summary Map Unit 9

Table 3-56: Soil Chemistry Results for Detailed Site 65-SCL

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.83	8.47	8.90	8.93	8.96
Soil CI (mg/kg)	12	10	18	101	159
PSA-Sand (>20µm %)	28.9	41.6	26.8	25.8	28.0
PSA-Fine Silt (2-20µm %)	28.0	14.1	25.6	23.4	20.5
PSA-Clay (<2µm%)	43.1	44.3	47.6	50.8	51.6
15 Bar (%)	27	28	30	31	31

Table 3-57: Soil Chemistry Results for Detailed Site N29

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.69	8.87	9.18	9.39	9.42	
Soil Cl (mg/kg)	8	13	30	18	14	
PSA-Sand (>20µm %)	50	57	53	44	45	
PSA-Fine Silt (2-20µm %)	8	6	7	10	11	
PSA-Clay (<2µm%)	41	37	40	46	44	

Table 3-58: Soil Chemistry Results for Detailed Site N30

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.35	8.80	9.21	9.41	9.07	
Soil Cl (mg/kg)	24	11	14	17	11	
PSA-Sand (>20µm %)	47	61	57	54	58	
PSA-Fine Silt (2-20µm %)	6	7	4	5	3	
PSA-Clay (<2µm%)	46	32	40	41	39	

Table 3-59: Soil Chemistry Results for Detailed Site N31

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.54	8.34	8.44	8.88	9.02	
Soil Cl (mg/kg)	12	21	18	21	12	
PSA-Sand (>20µm %)	57	49	39	40	41	
PSA-Fine Silt (2-20µm %)	0	8	11	6	6	
PSA-Clay (<2µm%)	43	43	50	53	53	

Table 3-60: Soil Chemistry Results for Detailed Site N32

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.32	8.51	8.90	9.12	9.11	
Soil Cl (mg/kg)	16	15	16	14	14	
PSA-Sand (>20µm %)	54	50	51	41	40	
PSA-Fine Silt (2-20µm %)	8	6	7	10	10	
PSA-Clay (<2µm%)	38	44	42	49	51	

Table 3-61: Soil Chemistry Results for Detailed Site N33

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.22	8.92	9.23	8.71	9.27	
Soil Cl (mg/kg)	24	15	11	14	12	
PSA-Sand (>20µm %)	51	52	45	39	38	
PSA-Fine Silt (2-20µm %)	8	8	0	11	8	
PSA-Clay (<2µm%)	42	40	55	51	54	

Table 3-62: Soil Chemistry Results for Detailed Site N34

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	9.06	8.88	9.19	9.41	9.48	
Soil Cl (mg/kg)	24	14	11	22	25	
PSA-Sand (>20µm %)	55	59	64	52	49	
PSA-Fine Silt (2-20µm %)	7	5	1	6	10	
PSA-Clay (<2µm%)	38	36	35	42	41	

3.10 Map Unit 10

Overview

Map Unit 10 consists of deep sandy clay loams with clay subsoils on gently undulating plains of tall woodlands. This map unit is in the north-east portion of the project site and covers an area within the SCL trigger map of 32.9 ha.

Observation Sites

A total of 5 observation sites were completed within this map unit and are summarised in Table 3-63. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 6.58 ha.

Table 3-63: Observation Sites for Map Unit 10

Observation Sites					
Check	Detailed (analysed)				
2	3 (3)				

A land summary of detailed site N43 is presented in Table 3-64, soil profile description in Table 3-65 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N28, Site N43 and Site N45, were selected to undergo chemical analysis for Map Unit 10. The soil chemistry results for the three selected detailed sites are presented in Tables 3-66 to 3-68.

Table 3-64: Map Unit 10

ltem	Description
Representative Site	N43
Representative Site photograph	<image/>
Location	643716mE 7513193mN
Current Use	Grazing
Site survey type	Detailed - 50mm hand auger
Vegetation	Eucalyptus species
Disturbance	Semi disturbed,
Landform element /pattern	Gently Undulating Plains, Upper slope
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	<2/<2
Drainage	Well to well-moderate
Surface coarse fragments	Nil coarse fragments
Surface condition	Firm, minor cracking
ASC Order (s)	Black Dermosol
Total area (ha)	32.9



Table 3-65: Soil Profile Morphology Summary Map Unit 10

Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A11 0.0 – 0.06 Abrupt	Sandy clay loam	Massive	Nil	10YR3/2 Nil mottles / bleaching	Dry, well drained	Present	0.10 / 7.5	0.00-0.10 0.20-0.30 0.50-0.60	Nil
A12 0.06 – 0.20 Gradual	Sandy clay loam	Weak, sub- rounded peds <10 mm	Nil	10YR3/2 Nil mottles / bleaching	Dry, well drained	Present	0.20 / 7.5	0.80-0.90 0.9-1.00	
B21 0.20 – 0.46 Gradual	Sandy clay loam	Subangular blocky, moderate, peds <20 mm, firm	Nil	10YR3/2 Nil mottles / bleaching	Dry, well drained	Present	0.30 / 7.5		
B22 0.46 – 1.00 EOBH	Medium clay, sandy	Subangular blocky, moderate, peds <20 mm, firm	<20% calcium carbonate	10YR3/3 Nil mottles / bleaching	Dry, well – moderate drained	Present	0.60 / 7.5 0.90 / 7.5		

Table 3-66: Soil Chemistry Results for Detailed Site N28

	Sample Depth (m)					
Analysis (Unit)	0.00-0.05	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.10	8.46	8.99	9.09	9.04	
Soil CI (mg/kg)	13	23	227	522	686	
PSA-Sand (>20µm %)	72	66	48	55	49	
PSA-Fine Silt (2-20µm %)	9	6	6	7	7	
PSA-Clay (<2µm%)	20	29	46	38	44	
15 Bar (%)	17	17	25	22	22	
CEC (meq/100g)	21.46	21.65	30.84	24.84	26.78	
Ca/Mg (ratio)	0.3	2.0	9.4	11.2	12.1	
ESP (%NaCEC)	7.3	2.6	0.8	0.7	0.6	

Table 3-67: Soil Chemistry Results for Detailed Site N43

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.77-0.87	0.90-1.00	
Soil pH	8.26	8.27	8.79	9.04	8.93	
Soil CI (mg/kg)	16	17	157	270	910	
PSA-Sand (>20µm %)	67	64	52	51	51	
PSA-Fine Silt (2-20µm %)	6	6	6	7	6	
PSA-Clay (<2µm%)	27	30	42	42	43	
15 Bar (%)	15	15	23	21	21	
CEC (meq/100g)	21.19	21.84	27.10	25.56	28.30	
Ca/Mg (ratio)	0.3	0.9	5.5	8.3	12.7	
ESP (%NaCEC)	5.3	3.0	1.1	0.8	0.6	

