FINAL REPORT

Queensland Gas Company Limited (QGC)

Queensland Curtis LNG Project: LNG Facility and Associated Infrastructure

Geology, Geomorphology, Topography and Soils

January 2010

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For and on behalf of Environmental Resources Management Australia	
Approved by:	David Pope
Signed:	
Position:	Partner
Date:	20 April 2009

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ANNEXURES

1 INTRODUCTION

This report detailing the geology, geomorphology, topography and soils of the project area of the proposed LNG facility on Curtis Island has been compiled using available data and published information, including aerial photographs, geological reports, topographic maps and database searches. This has been supplemented by field works undertaken in October – November 2008 to ground truth the data in the published reports.

Field works incorporated detailed soil sampling and chemical characterisation of soils to assess the erosion potential of soils and landscape as a result of the proposed construction works. Specific investigations were also undertaken to identify and characterise acid sulfate soils and contaminated land in the LNG project precinct. The findings from these investigations are presented in separate reports.

This report addresses the requirements specified in the Queensland Curtis LNG Project EIS and Permitting CTR documents CTR 2-02 and CTR 2-06 (Geology, Soils and Land Contamination) and CTR 2-01 (Topography and Geomorphology). The report is intended to provide information on the environmental values of baseline for each component of interest in order to assess the potential environmental impacts associated with the proposed development of the site.

The report was compiled with reference to the following guideline documents:

- *SPP 1/92: Development and the Conservation of Agricultural Land (*and associated Guidelines*);*
- *SPP 2/02: Planning and Managing Development Involving Acid Sulphate Soils;*
- *SPP 2/07: Protection of Extractive Resources;*
- *SPP 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide;*
- *Australian Soil and Land Survey Field Handbook (McDonald et al, 1990) & Australian Soil Classification (Isbell, 1996);*
- *Planning Guidelines: the Identification of Good Quality Agricultural Land (DPI, DHLGP, 1993);*
- *Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils (ASS) in Queensland 1998 (Revision 4.0);*
- *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (Qld EPA, 1998); and*
- *Queensland State Coastal Management Plan (SCMP) and Regional Coastal Management Plans. (RCMP).*

2 GEOLOGY

2.1 PUBLISHED REPORTS

The following description of the regional geology is based on the Gladstone Special Sheet 9150, 1:100,000 (Donchak and Holmes 1991), published by Queensland Department of Natural Resources and Mines.

The Palaeozoic rocks of the Gladstone area form part of the Tasman orogenic zone, a linear belt of deformed rocks on the eastern margin of the Australian craton which forms the northern extension of the New England Fold Belt.

The main geological unit in the eastern portion of the region is the Devonian – Carboniferous Curtis Island Group, which consists of conformable sequence of three formations – the Doonside, Wandilla and Shoalwater Formations. The Curtis Island Group has undergone a regional metamorphic event of upper greenschist to lower amphibolite grade, with the grade decreasing from east to west. The regional geology is shown in *Figure 1*. The regional structural trend is toward the north-west at 330. The location of the LNG facility and geological cross-section are presented in *Figure 2.*

The Narrows Graben, a block faulted basin, was formed during a period of crustal extension which occurred throughout eastern Queensland during the Late Cretaceous. The tectonic activity reactivated northwest trending basement faulting, resulting in relatively rapid subsidence in the region of the Narrows, producing Narrows Graben a block faulted continental basin approximately 40 km long and 5 km wide. The southern end of the Narrows Graben forms the Narrows Passage between the mainland and Curtis Island.

2.1.1 *Wandilla Formation*

The main geological unit in the project area is the Wandilla Formation, which forms a broad, north-west trending belt approximately 10 kilometres wide. This unit makes up the majority of Curtis Island and extends to the south through Gladstone. The thickness of the unit is uncertain due to internal folding and faulting. The unit consists mainly of mudstones and arenite, with subordinate chert and minor limestone. The mudstone is characteristically dark grey, and is commonly indurated. Lenticular and discontinuous cream sandy laminae are common, with locally developed phyllitic, micaeous sheen developed on cleavage surfaces. Thin quartz veinlets and less commonly thick quartz veins penetrate the rocks parallel to the major foliation. Interbedded with the mudstones are thick, massive beds of weakly foliated grey to greenish grey arenites, with minor greywackes and quartz arenites.

Holocene sediments comprising of tidal flats and surficial alluvial material occur on the western margin of the site on Curtis Island and on the eastern shore at Friend Point

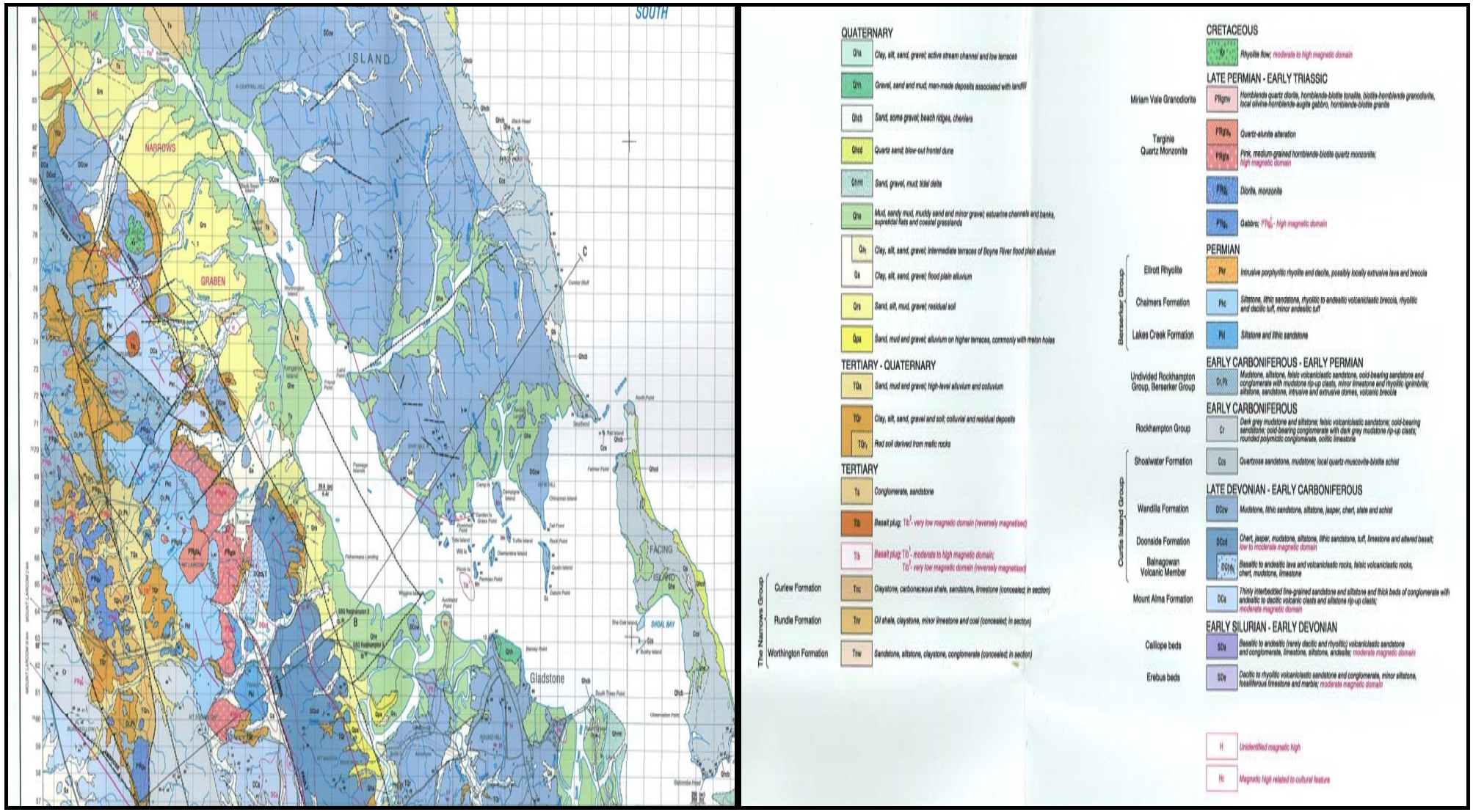

Figure 1 Regional Geology of the Gladstone region (from Donchak and Holmes, 1991)

2.2 *FIELD OBSERVATIONS*

The extent of outcrop across the site was < 5%, with outcrops of bedrock generally restricted to incised creeks. Colluvium deposits which were observed across the site, comprising

Superficial deposits observed across the site comprised of angular to subangular clasts ranging in size from 10mm to 1 metre.

The dominant rock type identified in the site area consisted of fine grained to microcrystalline massive to blocky dark grey to light grey indurated mudstone and arenite which was considered to be attributable to the Wandilla Formation. Minor cream to pale brown siltstone outcrops within the project area exhibit foliation and jointing**.** The siltstone exhibited a dominant jointing direction of 330, reflecting the regional trend. Quartz veinlets (2-5 mm wide) were observed in surface outcrops and colluvium as a result of the jointing and folding developed during the regional metamorphic event.

An exposed outcrop and soil profile in the creek bed at GR 0317168E 7370626N shown in Photo 1 exhibited evidence of prolonged weathering, with the development of ferruginous soils and the formation of yellow brown to orange brown laterite. The underlying alluvial material also exhibited extensive cementation by ferruginous material.

The soil profile shown in Photo 1 was observed in a single location (GR 0317291 7370681) and may represent an older soil profile which has undergone extensive weathering which has resulted in the formation of a duplex soil exhibiting extensive ferruginous weathering and development of an underlying lateritic concretion/cemented matrix.

Photo 1 ***Deep weathering profile exposed in creek cutting at GR 0317168E 7370626N.***

2.3 *SEISMICITY*

The seismicity of the Gladstone area has been reported by the Queensland University Advanced Centre for Earthquake Studies (QUAKES)[1]. The Gladstone area is considered to be the sixth most seismically active area in Australia, and lies on the northern edge of a seismic belt that stretches between Brisbane and Gladstone.

The Queensland catalog contains a total of 409 earthquakes in the Gladstone map region. Major recorded earthquakes include the 1918 quake, possibly the largest earthquake to strike in or adjacent to eastern Australia, which occurred about 135 km offshore Gladstone in 1918 (Richter magnitude estimate of ML = 6.3 based on felt area and ML = 6.0 based on an instrumental recording). The quake was felt from Mackay in the north to Grafton (NSW) in the south and Charleville in the west.

Other noteworthy earthquakes near Gladstone include the 1953 Many Peaks earthquake, the Heron Island 1978 earthquake, and the 1998 offshore Rockhampton earthquake. Other earthquakes felt in Gladstone include the 1883 ML = 5.9 Gayndah earthquake, the 1910 ML = 5.2 Mundubbera earthquake, and the 1935 ML = 6.1 Gayndah earthquake

The western margin of Curtis Island falls within or near the boundary of the Narrows Graben, a prominent structural feature in the area. The available data indicate that these faults are not known to be active.

Data from the Rockhampton 1:250,000 geological sheet SF 56-13 (1974) indicated that possible east-west faulting exists to the immediate north of the site through Graham Creek, and southeast-northwest through the Narrows.

2.4 *ENVIRONMENTAL VALUES*

Based on the information obtained from the published reports and field observations, there are currently no significant environmental values associated with the geological formations present in the proposed project area.

[1] Earthquake Maps of Queensland and Australia. www.quakes.uq.edu.au/seis_maps/

3 GEOMORPHOLOGY

3.1 FIELD OBSERVATIONS

The main factors controlling the geomorphological development on Curtis Island are water, as runoff and tidal movements, vegetation, soils and geology. There were two main water courses observed during the field works, which flow through the site from the northeast to the southwest. There are several smaller first and second order perennial water courses which flow into the main creeks from the elevated areas on the south and north of the site.

The creeks observed across the site generally range in width between 2 - 5 metres and a typical depth of 0.5 - 1.5 with a maximum depth of up to 5 metres in the eastern portion of the site (see Photo 1). The water courses exhibit variable degrees of erosion, with the upper reaches showing higher erosion than the lower reaches (Photo 2).

Photo 2 Evidence of erosion in the upper part of water course (flowing to the south)

The landform of the site and within the ancillary access routes consists predominantly of low rolling hills, with elevation increasing to the eastern margin of the site to a maximum of approximately 60m AHD. The western margin of the site consists of intertidal to intratidal flats, which grade westwards into mangroves and salt flats. The tidal flats occupy an area of approximately 15 hectares, consisting of an elongate area approximately 1.3km long by 100-150 metres wide.

The major factor influencing the development of landform characteristics is water, with erosion of soils from runoff occurring as rills across the relatively flat sections of the site, and as water-driven erosion, which formed creeks of generally limited width and depth.

The site contains a number of small water courses, which occur between hills across the site and drain west to south-westwards towards the tidal flats on the western margin of the site. The water courses are first and second order and exhibit variable degrees of bank erosion.

The creeks were observed to be dry during the field work (November 2008) and therefore no assessment of the erosion potential or runoff could be made during the site inspection and mapping. However, based on the evidence of erosion in several of the streams, it appears that erosion potential for the site exists, particularly during high rainfall events (Photo 3).

Photo 3 ***Erosion along creek bank, exposing overlying soil profile consisting of overbank alluvial deposits***

Other factors which impacted on the geomorphological development of the land include vegetation and weathering. Soil disturbance due to falling trees was observed in a limited number of locations across the site, which resulted in limited disturbance of the underlying soil and exposure of the underlying bedrock from penetration of the weathered substrate by roots.

3.2 *LANDSLIPS*

There was no evidence of seismic activity or landslides/landslips in the project area, based on visual observation of surface conditions. An assessment of the geology, soils and landform types was undertaken during the site inspection to assess whether the area met the criteria detailed in SPP 1/03 (Annex 3 - landslide component), which are as follows:

- an area identified by a local government in its planning scheme consistent with the conclusions of a landslide hazard assessment prepared in accordance with Appendix 4 of the SPP 1/03 Guideline; or

- where such a study has not been undertaken, an area identified by a local government in its planning scheme and including all land of 15% and greater slope and other land known or suspected by the local government as being geologically unstable, together with other areas that the local government considers may be adversely affected by a landslide event; or

- where an area has not been identified by a local government, all land with a slope of 15%or greater.

The initial limited assessment considered the risk of landslide, as defined in SP 1/03, as acceptable for the Curtis Island LNG site and the associated pipeline and infrastructure. However, the overall acceptability of the site in terms of SPP1/03 (landslide component) should be re-assessed to incorporate the results from the geotechnical drilling on the site to determine the subsurface conditions on the site.

3.3 *ENVIRONMENTAL VALUES*

Based on the information obtained from the published reports and field observations, there are currently no significant environmental values associated with the geomorphology present in the proposed project area.

4 TOPOGRAPHY

The majority of the Curtis Island site consists of undulating hilly terrain, with a maximum elevation of 60 m AHD. The elevation of the majority of the site is between 10 metres and 25 metres AHD. The overall site is basin-like with hills on the southern, northern and western boundaries. These hills have maximum elevations of 60 metres, 55 metres and 60 metres respectively. The topography of the project area and proposed pipeline and access road routes is shown in Figure 3.

The western margin of the site is flanked by intertidal to supratidal salt and mangrove flats. The intertidal flats range from approximately 0.5 metres to 3 metres above sea level and extend approximately 100 metres to 250 metres from the shore line.

The flats commonly contain alluvial deposits consisting of angular to sub-angular clasts derived from the adjacent surrounding hills. The clasts range in size from 2mm to 300mm, with larger clasts (20-100mm) associated with outflows from creeks draining from the hilly region immediately to the east of the flats.

4.1 SURFACE RUNOFF

Based on the field observations of the relatively low relief and the extensive coverage of the site by colluvium, the potential for extensive erosion and run off across the site in not considered as significant. However, runoff and erosion may be accelerated along extant water courses during periods of heavy rainfall, which are more common during the period between December and February.