Table 3-68: Soil Chemistry Results for Detailed Site N45

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.36	8.80	8.92	8.93	8.94	
Soil Cl (mg/kg)	14	40	333	803	840	
PSA-Sand (>20µm %)	61	57	44	52	44	
PSA-Fine Silt (2-20µm %)	13	6	5	5	5	
PSA-Clay (<2µm%)	25	37	51	42	51	
CEC (meq/100g)	26.63	27.55	31.88	29.14	30.59	
Ca/Mg (ratio)	0.3	5.1	10.9	13.1	12.9	
ESP (%NaCEC)	6.0	1.5	0.8	0.7	0.7	

3.11 Map Unit 11

Overview

Map Unit 11 consists of dark grey clay loams to grey brown clays within forested drainage line areas. This map unit is in the north-east portion of the project site and covers an area within the SCL trigger map of 7.2 ha.

Observation Sites

A total of 5 observation sites were completed within this map unit and are summarised in Table 3-69. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 1.44 ha.

Table 3-69: Observation Sites for Map Unit 11

Observation Sites				
Check	Detailed (analysed)			
2	3 (3)			

A land summary of detailed Site N23 is presented in Table 3-70, soil profile description in Table 3-71 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N23, Site N24 and Site N25, were selected to undergo chemical analysis for Map Unit 1. The soil chemistry results for the three selected detailed sites are presented in Tables 3-72 to 3-74.

ltem	Description
Representative Site	N23
Representative Site photograph	
Location	642838mE 7513991mN
Current Use	Grazing
Site survey type	Detailed - 50mm hand auger
Vegetation	Mixed vegetation
Disturbance	Cropping nearby disturbance
Landform element / pattern	Depression
Micro relief	Nil microrelief
Erosion	Minor sheet erosion
Slope (%)	<1% / <1%
Drainage	Well to well-moderate
Surface coarse fragments	Soft, <10% cf <5mm
Surface condition	Minor cracking
ASC Order (s)	Grey Dermosol
Total area (ha)	7.2 (Extends outside the project site >10 ha)

Table 3-70: Map Unit 11

Site N23							N23		
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A1 0.00-0.12 Abrupt	Clay loam	Weak, soft sub- rounded <10mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well	Present	0.10 / 8.5	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.90-1.00	Nil
B21 0.12-0.48 Abrupt	Light clay	Weak to moderate, firm sub- rounded <10mm	<5% weathered rock	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well – moderate	Present	0.30 / 8.5		
B22 0.48-1.00 EOBH	Light clay	Moderate, very firm sub- rounded <20mm	<5% calcium carbonate	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well – moderate	Present	0.60 / 8.5 0.90 / 8.5		

Table 3-71: Soil Profile Morphology Summary Map Unit 11

Table 3-72: Soil Chemistry Results for Detailed Site N23

		S	ample Depth (m)	
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.77-0.87	0.90-1.00
Soil pH	8.33	8.71	9.31	9.46	9.50
Soil CI (mg/kg)	20	27	42	225	440
PSA-Sand (>20µm %)	56.7	50.4	44.5	34.8	39.9
PSA-Fine Silt (2-20µm %)	11.9	9.5	15.1	16.3	8.9
PSA-Clay (<2µm%)	31.4	40.1	40.4	48.9	51.1
CEC (meq/100g)	27.67	25.03	23.49	26.84	26.59
Ca/Mg (ratio)	0.2	0.7	7.9	16.0	20.3
ESP (%NaCEC)	4.7	2.3	0.7	0.4	0.3

Table 3-73: Soil Chemistry Results for Detailed Site N24

		S	ample Depth (m)	
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	8.59	8.98	9.45	9.49	9.48
Soil Cl (mg/kg)	18	21	122	284	445
PSA-Sand (>20µm %)	59.9%	54.8%	47.0%	37.7%	43.9%
PSA-Fine Silt (2-20µm %)	5.7%	8.0%	13.6%	15.4%	10.8%
PSA-Clay (<2µm%)	34.4%	37.1%	39.4%	46.8%	45.2%
CEC (meq/100g)	27.47	25.47	25.09	27.88	28.79
Ca/Mg (ratio)	0.4	3.3	12.7	17.6	19.4
ESP (%NaCEC)	3.8	1.4	0.6	0.4	0.4

Table 3-74: Soil Chemistry Results for Detailed Site N25

		S	Sample Depth (m)	
Analysis (Unit)	0.00-0.10	0.22-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	8.36	9.11	9.33	9.30	9.23
Soil Cl (mg/kg)	22	108	317	563	792
PSA-Sand (>20µm %)	60.6%	46.3%	53.0%	42.1%	36.6%
PSA-Fine Silt (2-20µm %)	8.0%	4.3%	4.6%	8.7%	8.8%
PSA-Clay (<2µm%)	31.4%	49.3%	42.4%	49.2%	54.6%
CEC (meq/100g)	34.74	42.08	39.17	31.05	33.12
Ca/Mg (ratio)	0.6	8.0	14.9	17.4	18.4
ESP (%NaCEC)	3.7	1.0	0.6	0.5	0.5

3.12 Map Unit 12

Overview

Map Unit 12 consists of black, well-structured clays on gently undulating cropping land. This map unit is in the north-east portion of the project site and covers an area within the SCL trigger map of 116.4 ha.

Observation Sites

A total of 8 observation sites were completed within this map unit and are summarised in Table 3-75. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 14.55 ha.

Table 3-75: Observation Sites for Map Unit 12

Observation Sites				
Check	Detailed (analysed)			
5	3 (3)			

A land summary of detailed Site N35 is presented in Table 3-76, soil profile description in Table 3-77 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N35, Site N36 and Site N37 were selected to undergo chemical analysis for Map Unit 1. The soil chemistry results for the three selected detailed sites are presented in Tables 3-78 to 3-80.