4.2 ENVIRONMENTAL VALUES

Based on the information obtained from the published reports and field observations, there are currently no significant environmental values associated with the topography present in the proposed project area.

5 SOILS

The soils of the proposed LNG site on Curtis Island were assessed using the *Australian Soil and Land Survey Field Handbook 2nd ed.* (McDonald et al, 1998) and from information obtained from the Australian Soil Resource Information System (ASRIS)[2]. There are a number of factors which influence the formation and soil development, including climate, geology, landform, land use and vegetation.

Soil sampling and analysis was undertaken as part of three individual investigations; acid sulphate soils (ASS), contaminated land assessment and the assessment of the erodibility of soils across the entire LNG site, including the proposed road way and pipeline routes.

5.1 BASELINE DESCRIPTION

The soils on Curtis Island have been classified within the Australian Soil Classification (Isbell, 1996) as grey sodosols, and brown and red Chromosols. Soils at elevations < 5 metres AHD are detailed in the section on acid sulphate soils. These soils have been classified within the Australian Soil Classification as Hydrosols, Sulphidic Hydrosols and Histic-Sulphidic Hydrosols (potential acid sulphate soils. Detailed information on the various properties of the soils on Curtis Island and adjacent mainland is available from Australian Soil Resource Information System (ASRIS)[2]. The soil characteristics change to bleached silty surface, brown and grey, sodic duplex soils on the lower colluvial slopes of the project site.

Surficial soils identified during field work on Curtis Island consisted predominantly of hard dry pale grey to light brown clay and silts. The soil cover on the project area is relatively thin (0.5m to approximately 1.5 m). The depth of the soil profile varied, with thicker profiles observed in creek cuttings. Limited mechanical augering conducted during the contaminated land investigation on the flatter areas of the site indicated soils up to 3.4 metres deep. The soils identified at this site (GR 0316533E 7370038N) consisted of yellow grey stiff clays overlying coarse angular blocky indurated mudstone.

The total area of the site is approximately 260 hectares, with the majority of the site (approximately 240 hectares) being at elevation > 5 metres AHD. The area of the site at elevation < 5m AHD is approximately 15-20 hectares, present on the western margin of the site. This low-lying area consists of salt flats and mangrove areas. This area has been assessed in detail separately as part of acid sulphate soil assessment.

[2] Australian Soil Resource Information System (ASRIS). www.asris.csiro.au

5.2 *CLIMATE*

The climate of the Gladstone area consists of hot, wet summers and cool dry winters. The mean maximum temperature of 31.2° C occurs in January and the mean minimum temperature of 13.3° C occurs in July. The average annual rainfall is 878 mm, with most rainfall occurring between December and February (BoM data, Gladstone Radar, 1957 – present).

5.3 *LAND USE*

The site and surrounding land is currently used for pastoral grazing of cattle. The historical land use, from 1940's to 1970's included dairying and limited horticulture

5.4 *GEOLOGY*

The geology of the site consists predominantly of pale to mid grey, fine to indurated microcrystalline siliceous dark grey mudstone with minor arenite and siltstone of the Devonian-Carboniferous Wandilla Formation, which forms part of the Curtis Island Group (Donchak and Holmes, 1991).

5.5 *OUTCROP*

The exposed outcrop across the site was generally less than 5% of the total area, with exposed bedrock limited to creeks and less commonly on higher ground on the top of hills. The majority of the site was covered with colluvium, which ranged in size from approximately 10mm to 1m. The distribution of clast sizes varied across the site, with most clasts in the size range of 20-100mm. The blocky nature of the outcrop is shown in Photo 4.

Photo 4 ***Outcrop of dark grey blocky indurated mudstone of the Wandilla Formation, Curtis Island***

5.6 *VEGETATION*

The vegetation distribution across the site ranged from open woodland, with individual eucalypts and iron bark trees up to approximately 30 metres in height, to closed medium density undergrowth of eucalypt saplings ranging in height from 1-3m. The open woodlands occupied approximately 65% of the site, with the medium density saplings occupying the remaining 35%. The sapling understory occupied areas approximately 50-200m wide, where present, with larger trees distributed relatively evenly throughout.

The dominant vegetation types consisted of *Eucalyptus citriodora* woodland (Lemon-scented Gum), *Eucalyptus tereticornis* woodland (Red Gum) (with *Eucalyptus crebra)* (Narrow-leaved Ironbark). *Xanthorrea* spp. occurred in limited distribution across the site, and occupied approximately 5% of the total area. Tree heights of the open woodland ranged up to approximately 25m. Open woodlands and medium density understory of saplings are shown in Photos 5 and 6.

Photo 5 *Typical open woodland, dominated by E.citriodora and E.tereticornis*

Photo 6 *Typical understory of saplings of E. crebra, E. citriodora and E. tereticornis*

6 SOIL SAMPLING AND ANALYSIS

The density of the soil sampling undertaken on the project site was based on the requirements specified in *Planning Guidelines: The Identification of Good Quality Agricultural Land (1993)* and detailed in *Table 1*. Soil sampling locations are shown in Figure 4.

Table 1 Recommended Density of Ground Observations for Detailed Mapping

Total Area of Site	Map Scale	Density (ha per observation)[1]
Less than 10 hectares	1:2,500	0.5 – 1.0 ha
10-100 hectares	1:5,000	1.0 – 4.0 ha
More than 100 hectares	1:10,000	6.25 – 25 ha

Notes: 1.Lower recommended densities are acceptable only in areas of uniform soil types

The requirements outlined for the sampling in the Guidelines for the determination of good quality agricultural land recommend sampling of soil profiles to a depth of 1.2 metres, with samples collected from 0-0.1m, 0.2-0.3m, 0.5-0.6m, 0.8-0.9m and 1.1-1.2m.

Based on the sampling density detailed in *Table 1.1*, a total of 45 locations were sampled, with a total of 59 samples collected for analysis. Sampling was conducted across the site of the proposed LNG plant and along the proposed pipeline and access road routes. Soil sampling locations are presented in *Annex A*.

Samples were obtained by hand auger from depths between 0.05 metres to 0.6 metres. The depth of sampling was restricted by the hardness of the ground and the widespread presence of coarse gravel fragments, which limited the depth of penetration of the hand auger. As a result of the hard soils, most samples collected for analysis were obtained from depths of 0.15-0.2 metres.

Samples were placed into glass jars and sealed prior to storage on ice in insulated cool boxes. Samples were sent to Amdel/Labmark in Brisbane, a NATA accredited laboratory, for determination of pH, salinity and cation exchange capacity (CEC) for sodium, calcium, magnesium, potassium and exchangeable sodium percentage (ESP). ESP was determined for the soils to ascertain the dispersivity of soils, which in turn is related to the erodibility of the soils. This parameter is important as the distribution of soils with high ESP (> 6) will influence the geotechnical characteristics of the soil.

6.1 ACID SULPHATE SOILS

Acid sulfate soils were identified in areas on Curtis Island and Friend Point on intertidal to supratidal sediments at elevations < 5 metres AHD. The total area occupied by the tidal flats is approximately 15 hectares (Curtis Island)

and approximately 1,000 hectares at Friend Point, of which 16 hectares was sampled as part of the assessment of ASS material along the provisional gas pipeline and access road routes. Detailed description and results of the ASS investigation are presented separately.

6.2 FIELD OBSERVATIONS

The soils were described using the approach detailed in McDonald et al (1998). The development of soil profiles across the site was generally poor, with little organic matter observed in the soil samples. Soils were predominantly hard, dry and powdery, and formed hard surfaces up to 10 cm in depth. The development of O horizon was restricted to locations with extensive leaf litter, with the maximum observed thickness of 5mm. This horizon was absent from the majority of sample locations.

Soil colour was predominantly pale yellowish brown (10YR 6/2) to dark yellowish brown (10YR 4/2) and pale brown (5YR 5/2), with minor (< 5%) moderate brown (5YR 3/4) and greyish brown (5YR 3/2) soils also observed.