Item	Description				
Representative Site	N35				
Representative Site photograph					
Location	643659mE 7511986mN				
Current Use	Cropping				
Site survey type	Detailed - 50mm hand auger				
Vegetation	Cropping				
Disturbance	Extensive disturbed,				
Landform element / pattern	Gently undulating plain, mid slope				
Micro relief	Nil microrelief				
Erosion	Nil erosion				
Slope (%)	2% / 2%				
Drainage	Well to well-moderate drained				
Surface coarse fragments	Nil				
Surface condition	Minor cracking, self-mulching				
ASC Order (s)	Black Vertosol				
Total area (ha)	116.4				

Table 3-76: Map Unit 12



Table 3-77: Soil Profile Morphology Summary Map Unit 12

Table 3-78 Soil Chemistry Results for Detailed Site N35

	Sample Depth (m)				
Analysis (Unit)	0.00-0.04	0.20-0.30	0.50-0.60	0.77-0.87	0.90-1.00
Soil pH	8.70	8.68	8.99	9.10	9.12
Soil Cl (mg/kg)	7	24	33	75	149
PSA-Sand (>20µm %)	47	45	39	41	36
PSA-Fine Silt (2-20µm %)	5	7	5	7	11
PSA-Clay (<2µm%)	47	47	55	52	53

Table 3-79: Soil Chemistry Results for Detailed Site N36

	Sample Depth (m)				
Analysis (Unit)	0.00-0.05	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	8.69	8.46	8.50	8.80	8.90
Soil Cl (mg/kg)	11	32	25	39	66
PSA-Sand (>20µm %)	49	41	42	24	35
PSA-Fine Silt (2-20µm %)	8	12	9	15	12
PSA-Clay (<2µm%)	44	47	49	61	54

Table 3-80: Soil Chemistry Results for Detailed Site N37

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	8.70	8.67	8.86	8.99	9.04
Soil CI (mg/kg)	8	17	24	49	99
PSA-Sand (>20µm %)	49	50	53	56	36
PSA-Fine Silt (2-20µm %)	6	7	2	2	1
PSA-Clay (<2µm%)	45	44	44	42	63

3.13 Map Unit 13

Overview

Map Unit 13 consists of black, well-structured clays on gently undulating cropping land. This map unit is in the north-east portion of the project site and covers an area within the SCL trigger map of 105.2 ha.

Observation Sites

A total of 8 observation sites were completed within this map unit and are summarised in Table 3-81. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 13.15 ha.

Table 3-81: Observation Sites for Map Unit 13

Observation Sites				
Check	Detailed (analysed)			
3	5 (3)			

A land summary of detailed Site 6-SCL is presented in Table 3-82, soil profile description in Table 3-83 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site 6-SCL, Site 7-SCL and Site 100-SCL, were selected to undergo chemical analysis for Map Unit 13. The soil chemistry results for the three selected detailed sites are presented in Tables 3-84 to 3-86.

Table	3-82:	Map	Unit 13	
TUDIC	J UL.	wiup	0111111	

Item	Description
Representative Site	6-SCL
Representative Site photograph	<image/>
Location	641287mE 7510129mN
Current Use	Grazing
Site survey type	Detailed - 50mm hand auger
Vegetation	Grasses
Disturbance	Extensively disturbance
Landform element / pattern	Gently undulating plains, mid-slope
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	2.0/2.0
Drainage	Well – moderate
Surface coarse fragments	Coarse fragments`<5mm <5%
Surface condition	Humid self-mulching with crust 2-6 mm thick, minor sand on surface.
ASC Order (s)	Black Vertosol
Total area (ha)	105.2



Table 3-83: Soil Profile Morphology Summary Map Unit 13

peds 40-60 mm,

Table 3-84: Soil Chemistry Results for Detailed Site 6-SCL

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.77-0.87	0.90-1.00
Soil pH	7.88	8.43	8.61	8.55	8.72
Soil Cl (mg/kg)	22	117	626	1042	917
PSA-Sand (>20µm %)	38.2%	52.4%	43.2%	41.5%	54.3%
PSA-Fine Silt (2-20µm %)	13.6%	5.9%	7.3%	9.0%	8.9%
PSA-Clay (<2µm%)	48.2%	41.6%	49.5%	49.5%	36.8%
CEC (meq/100g)	36.65	34.09	34.70	37.27	28.91
Ca/Mg (ratio)	0.6	4.3	11.8	15.5	15.2
ESP (%NaCEC)	2.3	1.8	1.1	1.0	1.0

Table 3-85: Soil Chemistry Results for Detailed Site 7-SCL

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.47	9.05	9.18	9.16	9.16
Soil Cl (mg/kg)	10	29	232	354	417
PSA-Sand (>20µm %)	54.8%	51.9%	40.2%	59.9%	46.8%
PSA-Fine Silt (2-20µm %)	9.8%	8.4%	13.8%	6.6%	12.0%
PSA-Clay (<2µm%)	35.5%	39.6%	46.0%	33.5%	41.1%
15 Bar (%)	19	24	26	20	21
CEC (meq/100g)	27.53	25.76	32.45	34.30	27.51
Ca/Mg (ratio)	0.5	0.5	8.8	15.6	16.0
ESP (%NaCEC)	3.2	3.2	1.3	1.0	1.0

Table 3-86: Soil Chemistry Results for Detailed Site 100-SCL

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.92	8.44	8.60	8.53	8.63
Soil CI (mg/kg)	8	57	244	467	449
PSA-Sand (>20µm %)	48.3%	45.9%	42.6%	34.9%	34.9%
PSA-Fine Silt (2-20µm %)	9.2%	12.7%	11.6%	9.8%	14.2%
PSA-Clay (<2µm%)	42.5%	41.4%	45.8%	55.3%	50.9%
CEC (meq/100g)	29.18	33.32	38.02	37.41	36.61
Ca/Mg (ratio)	0.8	4.8	10.0	11.6	10.5
ESP (%NaCEC)	2.1	2.5	1.8	1.5	1.6

3.14 Map Unit 14

Overview

Map Unit 14 consists of a texture contrast sandy loams over red clay subsoils on cleared gently undulating plains. This map unit is in the centre, south area of the project site and covers an area of 33.2 ha.

Observation Sites

A total of 8 observation sites were identified within the Map Unit 14 and are summarised in Table 3-87. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 4.15 ha.

Table 3-87: Observation Sites for Map Unit 14

Observation Sites		
Check	Detailed (analysed)	
2	5 (3)	

A land summary of detailed Site 10-SCL for the map unit is presented in Table 3-88, soil profile description in Table 3-89 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site 10-SCL, Site N41 and Site N42, were selected as to undergo chemical analysis. The soil chemistry results for the three selected detailed sites are presented in Tables 3-90 to 3-92.