The texture of the soils was generally fine, with clay and fine silt fractions dominant, fine sand, where present, was subordinate (< 5%). Gravel fragments were widespread, and constituted up to 25% in a number of sampling locations. Coarse fragments ranged in size from 2mm to 30mm and ranged from angular to sub-rounded, with sub-angular fragments dominant. Orange mottling was observed rarely (GR 0316249E 7370499N), with the percentage of mottles being < 5% where present. Land disturbance was minimal, with a single access track across the site to Laird Point being the only evidence of regular human disturbance. Tracks from hard hooved animals (cattle and brumbies) were also observed in a limited area across the site.

The results from the acid sulfate soil investigation on Curtis Island indicated that the tidal flats area is underlain by hard Pleistocene clays at depths between 0.5m and 2.5m, with the thickness of the soft, intertidal /mangrove silts and muds decreasing towards the landward side of the site.

The depth of the tidal sediments at Friend Point was not able to be determined during the field works as sampling was only conducted using a hand auger to a maximum depth of 3 metres. Field penetrometer testing indicated that the substrate became harder and stiffer at depths between 5 metres and 7.5 metres below ground level.

The tidal flats from Curtis Island and Friend Point were generally oxidised in the upper 0.3-0.5 metres, grading into dark grey silt and clay to depth. The sediments generally contained layers of organic-rich material 0.1-0.2 metres thick. The sediments from Curtis Island contained a layer of medium to coarse gravel 5-10 cm thick immediately above the Pleistocene clays which were observed to underlie the entire tidal flat area.

7 SOIL ANALYTICAL RESULTS

The following parameters were determined for soil samples collected from Curtis Island:

- Moisture content (% moisture);
- pH (1:5 H_2O);
- Electrical Conductivity (1:5 H_2O);
- Cation Exchange Capacity (CEC);
- Exchangeable Cations (Ca^{2+}, Mg^{2+}, K^+, Na^+); and
- Exchangeable sodium percentage (ESP).

Detailed field descriptions for each sample are presented in *Annex B* and full laboratory analytical results presented in *Annex C*.

7.1 MOISTURE CONTENT

The moisture content of the soils was generally low, ranging between 1-6%. Samples collected following overnight rainfall of 5mm exhibited somewhat higher moisture contents of 8-16%.

7.2 PH (1:5 H_2O)

The pH of the soils was relatively constant, ranging between pH 5.1 and pH 6.6. The only exceptions were samples SB-13 (pH8.3) and SB-14 (pH 8.0). Soils with pH <5.5 are generally classified as acidic. Application of this criteria indicated that 19% of the soil samples would be classified as acidic.

7.3 ELECTRICAL CONDUCTIVITY (μScm^{-1})

The measured electrical conductivity (EC) for the soils was low, ranging between <20 – 257 μScm^{-1}. EC greater than 100μScm^{-1} was recorded in samples SB-3 (0.4-0.5 m), SB-6, SB-12, SB-14 and SB-24, otherwise the EC was < 93 μScm^{-1} (ave. 38 μScm^{-1}).

7.4 *CATION EXCHANGE CAPACITY (CEC)*

Cation exchange capacity is the ability of a soil to "hold" onto positively charged ions, including plant nutrients such as potassium, calcium, magnesium and ammonium. The CEC is largely determined by clay content and organic matter. The CEC of the soils from Curtis Island ranged between low (6-12 meqv/100g) and very high (40-100 meqv/100g), with an average value of 22 meqv/100g.

7.5 *EXCHANGEABLE CATIONS (MEQV/100G)*

Exchangeable cations (Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}) analysis was conducted to determine the potential erodability of the soils. The concentrations of exchangeable cations were reported in mg/kg, with the CEC calculated according to the following equation:

$$1 \text{ meq} = \text{mg*} \text{ valence/molecular mass}$$

Where mg* equals the reported weight (in mg/kg) of the cation of interest

7.6 *EXCHANGEABLE SODIUM PERCENTAGE (ESP)*

Sodicity is a measure of the proportion of sodium ions present in a soil. It is measured as the exchangeable sodium percentage:

$$\text{ESP} = \text{Exchangeable Na} / \text{CEC}$$

General ratings for sodicity are as follows:

- Non-sodic ESP < 6%;
- Sodic ESP 6-14%;
- Strongly Sodic ESP >14-25%; and
- Very Strongly Sodic ESP >25%.

An ESP of 6 (%) is widely used in Australia as a critical limit for the adverse effects of sodicity (Northcote and Skene, 1972). ESP is conventionally defined as exchangeable sodium expressed as a percentage of the cation exchange capacity (CEC) - both usually determined in Australia at pH 7 or 8.5. The influence of soil properties such as organic matter content, clay mineralogy, cation composition, sesquioxide content, and particularly electrolyte concentration will effect of ESP on dispersion behaviour of the soils.

The exchangeable cation concentrations are shown in *Table 2*. The maximum exchangeable cation concentration of 21.5 meqv/100g was reported for Ca in sample SB-30 (0-0.05m). The maximum exchangeable Mg, K and Na were reported for samples SB-14 (0.2-0.4m), SB-28 (0-0.1m) and SB-24 (0.2-0.3m), respectively.

Table 2 ***Exchangeable Cations (meqv/100g)***

	Minimum (meqv/100g)	Maximum (meqv/100g)	Geometric Mean(meqv/100g)
Calcium	0.07	21.8	1.93
Magnesium	0.32	18.1	2.69
Potassium	0.07	2.6	0.29
Sodium	0.09	2.4	0.29

The ESP of soils from Curtis Island ranged between 0.43-12.0% (geo. mean = 1.47%, n = 59), with ESP values > 6% reported from a total of four samples:

- SB3 (0.4-0.5m): 12.0%;
- SB12 (0.0-0.1m): 6.5%;
- SB12 (0.1-0.2m): 9.5%; and
- SB24 (0.2-0.3m): 7.6%.

The total areal extent of the sodic soils has not been fully delineated, but the presence of sodic soils, particularly in sub-surface samples obtained from depths of 0.2-0.5 metres does indicate that the potential for elevated erosion does exist, albeit in a limited area identified during the sampling program. Further sampling on a finer scale may be required particularly in areas where excavation of soils is planned to fully address the extent of the sodic soils on the site, and hence the erosion potential.

7.7 PHILLIPIE'S LANDING TO TARGINIE ROAD

Soil characterisation and properties for the mainland section of the proposed pipeline route were derived from Australian Soil Resource Information System (ASRIS). The information on the soil properties and classification are presented in *Table 3*.

Table 3 Soil Characteristics and Properties – Phillipie's Landing to Tarinie Road

Property	Soil Characteristics
Clay/silt/sand	20-40%/20-40%/20-40%
Topsoil thickness (m)	0.25-0.5 m
Solum Thickness (m)	0.5-1.0m
Elevation	5-30m (low rolling hills)
Texture	Loam/sandy clay (<10%) (Topsoil), medium clays (> 45% clay – Layer 3)
Drainage	Imperfectly drained
pH	6-6.5 (topsoil – Layer 1), 4.8-5.5 (Layer 3)
CEC	15-20cmol/kg (topsoil), 20-30cmol/kg (Layer 3)
Sodicity	< 5% (Topsoil), 5-10% (Layer 3)
Electrical Conductivity	Topsoil – < 0.05 dS/m, Layer 3 – 0.1-0.15dS/m
ASS potential	Extremely low probability of ASS

The soils in the area from Phillipie's Landing to Targinie Road are reported to be between 0.25 – 1metre in thickness, and have been classified as Sodosols, based on the properties of the B layer. The classification of the soils and reported parameters should be verified and refined through more detailed field assessment, as the classification as Sodosols indicates that the soils have a higher dispersive and hence erosion potential.

7.8 ACID SULFATE SOILS

A detailed investigation was conducted on Curtis Island to identify and characterise the presence of acid sulfate soils within the project area. The investigation focussed on the intertidal mudflats on the western margin of the site at elevations < 5m AHD and involved the installation of 21 soil boreholes to depths between 0.5m – 3.0m bgl and collection of and analysis of 94 samples by SPOCAS. The analysis of ASS from Friend Point and Curtis Island revealed that the sulfur content (S_{POS} - %S) ranged between <0.02% to 3.72% at Friend Point and <0.02% to 7.2% S at Curtis Island. The upper 0.3 metres at both sites was generally oxidised, with S_{POS} < 0.02%. The maximum concentration of S_{POS} occurred at depth of 0.5-1m at both locations and exhibited marked variation between sampling locations at both areas.

Detailed description of the PASS and the chemistry of the ASS material is discussed in detail in the chapter dealing with ASS and the associated ASS Management Plan.

8 *EROSION POTENTIAL*

The erosion potential of the soils is considered to be low for the site as currently exists due to the shallow depth of the soil profiles, the presence of extensive colluvium cover, vegetation coverage and the relatively gentle topography of the site. The erosion potential is dependent upon climatic conditions, and would be increased during periods of heavy rainfall, particularly along water courses which are present on the site. The soil sodicity (and EC) measurements as detailed in *Section 1.6.6* indicates that the soil generally does not have high dispersal properties and therefore should not have a high erosion potential.

However, ESP data from a limited number of samples does indicate that caution should be exercised when excavating soils from these sites (SB-3, SB-12, SB-24), as there is potential for increased erosion of these soils, particularly during higher rainfall events.

9 LAND SUITABILITY ASSESSMENT

9.1 QUALITY AGRICULTURAL LAND

The criteria used for the assessment of good quality agricultural land were derived from the *Planning Guidelines: The Identification of Good Quality Agricultural Land (1993)* detailed in *Table 4*.

Table 4 Description of Land Classes (Source: DHLGP, 1993)

Class	Description
Class A	**Crop land –** Land that is usable for current and potential crops with no limitations to production which range from none to moderate levels. There are 3 sub-classes of crop land: **A –** land suitable for plantation, tree and vine crops **A1 –** Cropland suitable for rain fed cropping **A2 –** Crop land suitable for horticulture
Class B	**Limited crop land –** Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping. Land marginal for particular crops of local significance is considered GQAL
Class C	**Pasture land –** Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment. In areas where pastoral industries are the primary industry, land suitable for improved or high quality native pastures may be considered GQAL. There are 3 sub-classes of pasture land: **C1 –** land suitable for sown pastures with moderate limitations **C2 –** Land suitable for sown pastures with severe limitations **C3 –** Land suitable for light grazing of native pastures in inaccessible areas. Of these, only C1 is considered to be GQAL.
Class D	**Non-agricultural land –** Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage

The GQAL assessment was determined from the results from field and laboratory assessment and with reference to *Table 4*. Using this data, the land suitability is Class C3 - Pasture land – Land suitable for light grazing of native pastures in inaccessible areas.

10 POTENTIAL IMPACTS AND MITIGATION METHODS

The construction phase of the Curtis Island LNG plant will involve extensive disturbance of vegetation and excavation of soil and bedrock across the site. Preliminary estimates of the volume of material to be excavated indicate that approximately 6,044,000 m^3 of cut and fill material will be generated, consisting of the following:

- Stripping/Grubbing – 774,000 m^3 (0.5 m over entire site);
- Cut – 3,154,000 m^3;
- Fill – 2,890,000 m^3; and
- Diversion ditch (Cut) – 500,000 m^3.

The erosion potential of the site may be increased as a result of vegetation clearing and construction activities associated with the development of the site. Mitigation procedures to minimise the erosion of soils, runoff and associated environmental impacts, including the degradation of waterways, should be incorporated into an erosion and sediment control plan (ESCP), which should include the implementation of the following control measures:

- Clearing of vegetation should be a staged operation, limited as much as possible to coincide with construction to minimise the area exposed to erosion by wind and/or water;
- Instruct all site workers in the implementation and management of erosion control measures and drivers to minimise damage to the local environment;
- Excavations and cut/fill works should be conducted in a staged manner to reduce the quantity of material stored on site in stockpiles;
- Excavations and clearing should be restricted as far as practicable, with retention of a buffer zone adjacent to water courses to minimise the potential for enhanced erosion through exposure of fresh soils;
- Land clearing and excavation work should be restricted during summer (December – February), when higher rainfall occurs which would increase the potential for sediment movement and runoff from the site;
- The installation of sediment traps and bunds along the boundaries of the construction areas to minimise the movement of soil into watercourses during high rainfall events;
- Dust suppression measures, such as the use of water sprays, non-toxic dust suppression chemicals such as calcium lignosulphonate, and wind fences, should be used on stockpiled material, roadways and other areas from which soil may be mobilised by activities associated with the construction phase;

- Re-vegetation of stockpiles which are not to be used as fill material during construction;

- Stormwater runoff shall be managed to minimise the potential for erosion including diverting flow over stable areas and away from disturbed areas;

- The condition of erosion/stormwater control structures shall be periodically checked during construction, especially after rainfall to ensure they remain effective e.g. berms, silt fences, turnoff drains;

- Uncontaminated sediment is to be removed from all sediment control devices and incorporated in fill batters or mounds on site. Contaminated sediment shall be disposed of to an approved stockpile area of disposal area;

- During construction, works will be regularly inspected to access the implementation of Management Actions;

- Weekly or post event inspections of erosion and sediment control devices should be conducted to ensure efficient operation;

- Monitoring of re-vegetation progress and soil stabilisation;

- Daily or weekly reports (as appropriate) shall be completed on site and reviewed by each Supervisor and/or Superintendent; and

- Regular reports will be prepared by the Construction Contractor in a format agreed to by the proponent, detailing the location of any soil erosion and sediment control structures and corrective actions undertaken in the event of exceeding performance criteria.

The excavation, handling, storage and subsequent use of soil and rock material will be dependant upon the geotechnical properties. Should the properties of the in-situ materials not be adequate to meet the requirements for construction, then material will need to be sourced from other areas. Based on the geological information, rock types within the project area and identified soil types, this scenario is considered unlikely. The only exception would be the need to import clean sand onto the site, as extensive sand deposits have not been identified in the proximity of the site.

10.1 QUANTITATIVE DETERMINATION OF SOIL LOSS

The quantitative determination of soil loss from the site resulting from erosion may be determined by the Universal Soil Loss Equation (USLE) model[3], which is an arithmetic method that can be used to obtain a quantitative estimate of

[3] Mitsova H. and Mitas L. (1999).
http://www2.gis.uiuc.edu:2280/modviz/erosion/usle.html

soil loss from a site. If it is assumed that all of the eroded soil on a project site will be delivered into one waterway or sediment basin, then the derived figure for soil loss will be equivalent to the potential sediment yield.

The method does have significant drawbacks in that it only considers sheet and rill erosion, taking no account of gully, tunnel or wind erosion. Further, it only predicts average annual soil loss rather than loss from individual storm events. Nevertheless, it still provides a useful tool that is widely used in impact assessment and in the design of erosion and sediment controls.

The method is based on a combination of all the factors influencing soil erosion outlined in (i) above, which are brought together into the following simple arithmetic equation:

$A = R \times K \times L \times S \times C \times P$

where A = annual rate of soil loss (t/ha)

R = rainfall erosivity factor, a measure of the erosive power of the rain

K = soil erodibility factor, a measure of the resistance of the soil to erosion

L = slope length factor

S = slope gradient factor

C = ground cover factor

P = land management practice factor.

The input parameters for the determination of the soil loss potential associated with earthworks and excavation require further evaluation of the geotechnical parameters to enable an estimation of the potential soil losses associated with excavation and earthworks during the construction phase of the LNG facility. The result from this will also provide input into the determination of the scale and range of mitigation measures.