Table 3-88: Map Unit 14

ltem	Description								
Representative Site	10-SCL								
Representative Site photograph									
Location	642525mE 7510097mN								
Current Use	Grazing								
Site survey type	Detailed, 50 mm hand auger.								
Vegetation	Buffel Grass								
Disturbance	Extensive disturbance								
Landform element /pattern	Very gently undulating plain, Mid-slope								
Micro relief	Nil microrelief								
Erosion	Nil erosion								
Slope (%)	2.0/1.0								
Drainage	Moderate								
Surface coarse fragments	Nil coarse fragments								
Surface condition	Minor cracking, loose								
ASC Order (s)	Red Chromosol								
Total area (ha)	33.2								
Site 10-SCL						10-5C			
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Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A1 0.00-0.13 Abrupt	Sandy clay	Moderate, firm, <10mm sub- angular	<1% calcium carbonate nodules	10YR3/2 Very dark greyish brown Nil mottles/ bleach	Dry, moderate	Few, fine	0.10 / 7.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.90-1.00	First borehole, 0.20 mbgl Second borehole 0.40 mbgl
A2 0.13-0.39 Abrupt	Light sandy clay	Moderate, firm, <10mm sub- angular	Nil	10YR3/3 Dark Brown Nil mottles/ bleach	Dry, moderate	Few, fine	0.30 / 7.0		kerusal likely due to roots, no physical barrier
B21 0.39-0.84 Abrupt	Light sandy clay	Moderate, firm, <10mm sub- angular	<10% calcium carbonate nodules	5YR4/4 Reddish brown Nil mottles /bleach	Dry, moderate	Few, fine	0.60 / 7.5		
B22 0.84-1.00 EOBH	Light clay	Moderate, firm, <10mm sub- angular	<2% calcium carbonate nodules	10YR4/4 Dark yellowish brown Nil mottles/ bleach	Dry, moderate	Very few, very fine	0.90 / 8.5		

Table 3-89: Soil Profile Morphology Summary Map Unit 14

Table 3-90: Soil Chemistry Results for Detailed Site 10-SCL

		S	Sample Depth (m)	
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.70-0.80	0.90-1.00
Soil pH	7.22	7.28	8.21	8.40	8.56
Soil Cl (mg/kg)	13	11	14	25	73
PSA-Sand (>20µm %)	75.1	67.5	67.3	59.0	49.3
PSA-Fine Silt (2-20µm %)	8.1	11.9	9.8	16.6	21.1
PSA-Clay (<2µm%)	16.8	20.5	22.9	24.4	29.5
15 Bar (%)	16	13	14	15	17

Table 3-91: Soil Chemistry Results for Detailed Site N41

		S	ample Depth (m)	
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.27	7.70	7.95	8.28	8.51
Soil Cl (mg/kg)	9	9	9	12	17
PSA-Sand (>20µm %)	71	63	53	81	55
PSA-Fine Silt (2-20µm %)	6	4	13	3	10
PSA-Clay (<2µm%)	23	33	34	15	35
CEC (meq/100g)	14.90	11.44	11.63	13.31	16.35
Ca/Mg (ratio)	1.1	0.8	1.9	3.1	2.3
ESP (%NaCEC)	2.0	1.6	1.2	1.0	1.1

Table 3-92: Soil Chemistry Results for Detailed Site N42

		S	ample Depth (m	1)	
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.02	7.79	7.97	8.32	8.80
Soil Cl (mg/kg)	8	9	7	12	21
PSA-Sand (>20µm %)	77	59	61	57	56
PSA-Fine Silt (2-20µm %)	5	6	2	6	6
PSA-Clay (<2µm%)	19	35	37	37	38
15 Bar (%)	12	15	16	18	18
CEC (meq/100g)	13.23	12.92	10.81	12.95	18.45
Ca/Mg (ratio)	0.4	0.4	1.4	2.7	3.0
ESP (%NaCEC)	2.3	1.8	1.3	1.1	1.0

3.15 Map Unit 15

Overview

Map Unit 15 consists of a dark uniform to gradational clay soils on lower sloped plains and open depression. This map unit is in the central east portion of the project site and covers an area within the SCL trigger map of 107.7 ha.

Observation Sites

A total of 5 observation sites were completed within this map unit and are summarised in Table 3-93. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 21.54 ha.

Table 3-93: Observation Sites for Map Unit 15

Observation Sites			
Check	Detailed (analysed)		
2	3 (3)		

A land summary of detailed Site N38 is presented in Table 3-94, soil profile description in Table 3-95 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site N38, Site N39 and Site N40, were selected to undergo chemical analysis for Map Unit 15. The soil chemistry results for the three selected detailed sites are presented in Tables 3-96 to 3-98.

Item	Description
Representative Site	N38
Representative Site photograph	
Location	645726mE 7510395mN
Current Use	Grazing
Site survey type	Detailed - 50mm hand auger
Vegetation	Mixed vegetation, eucalyptus species,
Disturbance	Semi disturbed
Landform element / pattern	GUP Lower slope to depression
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	1% / 2%
Drainage	Well to well-moderate drained
Surface coarse fragments	<2% coarse fragments <5mm
Surface condition	Cracking
ASC Order (s)	Black Vertosol
Total area (ha)	107.7

Table 3-94: Map Unit 15

Site N38									
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons
A11 0.0 – 0.12 Abrupt	Light clay	Moderate, firm, sub- angular <20 mm	Nil	10YR3/2 Nil mottles / bleaching	Dry, well drained	Present	0.10 / 7.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90	Nil
B21 0.12 – 0.90 Abrupt	Medium clay	Moderate- strong, strong, sub- angular <20 mm	Nil	10YR3/2 Nil mottles / bleaching	Dry, well- moderate drained	Present	0.30 / 7.5 0.60 / 7.5	0.9-1.00	
В22 0.90 — 1.00 ЕОВН	Medium clay	Moderate- strong, strong, sub- angular <20 mm	<2% calcium carbonate	10YR3/2 Nil mottles / bleaching	Dry, well- moderate drained	Present	0.90 / 8.0		

Table 3-95: Soil Profile Morphology Summary Map Unit 15

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Table 3-96: Soil Chemistry Results for Detailed Site N38

		S	ample Depth (m)	
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.77-0.87	0.90-1.00
Soil pH	8.03	7.72	8.04	8.59	8.59
Soil Cl (mg/kg)	37	68	221	640	802
PSA-Sand (>20µm %)	60	57	58	53	54
PSA-Fine Silt (2-20µm %)	4	2	5	8	4
PSA-Clay (<2µm%)	36	41	37	40	43

Table 3-97: Soil Chemistry Results for Detailed Site N39

		S	ample Depth (m)	
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.69	7.90	8.49	8.75	8.74
Soil Cl (mg/kg)	18	33	220	534	562
PSA-Sand (>20µm %)	52	45	60	51	57
PSA-Fine Silt (2-20µm %)	7	9	8	3	6
PSA-Clay (<2µm%)	41	46	32	46	37

Table 3-98: Soil Chemistry Results for Detailed Site N40

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.92	8.76	9.04	8.98	8.80
Soil CI (mg/kg)	8	11	107	384	669
PSA-Sand (>20µm %)	49	50	46	46	41
PSA-Fine Silt (2-20µm %)	8	9	9	7	11
PSA-Clay (<2µm%)	43	40	45	47	48

3.16 Map Unit 16

Overview

Map Unit 16 consists of dark brown clay soils with gilgai microrelief on gently undulating plains of mixed regrowth. This map unit is in the south-west portion of the project site and covers an area within the SCL trigger map of 383.0 ha.