10.2 ACID SULFATE SOILS (ASS)

The potential exists for disturbance of ASS identified on Curtis Island and Friend Point during the construction phase of the LNG plant and the associated infrastructure. The most effective management strategy is to leave the ASS, where possible, in an undisturbed state. As the proposed locations of the infrastructure and LNG plant will result in some disturbance of ASS, there is a requirement for separate, detailed assessment of the area to be impacted prior to commencement of excavation works. There is also a requirement to identify and prepare a dedicated area for the treatment of acid sulfate soils which may be disturbed during the construction phase. The requirements necessary to address the issues resulting from the disturbance of ASS are

discussed in detail in the acid sulfate soil management plan (ASSMP). As a minimum, the following steps need to be implemented:

- A detailed sampling program to fully characterise the extent and acid generating potential of the preferred road way and or pipeline route should be conducted prior to any excavation works where ASS has been identified;

- any area designated for treatment of ASS must be located at least 30 metres from the nearest water course; and

- The area must be lined with compacted clay, with bunding, leachate collection drains and separate runoff treatment ponds to treatment to eliminate the potential for acid runoff impacting on receiving waters.

A number of water courses currently flow through the site where construction is planned. In order to minimise the influence of sediment in runoff on the receiving waters adjacent to the site, the following strategies should be implemented:

- The installation of a retention pond, with sufficient capacity to contain runoff;

- Design and installation of drainage system to ensure surface runoff is captured and directed to the retention pond prior to release; and

- Installation of water quality monitoring system to assess water quality parameters including total dissolved solids, suspended solids, pH and electrical conductivity to ensure no adverse impacts will occur in receiving waters following release.

10.3 CONTAMINATION POTENTIAL

Limited analysis of soils for heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) and organochlorine (OC) and organophosphorus (OP) pesticides undertaken as part of the investigation of potentially contaminated soils associated with an area assumed to be a former cattle dip site, reported that concentrations of all analytes were either below analytical detection limit (OC and OP) or below the investigation criteria specified in *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland, 1998*.

Information obtained from the database search of the Environmental Management Register (EMR) and Contaminated Land Register (CLR) on the current and historical land use in the project area, indicated that there were no listed or registered sites within the project boundary and it is therefore unlikely that significant contamination from heavy metals, petroleum hydrocarbons or polycyclic aromatic hydrocarbons (PAH) exist on the site. However, sampling and analysis of soils from the project area should be undertaken during the construction phase to confirm this assessment. Should

contamination be identified, appropriate measures, such as delineation of contamination and separation of contaminated soils should be implemented to ensure environmental impacts do not occur.

Contamination may arise from storage and handling of hydrocarbons and chemicals on the site during the construction phase. To minimise the potential for soil, groundwater and receiving water contamination, storage of all fuels and chemicals must comply with the requirements specified for the handling and storage of dangerous goods in the *Queensland Dangerous Goods Safety Management Regulations, 2001*, and any other regulation that apply for the storage and handling of any materials that may have an adverse impact if released into the surrounding environment. This includes the use of bunded areas, installation of oil/water separators and regular monitoring of groundwater and surface waters to ensure that any releases are identified and remediated in a prompt manner.

Contamination of groundwater, surface waters and surrounding receiving waters may also occur from leachate derived from temporary toilet facilities to be installed for the construction phase of the Curtis Island LNG facility, and permanent facilities on site for the operational life of the plant. Construction of the facilities should ensure the leakages and spillage of waste water and sewage is minimised. Should disposal of the waste water and sewage require treatment and disposal to be undertaken at a designated STP in Gladstone, an assessment of the storage, handling and transportation operations will need to be undertaken. This should include:

- Monitoring and regular checks of the facilities to ensure there is no leakage or spillage;
- Installation of bunding around the facilities to minimise runoff and facilitate rapid response and treatment should a spill occur; and
- Installation of groundwater monitoring system to enable sampling of biological agents, such as e.coli and faecal coliforms as part of the overall monitoring program.

10.4 CONSTRUCTION ACTIVITIES

The potential use of fill material on the identified areas of ASS on Curtis Island will require a detailed assessment of the geotechnical properties of the material prior to ant works being undertaken. This should include the installation of peizometers to assess the depth and quality of pre-existing groundwater and to monitor any changes in groundwater elevation, flow direction and composition associated with compaction.

The potential changes to groundwater depth and preferential flow pathways should be addressed by an engineering assessment. Footwall drains should be installed along the front of the construction area to capture any

groundwater runoff that may arise from loading of the ASS material to prevent any environmental impact. The captured water should be sampled and analysed for pH, conductivity to determine whether further treatment is required prior to release.

Detailed sampling and assessment of ASS on the tidal flats at Friend Point which have been initially assessed for the construction of the gas pipeline and road access routes from Friend Point to Curtis Island will also need to undertaken prior to finalisation and construction. At present, the design and route(s) for the pipeline and road access have not been finalised, however, several of the options for the infrastructure entail excavation and construction across the tidal flats at Friend Point. Should the final route for the pipeline and/or road access cross the tidal flats, then a more detailed assessment of the ASS will be required to enable appropriate and adequate management measures to be implemented to ensure that no environmental impacts arise from disturbance of any ASS material.

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Annex A

Sampling Locations and Figures

Table A.1 Soil Sampling Locations

Sample No.	Easting	Northing	Elevation (m)	Depth (cm)	Colour
SB-1	0317262	7370046	45	0-20	10YR 4/2
SB-1	0317262	7370046	45	20-40	10YR 4/2
SB-1	0317262	7370046	45	40-60	5YR 4/1
SB-2	0316881	7369628	40	0-10	5YR 5/2
SB-2	0316881	7369628	40	10-20	5YR 5/2
SB-2	0316881	7369628	40	40-50	10YR 5/2
SB-3	0316767	7369408	58	0-20	10YR 6/2
SB-3	0316767	7369408	58	40-50	10YR 6/2
SB-4	0316740	7369903	38	0-15	10YR 6/2
SB-5	0315872	7370813	31	0-20	10YR 5/2
SB-5	0315872	7370813	31	20-40	10YR 6/2
SB-5	0315872	7370813	31	40-50	10YR 6/2
SB-6	0315901	7370512	14	0-5	10YR 6/2
SB-7	0316281	7370002	11	0-20	10YR 4/2
SB-7	0316281	7370002	11	30-50	5YR 5/2
SB-8	0315991	7372605	20	0-20	10YR 5/4
SB-9	0315856	7371990	26	0-20	10YR 6/2
SB-9	0315856	7371990	26	20-30	10YR 6/2
SB-10	0315885	7371629	8	0-20	10YR 3/2
SB-11	0316093	7370973	53	0-15	5YR 3/2
SB-12	0315680	7370771	12	0-10	10YR 4/2
SB-12	0315680	7370771	12	10-20	10YR 3/2
SB-13	0317291	7370681	28	0-15	5YR 3/4
SB-14	0317416	7370855	43	0-15	10YR 4/2
SB-14	0317416	7370855	43	20-40	10YR 4/2
SB-15	0316784	7370168	22	0-20	10YR 6/2
SB-16	0315990	7372578	27	0-20	10YR 4/2
SB-17	0315778	7372609	18	0-10	10YR 6/2
SB-18	0315648	7372628	15	0-20	10YR 4/2
SB-19	0316123	7372556	57	0-10	10YR 4/2
SB-20	0315906	7371637	8	0-10	10YR 2/2
SB-21	0316002	7371867	23	0-15	10YR 4/2
SB-22	0315904	7372105	12	0-5	10YR 4/2
SB-23	0315623	7372250	9	0-15	10YR 6/2
SB-24	0315244	7372243	3	0-15	5YR 5/2

Sample No.	Easting	Northing	Elevation (m)	Depth (cm)	Colour
SB-24	0315244	7372243	3	20-30	10YR 4/2
SB-25	0315129	7372371	7	0-15	5YR 4/1
SB-26	0314249	7372424	18	0-10	5YR 3/4
SB-27	0314503	7372759	27	0-15	5YR 3/4
SB-28	0314906	7372494	20	0-10	5YR 5/2
SB-29	0314881	7372374	30	0-15	5YR 3/4
SB-30	0314607	7372420	58	0-5	5YR 3/2
SB-31	0315257	7372299	26	0-5	5YR 4/1
SB-32	0315628	7372502	5	0-15	5YR 4/1
SB-33	0316004	7372508	20	0-10	10YR 4/2
SB-34	0316500	7372378	24	0-5	10YR 4/2
SB-35	0316882	7372212	26	0-5	10YR 4/2
SB-36	0317382	7371513	24	0-15	10YR 6/2
SB-37	0316618	7370506	23	0-15	10YR 6/2
SB-38	0316632	7370759	31	0-20	10YR 4/2
SB-39	0316368	7370822	21	0-15	5YR 3/2
SB-40	0316249	7370499	29	0-20	10YR 2/2
SB-41	0316501	7370125	16	0-20	5YR 3/2
SB-41	0316501	7370125	16	20-40	5YR 3/4
SB-42	0316501	7369751	19	0-15	10YR 6/2
SB-42	0316501	7369751	19	15-30	10YR 6/2
SB-43	0316497	7369492	32	0-15	5YR 3/2
SB-44	0316113	7369631	7	0-20	10YR 2/2
SB-45	0316056	7370344	17	0-20	5YR 3/2

Annex B

Detailed Soil Descriptions

B.1 DEFINITIONS USED FOR SOIL DESCRIPTIONS

The terminology used for the description of soils is from McDonald et al (1998).

Abbreviation	*Definition*
CHE	Chenier Plain: level to gently undulating landform pattern of extremely low relief. The pattern consists of relict, parallel linear ridges built up by waves, and separated by, built over flats (mud flats), aggraded by tides or over-bank stream flow
LOW	Low Hills: Landform pattern of low relief (30-90 m) and gentle to very steep slopes, typically with fixed erosional stream channels, closely to very widely spaced, which form a non-directional or convergent integrated tributary pattern.
RIS	Rises: Landform pattern of very low relief (9-30m) and very gentle to steep slopes. The fixed erosional stream channels are closely to very widely spaced and form a non-directional to convergent integrated or interrupted tributary pattern.
EROSION	State of erosion: P (partly stabilised) evidence of some active erosion and some evidence of stabilisation Gully erosion: G. A gully is a channel > 0.3m deep 1: Minor: Gullies are isolated, linear, discontinuous and restricted to primary or minor drainage lines 2: Moderate: Gullies are linear, continuous and restricted to primary or minor drainage lines Gully Depth – This gives the maximum depth within the site 1: < 1.5 m 2: 1.5 – 3.0 m 3: > 3.0 m
ZCL	Silty clay loam: coherent smooth bolus, plastic and often silky to the touch, will form ribbon 40-50 mm. 30-35% clay and with silt (> 25%)
LC	Light clay: plastic bolus, smooth to touch; slight resistance to shearing, will form ribbon 50-75mm
LMC	Light medium clay: plastic bolus, smooth to touch, slight to moderate resistance to ribbon shear; will form ribbon 50-75mm. 40-55% clay

Site No.	SB-1	Sampled: 7/11/2008		
Map Ref.	0317262E 7370046N	**Microrelief**		None
Run-off	2-3	**Erosion**		(***PG1,1***) Water: Minor gully erosion
Permeability	Low	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	LOW	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	45 m		**PPF**	
			Aust.	Grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 4/2	nil	ZCL/LC	2-5%	n.a.	Nil
A2	0.2 – 0.4	n.a.	10YR 4/2	nil	ZCL/LC	2-5%	n.a.	Nil
B	0.4 – 0.6	n.a.	5YR 4/1	nil	ZCL/LC	2-5%	n.a.	Nil

Laboratory Data		Site No. SB-1		Exchangeable cations (meqv/100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265172	0.0 - 0.2	5.3	46	27	3.5	1.7	0.56	0.22	0.80
1265173	0.2 - 0.4	5.5	45	27	3.1	2.9	0.51	0.21	0.77
1265174	0.4 - 0.6	5.5	50	29	1.7	0.92	0.54	0.21	0.72

Site No.	**SB-2**	**Sampled: 7/11/2008**	
Map Ref.	0316881E 7369628N	**Microrelief**	None
Run-off	2-3	**Erosion**	(***PG1,1***) Water: Minor gully erosion
Permeability	Low-moderate	**Surface coarse fragments**	10%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**	Nil
Landform	LOW	**Substrate**	indurated mudstone
Vegetation	Open forest	**Groundwater**	n/a
Site disturbance	none	**Soil Classification**	**GSG** Brown grey earth
Elevation (m)	40m		**PPF**
			Aust. grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.1	n.a.	5YR 5/2	nil	ZCL/LC	3-5%	n.a.	nil
A2	0.1 – 0.2	n.a.	5YR 5/2	nil	ZCL/LC	3-5%	n.a.	nil
B	0.4 - 0.5	n.a.	10YR 5/2	nil	ZCL/LC	3-5%	n.a.	nil

Laboratory Data		**Site No. SB-2**			**Exchangeable cations (m. equiv. 100g)**				
Lab. No.	**Depth (m)**	**pH (1:5) H2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265175	0.0 - 0.1	5.7	< 20	21	1.1	2.8	0.33	0.12	0.56
1265176	0.1 - 0.2	5.8	< 20	17	1.6	2.8	0.36	0.12	0.69
1265177	0.4 – 0.5	5.9	< 20	16	1.4	2.6	0.36	0.11	0.71

Site No.	SB-3	Sampled: 7/11/2008		
Map Ref.	0316767E 7369408N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	LOW	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	None	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	58 m		**PPF**	
			Aust.	Grey sodic Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil
A2	0.4 – 0.5	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil

Laboratory Data		Site No. SB-3			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265178	0.0 - 0.2	5.8	41	6.5	0.07	0.72	0.24	0.28	4.3
1265179	0.4 - 0.5	5.9	115	12	0.12	5.5	0.33	1.44	**12.0**

Site No.	SB-4	Sampled: 7/11/2008		
Map Ref.	0316740E 7369903N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	low	**Surface coarse fragments**		10-20%,indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	LOW	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Non calcic red-brown earth
Elevation (m)	38 m		**PPF**	
			Aust.	Red Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil

Laboratory Data	Site No. SB-4			Exchangeable cations (mg/kg)					
Lab. No.	**Depth (m)**	**pH (1:5) H2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265180	0.0 - 0.15	5.9	60	9.1	0.20	1.8	0.21	0.52	5.7

Site No.	SB-5	Sampled: 7/11/2008		
Map Ref.	0315872E 7370813N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	LOW	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	31 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil
A2	0.2 – 0.4	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil
A2	0.4 – 0.5	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil

Laboratory Data		Site No. SB-5			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265181	0.0 - 0.2	5.7	< 20	7.7	0.46	0.78	0.09	0.10	1.4
1265182	0.2 - 0.4	5.7	20	7.9	0.47	0.73	0.09	0.10	1.2
1265183	0.4 - 0.5	5.6	< 20	7.6	0.32	0.67	0.07	0.09	1.1

Site No.	SB-6	Sampled: 7/11/2008		
Map Ref.	0317262E 7370046N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor rill, gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		30-40%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance		**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	14 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.05	n.a.	10YR 6/2	nil	ZCL/LC	10%	n.a.	nil

Laboratory Data	Site No. SB-6			Exch. cations (m. equiv. 100mg)					
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265184	0.0 - 0.05	5.5	161	21	2.4	3.3	0.51	0.69	3.3

Site No.	SB-7	Sampled: 7/11/2008		
Map Ref.	0316281E 7370002N	**Microrelief**		None
Run-off	2	**Erosion**		Water: Minor rill erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	11 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 4/2	nil	ZCL/LC	1-2%	n.a.	nil
A2	0.3 – 0.5	n.a.	5YR 5/2	nil	ZCL/LC	1-2%	n.a.	nil

Laboratory Data	Site No. SB-7			Exch. cations (m. equiv. 100mg)					
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265185	0.0 - 0.2	6.4	49	25	8.5	3.6	0.44	0.16	0.63
1265186	0.3 - 0.5	6.6	44	22	8.0	3.4	0.46	0.22	1.01