Observation Sites

A total of 8 observation sites were completed within this map unit and are summarised in Table 3-99. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 47.87 ha.

Table 3-99: Observation Sites for Map Unit 16

Observation Sites				
Check	Detailed (analysed)			
4	4 (3)			

A land summary of detailed Site 5_SCL is presented in Table 3-100, soil profile description in Table 3-101 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site 5-SCL, Site 102-SCL and Site 103-SCL, were selected to undergo chemical analysis for with two soil profiles for each (Mound [M] and Depression [D]) were analysed. The soil chemistry results for the three selected detailed sites are presented in Tables 3-102 to 3-107.

Table 3-100: Map Unit 16

Item	Description
Representative Site	5-SCL-M (Mound)
Representative Site photograph	
Location	641663mE 7508746mN
Current Use	Grazing
Site survey type	Detailed - 50mm hand auger
Vegetation	Grasses
Disturbance	Extensively disturbed
Landform element / pattern	Gently undulating plain, mid-slope
Micro relief	Gilgai microrelief present 40% coverage
Erosion	Nil erosion
Slope (%)	2% / 1%
Drainage	Well to moderately drained
Surface coarse fragments	Nil coarse fragments
Surface condition	Self-mulching, minor crust, cracking 2-6+mm
ASC Order (s)	Black Vertosol
Total area (ha)	383.0

Site 5-SCL-M										
Horizon Depth (m), Boundar -y (Bdy)	Field Texture	Structure Strength	Inclusions Segregatio- ns	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH / EC dS/m	Samples (m)	Observati -ons	
A1 0.00-0.12 Abrupt	Light clay	Moderate, soft <20mm sub- angular	Nil	10YR2/1 Nil mottle / bleaching	Humid, Well drained	Comm on, mediu m	0.10 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.90-1.00	Nil	
B21 0.12-0.60 Abrupt	Medium heavy clay	Moderate, Firm <30mm sub- angular	Nil	10YR3/1 Nil mottle / bleaching	Humid, Well drained	Few, mediu m	0.30 / 7.0			
B22 0.60-1.00 EOBH	Medium heavy clay	Moderate, Firm <30mm sub- angular	<2% Calcium carbonate	10YR3/1 Nil mottle / bleaching	Humid, Well - moderate drained	Few, fine	0.10 / 7.0			

Table 3-101: Soil Profile Morphology Summary Map Unit 16

Table 3-102: Soil Chemistry Results for Detailed Site 5-SCL-M (Mound)

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.19	8.38	8.40	8.53	8.55	
Soil Cl (mg/kg)	15	17	16	19	39	
PSA-Sand (>20µm %)	37.0	35.7	36.9	32.7	35.6	
PSA-Fine Silt (2-20µm %)	10.4	9.2	9.3	8.0	7.5	
PSA-Clay (<2µm%)	52.6	55.1	53.8	59.2	56.9	

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.19	8.38	8.40	8.53	8.55	
Soil Cl (mg/kg)	15	17	16	19	39	
PSA-Sand (>20µm %)	37.0	35.7	36.9	32.7	35.6	
PSA-Fine Silt (2-20µm %)	10.4	9.2	9.3	8.0	7.5	
PSA-Clay (<2µm%)	52.6	55.1	53.8	59.2	56.9	

Table 3-103: Soil Chemistry Results for Detailed Site 5-SCL-D (Depression)

Table 3-104: Soil Chemistry Results for Detailed Site 102-SCL-M (Mound)

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00
Soil pH	7.33	8.23	8.81	8.98	8.92
Soil Cl (mg/kg)	10	16	23	74	151
PSA-Sand (>20µm %)	64.	54.3	50.4	47.7	36.6
PSA-Fine Silt (2-20µm %)	6.4	7.6	8.3	7.2	15.7
PSA-Clay (<2µm%)	29.0	38.1	41.4	45.1	47.7

Table 3-105: Soil Chemistry Results for Detailed Site 102-SCL-D (Depression)

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	7.56	8.19	8.80	8.74	8.54	
Soil Cl (mg/kg)	24	32	95	230	426	
PSA-Sand (>20µm %)	43.2	31.5	32.5	30.5	32.4	
PSA-Fine Silt (2-20µm %)	11.2	11.2	8.0	10.2	8.5	
PSA-Clay (<2µm%)	45.6	57.3	59.4	59.2	59.1	

Table 3-106: Soil Chemistry Results for Detailed Site 103-SCL-M (Mound)

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	8.65	8.36	9.20	9.15	9.09	
Soil Cl (mg/kg)	11	78	174	485	665	
PSA-Sand (>20µm %)	57.3	55.7	57.7	59.2	55.6	
PSA-Fine Silt (2-20µm %)	7.3	5.6	4.1	7.4	6.2	
PSA-Clay (<2µm%)	35.4	38.8	38.2	33.4	38.2	

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	0.90-1.00	
Soil pH	7.11	7.90	7.80	6.99	6.28	
Soil Cl (mg/kg)	11	53	463	818	821	
PSA-Sand (>20µm %)	33.7	29.8	28.4	32.2	36.9	
PSA-Fine Silt (2-20µm %)	16.4	13.1	13.0	12.3	12.0	
PSA-Clay (<2µm%)	49.8	57.1	58.6	55.5	51.1	

Table 3-107: Soil Chemistry Results for Detailed Site 103-SCL-D (Depression)

3.17 Map Unit 17

Overview

Map Unit 17 consists of dark cracking clays on basalt with cropping on undulating plains. This map unit is in the southern area of the project site and covers an area of 495.5 ha.

Observation Sites

A total of 11 observation sites were identified within Map Unit 17 and summarised in Table 3-108. Density of sites in the map unit exceeds minimum density for western cropping zone as outlined in RPI 08/14 at one site per 45.05 ha.

Table 3-108: Observation Sites for Map Unit 17

Observation Sites					
Check	Detailed (analysed)				
7	4 (3)				

A land summary of detailed Site 4-SCL is presented in Table 3-109, soil profile description in Table 3-110 and detailed site descriptions are presented in Appendix A.

Three representative detailed sites, Site 4-SCL, Site 110-SCL and Site 115-SCL, were selected to undergo chemical analysis. The soil chemistry results for the three selected detailed sites are presented in Tables 3-111 to 3-113.

Table 3-109: Map Unit 17

Item	Description
Representative Site	4-SCL
Representative Site photograph	
Location	643527mE 7507664mN
Current Use	Grazing
Site survey type	Detailed, 50 mm hand auger.
Vegetation	Cleared, very sparse mixed regrowth
Disturbance	Semi-Cleared
Landform element /pattern	Very gently undulating plains, mid-slope
Micro relief	Nil microrelief
Erosion	Nil erosion
Slope (%)	<1.0/1.0
Drainage	Moderate/imperfect
Surface coarse fragments	Nil coarse fragments
Surface condition	Cracking 20-40mm, self-mulching
ASC Order (s)	Black Vertosol
Total area (ha)	495.5



Table 3-110: Soil Profile Morphology Summary Map Unit 17

Table 3-111: Soil Chemistry Results for Detailed Site 4-SCL

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.70-0.80	0.90-1.00	
Soil pH	7.74	8.82	8.82	8.60	8.65	
Soil CI (mg/kg)	7	13	124	419	799	
PSA-Sand (>20µm %)	36.5	28.6	30.3	32.9	36.7	
PSA-Fine Silt (2-20µm %)	16.6	23.4	20.7	20.3	25.2	
PSA-Clay (<2µm%)	46.8	48.0	49.0	46.8	38.1	
15 Bar (%)	28	32	32	33	30	

Table 3-112: Soil Chemistry Results for Detailed Site 110-SCL

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.70-0.80	0.90-1.00	
Soil pH	7.30	7.93	8.83	8.91	9.04	
Soil CI (mg/kg)	27	12	39	72	47	
PSA-Sand (>20µm %)	56.3	43.4	36.6	28.8	55.5	
PSA-Fine Silt (2-20µm %)	6.5	9.3	5.4	25.4	23.0	
PSA-Clay (<2µm%)	37.2	47.3	58.0	45.8	21.5	
15 Bar (%)	22	28	30	33	33	

Table 3-113: Soil Chemistry Results for Detailed Site 115-SCL

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.20-0.30	0.50-0.60	0.70-0.80	0.90-1.00	
Soil pH	7.85	8.19	8.57	8.69	8.78	
Soil Cl (mg/kg)	34	14	68	16	40	
PSA-Sand (>20µm %)	46.1	38.7	44.1	36.2	38.9	
PSA-Fine Silt (2-20µm %)	17.1	19.5	6.4	19.0	7.5	
PSA-Clay (<2µm%)	36.8	41.8	49.6	44.7	53.7	
15 Bar (%)	24	29	31	32	32	

4 SCL ASSESSMENT

The SCL map units were assessed against the SCL criteria for the SCA's Western Cropping Zone. The findings of the SCL assessment are summarised in Table 4-1.

Map Unit	SCL Criteria Exceedances	SCL Status
1	pH – Sites N6-SCL, N7-SCL and N8-SCL	Not SCL
2	pH – Sites N17, N18 and N19	Not SCL
3	No SCL criteria exceedances reported	Likely SCL
4	pH – Sites N21 and N22. Chemical limitation for PAWC – Site N20	Not SCL
5	pH – Sites N4-SCL, N5-SCL and N9-SCL	Not SCL
6	pH – Sites N26, N27, N32 and 80-SCL SWS – Site 91-SCL	Not SCL
7	No SCL criteria exceedances reported	Likely SCL
8	No SCL criteria exceedances reported	Likely SCL
9	No SCL criteria exceedances reported	Likely SCL
10	pH – Sites N28 and N43	Not SCL
11	pH – Sites N23, N24 and N25	Not SCL
12	No SCL criteria exceedances reported	Likely SCL
13	pH – Site 7-SCL Remaining two sites have no SCL criteria exceedances reported	Likely SCL
14	SWS – Site 10-SCL, N41 and N42	Not SCL
15	No SCL criteria exceedances reported	Likely SCL
16	No SCL criteria exceedances reported	Likely SCL
17	No SCL criteria exceedances reported	Likely SCL

Table 4-1: SCL Assessment of Map Units

This assessment shows that the map units in the project site which are not SCL. A detailed assessment of each map unit is presented in Sections 4.1 to 4.17.

4.1 Map Unit 1

The SCL assessment of Map Unit 1 is summarised below in Table 4-2.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
Site N6-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 8.94 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
Site N7-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.15 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
Site N8-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.37 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
Overall									Not SCL

Table 4-2: SCL Assessment of Map Unit 1

Map Unit 1 exhibited limitation relating to SCL criteria soil pH.

pH levels were above pH 8.9 at 600 mm soil depth at Sites N6-SCL, N7-SCL and N8-SCL ranged from 8.94 to 9.37. These concentrations did not meet the SCL pH criterion within range pH 5.1 and pH 8.9 for rigid soils.

None of the analysed sites meet the SCL criteria, therefore Map Unit 1 is not SCL.

4.2 Map Unit 2

The SCL assessment of Map Unit 1 is summarised below in Table 4-3.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
N17	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.25 at 0.20- 0.30 mbgl)	Not required	Not required	Not SCL

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
N18	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 8.94 at 0.20- 0.30 mbgl)	Not required	Not required	Not SCL
N19	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.25 at 0.50- 0.60 mbgl)	Not required	Not required	Not SCL
Overall									Not SCL

Map Unit 2 exhibited limitations relating to SCL criteria soil pH.

pH levels were above pH 8.9 at 300- and 600-mm soil depth at Sites N17, N18 and N19 from 8.94 to 9.25. These concentrations did not meet the SCL pH criterion within range pH 5.1 and pH 8.9 for rigid soils.

None of the analysed sites meet the SCL criteria, therefore Map Unit 2 is not SCL.

4.3 Map Unit 3

The SCL assessment of Map Unit 3 is summarised below in Table 4-4.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	CCI
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
60-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N15	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N16	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Overall									Likely SCL

Table 4-4: SCL Assessment of Map Unit 3

Map Unit 3 did not exhibit any limitations relating to SCL criteria. All the analysed sites met the SCL criteria, therefore Map Unit 3 is likely SCL.

4.4 Map Unit 4

The SCL assessment of Map Unit 4 is summarised below in Table 4-5.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
N20	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail – Chemical limitation of pH 9.24 at 0.75-0.85 restricts PAWC	Not SCL
N21	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.01 at 0.50- 0.58 mbgl)	Not Required	Not Required	Not SCL
N22	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 8.96 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
Overall									Not SCL

Table 4-5: SCL Assessment of Map Unit 4

Map Unit 4 exhibited limitations relating to SCL criteria soil pH.

pH levels were above pH 8.9 at 600 mm soil depth at Sites N21 and N22 from 8.96 to 9.01. These concentrations did not meet the SCL pH criterion within range pH 5.1 and pH 8.9 for rigid soils. pH levels were above 9.0 within Site N20 at 0.75-0.85 m, indicating a chemical limitation for PAWC.

None of the analysed sites meet the SCL criteria, therefore Map Unit 4 is not SCL.

4.5 Map Unit 5

The SCL assessment of Map Unit 5 is summarised below in Table 4-6.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
Site N4-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.23 at 0.50- 0.60 mbgl)	Not required	Not required	Not SCL
Site N5-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.03 at 0.5- 0.60 mbgl)	Not required	Not required	Not SCL
Site N9-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.20 at 0.55- 0.65 mbgl)	Not required	Not required	Not SCL
Overall									Not SCL

Table 4-6: SCL Assessment of Map Unit 4

Map Unit 5 exhibited limitations relating to SCL criteria soil pH.

pH levels were above pH 8.9 at 600 mm soil depth at Sites N4-SCL, N5-SCL and N9-SCL ranged from 9.03 to 9.23. These concentrations did not meet the SCL pH criterion within range pH 5.1 and pH 8.9 for rigid soils.

None of the analysed sites meet the SCL criteria, therefore Map Unit 5 is not SCL.

4.6 Map Unit 6

The SCL assessment of Map Unit 6 is summarised below in Table 4-7.

Table 4-7:	SCL A	Assessment	of	Мар	Unit	6

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
91-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.13 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
N26	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 8.93 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
N27	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.10 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
32-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.10 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
77-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
80-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.24 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
Overall									Not SCL

Map Unit 6 exhibited limitations relating to SCL criteria soil pH.

pH levels were above pH 8.9 at 600 mm soil depth at Sites 26, 27, 32 and 80-SCL from 8.93 to 9.24. These concentrations did not meet the SCL pH criterion within range pH 5.1 and pH 8.9 for rigid soils. SWS at site 91-SCL was 72.13 mm (Pawcer Pedotransfer function) and does not meet the SCL SWS criterion.

Most of the analysed sites did not meet the SCL criteria, therefore Map Unit 6 is not SCL.

4.7 Map Unit 7

The SCL assessment of Map Unit 7 is summarised below in Table 4-8.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	661
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
Site N1-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Site N2-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL

Table 4-8: SCL Assessment of Map Unit 7

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	50
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
Site N3-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Overall	-		<u>.</u>		- -	·			Likely SCL

Map Unit 7 did not exhibit any limitations relating to SCL criteria. All the analysed sites met the SCL criteria, therefore Map Unit 7 is likely SCL.

4.8 Map Unit 8

The SCL assessment of Map Unit 8 is summarised below in Table 4-9.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
N12	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N13	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N14	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Overall									Likely

Table 4-9: SCL Assessment of Map Unit 8

Map Unit 8 did not exhibit any limitations relating to SCL criteria. All the analysed sites met the SCL criteria, therefore Map Unit 8 is likely SCL.

4.9 Map Unit 9

The SCL assessment of Map Unit 9 is summarised below in Table 4-10.

Table 4-10: SCL Assessment of Map Unit 9

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	60
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
65-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N29	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	561
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
									SCL
N30	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N31	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N32	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N33	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Overall		•	•			•	·	·	Likely SCL

Map Unit 9 did not exhibit any limitations relating to SCL criteria. All the analysed sites met the SCL criteria, therefore Map Unit 9 is likely SCL.

4.10 Map Unit 10

The SCL assessment of Map Unit 10 is summarised below in Table 4-11.

Table 4-11: SCL Assessment of Map Unit 10

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
N28	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 8.92 at 0.50- 0.60 mbgl)	Not required	Not required	Not SCL
N43	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 8.99 at 0.50- 0.60 mbgl)	Not required	Not required	Not SCL
N45	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Overall									Not SCL

Map Unit 10 exhibited limitations relating to SCL criteria soil pH.

pH levels were above pH 8.9 at 600 mm soil depth at Sites N28 and N43 from 8.92 to 8.99. These concentrations did not meet the SCL pH criterion within range pH 5.1 and pH 8.9 for rigid soils.

Most of the analysed sites did not meet the SCL criteria, therefore Map Unit 10 is not SCL.

4.11 Map Unit 11

The SCL assessment of Map Unit 11 is summarised below in Table 4-12.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
N23	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.31 at 0.50- 0.60 mbgl)	Not Required	Not Required	Not SCL
N24	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 8.98 at 0.20- 0.30 mbgl)	Not Required	Not Required	Not SCL
N25	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.11 at 0.22- 0.30 mbgl)	Not Required	Not Required	Not SCL
Overall		•	·					·	Not SCL

Table 4-12: SCL Assessment of Map Unit 11

Map Unit 11 exhibited limitations relating to SCL criteria soil pH.

pH levels were above pH 8.9 at 300- and 600-mm soil depth at Sites N23, N24 and N25 from 8.98 to 9.31. These concentrations did not meet the SCL pH criterion within range pH 5.1 and pH 8.9 for rigid soils.

All the analysed sites did not meet the SCL criteria, therefore Map Unit 11 is not SCL.

4.12 Map Unit 12

The SCL assessment of Map Unit 12 is summarised below in Table 4-13.

 Table 4-13: SCL Assessment of Map Unit 12

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	661
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
N35	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N36	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N37	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	661
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
									SCL
Overall									Likely SCL

Map Unit 12 did not exhibit any limitations relating to SCL criteria. All the analysed sites met the SCL criteria, therefore Map Unit 12 is likely SCL.

4.13 Map Unit 13

The SCL assessment of Map Unit 13 is summarised below in Table 4-14.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	60
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
6-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
7-SCL	Pass	Pass	Pass	Pass	Pass	Exceeded (pH 9.05 at 0.20- 0.30 mbgl)	Not Required	Not Required	Not SCL
100-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Overall									Likely SCL

 Table 4-14: SCL Assessment of Map Unit 13

Map Unit 13 exhibited limitations relating to SCL criteria soil pH.

pH levels were above pH 8.9 at 300 mm soil depth at Site 7-SCL at 9.05. This concentration did not meet the SCL pH criterion within range pH 5.1 and pH 8.9 for rigid soils.

Most of the analysed sites did meet the SCL criteria, therefore Map Unit 13 is likely SCL.

4.14 Map Unit 14

The SCL assessment of Map Unit 14 is summarised below in Table 4-15.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm within range of pH 5.1 – 8.9 inclusive	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
Site 10-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Below limit at 83.79 mm Pedotran sfer Function	Not SCL
N41	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Below limit at 75 mm PAWC	Not SCL
N42	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Below limit at 98.64 mm Pedotran sfer Function	Not SCL
Overall									Not SCL

Table 4-15: SCL Assessment of Map Unit 14

Map Unit 14 exhibited limitations relating to SCL criteria SWS.

SWS at site 10-SCL, N41 and N42 were 83.79 mm (Pawcer Pedotransfer function), 75mm (SWS Lookup table) and 98.64 mm (Pawcer Pedotransfer function) and do not meet the SCL SWS criterion.

All the analysed sites did not meet the SCL criteria, therefore Map Unit 14 is not SCL.

4.15 Map Unit 15

The SCL assessment of Map Unit 15 is summarised below in Table 4-16.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	661
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
N38	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N39	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
N40	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL

Table 4-16: SCL Assessment of Map Unit 15

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	50
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
Overall									Likely SCL

Map Unit 15 did not exhibit any limitations relating to SCL criteria. All the analysed sites met the SCL criteria, therefore Map Unit 15 is likely SCL.

4.16 Map Unit 16

The SCL assessment of Map Unit 15 is summarised below in Table 4-17.

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	661
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
5-SCL-M	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
5-SCL-D	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
102-SCL-M	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
102-SCL-D	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
103-SCL-M	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
103-SCL-D	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Overall								Likely SCL	

Table 4-17: SCL Assessment of Map Unit 15

Map Unit 16 did not exhibit any limitations relating to SCL criteria. All the analysed sites met the SCL criteria, therefore Map Unit 16 is likely SCL.

4.17 Map Unit 17

The SCL assessment of Map Unit 17 is summarised below in Table 4-18.

Table 4-18: SCL Assessment of Map Unit 17

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	60
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	Status
Site 4-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely

SCL Criterion	Slope	Rockiness	Gilgai	Soil Depth	Soil Wetness	Soil pH	Salinity	Soil Water Storage	661
Criterion Threshold	≤3%	≤20 rocks >60mm	<50% of gilgai >500m m depth	≥600 mm	Favourable drainage	300/600 mm greater than pH 5.0	<800mg/ kg at 600mm	≥100mm to soil depth ≥1000m m	SCL Status
									SCL
Site 110-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Site 115-SCL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Likely SCL
Overall								Likely SCL	

Map Unit 17 did not exhibit any limitations relating to SCL criteria. All the analysed sites met the SCL criteria, therefore Map Unit 17 is likely SCL

5 CONCLUSIONS

The key conclusions of the SCL assessment are as follows:

- 17 map units have been identified within the project site;
- Nine map units, 3, 7, 8, 9, 12, 13, 15, 16 and 17, meet the SCL criteria;
- Six map units, 1, 2, 4, 5, 10 and 11, do not meet the SCL criterion for soil chemistry pH limitation exceedance;
- One map unit, Map Unit 14, does not meet the SCL criterion for soil water storage; and
- One map unit, Map Unit 6, does not meet the SCL criterions for both for soil water storage and for soil chemistry pH limitation exceedance.

6 **REFERENCES**

Baker, D.E. and Eldershaw, V.J. (1993) *Interpreting Soil Analysis for agricultural use in Queensland*. QDPI QO93014. Brisbane.

Bruce, R.C. and Rayment, G.F. (1982), *Analytical Methods and interpretations used by the Agricultural Chemical Branch, QDPI, for soil and land use surveys.* QDPI Bulletin QB82004. Brisbane

Bruce, R.C. and Rayment, G.F. (1984), *Soil Testing and Some Test Interpretations used by the QDPI*. QDPI Bulletin QI84029. Brisbane.

Department of Minerals and Energy (1995), *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland – Land Suitability Assessment Techniques*. Environmental Protection Agency. Brisbane.

Google Earth (2018), CNES / Digital Globe Image, 7520399 mS 639150 mE (GDA94 Zone 55), Accessed 25 January 2018, <<u>http://www.google.com/earth/index.html</u>>.

GT Environmental Services (2011), Saraji East Coal Mine Project, Soils and Land Suitability.

Gunn, R.H, Beattie, J.A., Reid, R.E. and van de Graff, R. (1988), *Australian Soil and Land Survey: Guidelines for Conducting Surveys*. Inkata Press. Melbourne.

Gunn, R.H, Speck, N.H, Wright, R.L, Sweeney, F.C, Perry, R.A, Fitzpatrick, E.A, Wilson, I.B (1968) *Lands of the Dawson-Fitzroy Area, Queensland*. Commonwealth Scientific and Industrial Research Organisation. Melbourne.

Isbell, R.F. (2002), *The Australian Soil Classification*. CSIRO Publishing. Collingwood VIC.

Land Resources Branch Staff (1990), *Guidelines for agricultural land evaluation in Queensland*. Queensland Department of Primary Industries. QI9005.

McKenzie, N.J., Grundy, M.J., Webster. R. Ringrose-Voase. A.J. (2008), *Guidelines for Surveying Soils and Land Resources*. Second Edition. CSIRO Publishing.

Munsell Color (Firm). (2009). *Munsell soil color charts*: with genuine Munsell color chips. Grand Rapids, MI: Munsell Color.

National Committee on Soil and Terrain (2009), *Australian Soil and Land Survey: Field Handbook*. Third Edition, CSIRO Publishing. Melbourne.

Northcote. K. H (1979). *A factual key for the recognition of Australian soils*. 4th Edition, Rellim Tech Publishing, Glenside, South Australia.

Queensland Government, (2014), Regional Planning Interests Act 2014.

Queensland Government, (2014), Regional Planning Interests Regulation 2014.

Queensland Government, (2014), *Regional Planning Interests Act Statutory Guideline 08/14 2017*.

7 GLOSSARY OF TERMS

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

Alluvial. Describes material, sand, silt, clay, gravel or other material deposited by, or in transit in, flowing water.

ASC. Australian soil class

ASPAC. Australasian Soil and Plant Analysis Council.

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

Chloride. The concentration of chloride is usually an indicator of the severity of potential salinity.

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

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

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

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

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

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

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

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

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

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

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

NATA. National Association of Testing Authority.

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

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

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

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

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

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

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

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

8 FIGURES

- Figure 1 SCL Trigger Map
- Figure 2 Map Units
- Figure 3 Strategic Cropping Land






9 APPENDICES

- Appendix A Detailed site descriptions
- Appendix B Check site descriptions
- Appendix C Soil Water Storage Calculations
- Appendix D PAWCER Calculations
- Appendix E Laboratory Certificates

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