Site No.	SB-8	Sampled: 8/11/2008		
Map Ref.	0315991E 7372605N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open Woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	20 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 5/4	nil	ZCL/LC	5-10%	n.a.	nil

Laboratory Data	Site No. SB-8			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265187	0.0 - 0.2	5.7	30	18	1.3	2.7	0.17	0.20	1.1

Site No.	SB-9	Sampled: 8/11/2008		
Map Ref.	0315856E 7371990N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	26 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil
A2	0.2 – 0.3	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil

Laboratory Data	Site No. SB-9			Exch. cations (m. equiv. 100mg)					
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265188	0.0 - 0.2	6.1	63	10	1.1	1.8	0.16	0.36	3.6
	0.2 - 0.3	5.9	54	11	1.6	2.0	0.21	0.37	3.4

Site No.	SB-10	Sampled: 8/11/2008		
Map Ref.	0315885E 7371629N	**Microrelief**		None
Run-off	2	**Erosion**		Water: Minor rill erosion
Permeability	Low - moderate	**Surface coarse fragments**		10% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	8 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 4/2	nil	ZCL/LC	1-2%	n.a.	nil

Laboratory Data	Site No. SB-10			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265190	0.0 - 0.2	5.9	26	23	3.3	3.1	0.22	0.44	1.9

Site No.	SB-11	Sampled: 8/11/2008		
Map Ref.	0316093E 7370973N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	LOW	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	53 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	5YR 3/2	nil	ZCL/LC	10%	n.a.	nil

Laboratory Data	Site No. SB-11			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265191	0.0 - 0.15	5.3	49	28	3.0	2.6	0.33	0.20	0.71

Site No.	SB-12	Sampled: 8/11/2008		
Map Ref.	0315680E 7370771N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	moderate	**Surface coarse fragments**		10-15% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	12 m		**PPF**	
			Aust.	Grey acidic Sodosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.1	n.a.	10YR 4/2	nil	ZCL/LC	1-2%	n.a.	nil
A2	0.1 – 0.2	n.a.	10YR 4/2	nil	ZCL/LC	5%	n.a.	nil

Laboratory Data	Site No. SB-12			Exch. cations (m. equiv. 100mg)					
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265192	0.0 - 0.1	5.4	146	18	0.90	2.3	0.28	1.2	**6.5**
1265193	0.1 - 0.2	5.1	257	17	0.80	3.0	0.31	1.6	**9.5**

Site No.	SB-13	Sampled: 8/11/2008		
Map Ref.	0317291E 7370681N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	28 m		**PPF**	
			Aust.	Grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	5YR 4/3	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data	Site No. SB-13			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265194	0.0 - 0.15	6.3	42	38	13.0	4.9	0.79	0.17	0.44

Site No.	SB-14	Sampled: 8/11/2008		
Map Ref.	0317416E 7370855N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	LOW	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	43 m		**PPF**	
			Aust.	Grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	10YR 4/2	nil	ZCL/LC	1-2%	n.a.	nil
A2	0.2 – 0.4	n.a.	10YR 4/2	nil	ZCL/LC	1-2%	n.a.	nil

Laboratory Data		Site No. SB-14			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265195	0.0 - 0.15	8.0	198	37	17.0	17.3	0.36	0.74	2.0
1265196	0.2 - 0.4	8.0	195	43	15.5	18.1	0.36	0.96	2.2

Site No.	SB-15	Sampled: 8/11/2008		
Map Ref.	0316784E 7370168N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-15% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	22 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 6/2	nil	ZCL/LC	3-5%	n.a.	nil

Laboratory Data	Site No. SB-15			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265197	0.0 - 0.2	5.3	93	11	0.38	1.3	0.23	0.48	4.4

Site No.	SB-16	Sampled: 8/11/2008		
Map Ref.	0315990E 7372578N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor rill erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	27 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 4/2	nil	ZCL/LC	1-2%	n.a.	nil

Laboratory Data	Site No. SB-16			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265198	0.0 - 0.2	5.8	37	27	5.5	0.32	0.33	0.19	0.69

Site No.	SB-17	Sampled: 8/11/2008		
Map Ref.	0315778E 73702609N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	18 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.1	n.a.	10YR 6/2	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data	Site No. SB-17			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265199	0.0 - 0.1	5.5	37	18	0.50	2.0	0.24	0.39	2.2

Site No.	SB-18	Sampled: 8/11/2008		
Map Ref.	0317262E 7370046N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	15 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 4/2	nil	ZCL/LC	1-2%	n.a.	nil

Laboratory Data	Site No. SB-18			Exch. cations (m. equiv. 100mg)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265200	0.0 - 0.2	5.8	33	19	2.3	3.0	0.24	0.29	1.6

Site No.	SB-19	Sampled: 8/11/2008		
Map Ref.	0316123E 7372556N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	HSL	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	57 m		**PPF**	
			Aust.	Grey brown acidic Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.1	n.a.	10YR 4/2	nil	ZCL/LC	2-3%	n.a.	nil

Laboratory Data	Site No. SB-19			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265201	0.0 - 0.1	5.3	80	21	1.7	3.3	0.28	0.48	2.3

Site No.	SB-20	Sampled: 9/11/2008		
Map Ref.	0315906E 7371637N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		5-10% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	8 m		**PPF**	
			Aust.	Brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.1	n.a.	10YR 2/2	nil	ZCL/LC	2-3%	n.a.	nil

Laboratory Data	Site No. SB-20			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265202	0.0 - 0.1	6.2	40	20	7.0	3.5	0.41	0.10	0.50

Site No.	SB-21	Sampled: 9/11/2008		
Map Ref.	0316002E 7371867N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		5-10% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	23 m		**PPF**	
			Aust.	Brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	10YR 4/2	nil	ZCL/LC	5%	n.a.	nil

Laboratory Data	Site No. SB-21			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265203	0.0 - 0.15	6.0	40	31	3.9	4.7	0.54	0.30	0.97

Site No.	SB-22	Sampled: 9/11/2008		
Map Ref.	0315904E 7372105N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor rill erosion
Permeability	Low - moderate	**Surface coarse fragments**		20-30% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	12 m		**PPF**	
			Aust.	Brown grey Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.05	n.a.	10YR 4/2	nil	ZCL/LC	10%	n.a.	nil

Laboratory Data	Site No. SB-22			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265204	0 – 0.05	5.9	31	28	4.5	3.0	0.13	0.27	0.96

Site No.	SB-23	Sampled: 9/11/2008		
Map Ref.	0315623E 7372250N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland, minor medium density saplings	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Red brown earth
Elevation (m)	9 m		**PPF**	
			Aust.	Red Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	10YR 6/2	nil	ZCL/LC	5%	n.a.	nil

Laboratory Data	Site No. SB-23			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265205	0.0 - 0.15	5.6	34	5.7	0.10	0.81	0.08	0.25	4.4

Site No.	SB-24	Sampled: 9/11/2008		
Map Ref.	0315224E 7372243N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor rill erosion
Permeability	Low - moderate	**Surface coarse fragments**		5% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	Minor human (vehicle track)	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	3 m		**PPF**	
			Aust.	Grey brown acidic Sodosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	5YR 5/2	nil	ZCL/LC	1-2%	n.a.	nil
A2	0.2 – 0.3	n.a.	10YR 4/2	nil	ZCL/LC	1-2%	n.a.	nil

Laboratory Data		Site No. SB-24			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265206	0.0 - 0.15	5.3	126	32	1.5	9.1	0.56	1.6	4.9
1265207	0.2 - 0.3	5.1	195	32	0.85	11.5	0.61	2.4	**7.6**

Site No.	SB-25	Sampled: 9/11/2008		
Map Ref.	0315120E 7372371N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor rill erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	7 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	5YR 4/1	nil	ZCL/LC	5%	n.a.	nil

Laboratory Data	Site No. SB-25			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265208	0.0 - 0.15	5.6	30	32	4.7	2.9	0.26	0.25	0.79

Site No.	SB-26	Sampled: 9/11/2008		
Map Ref.	0314249E 7372424N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-15% indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	18 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.1	n.a.	5YR 3/4	nil	ZCL/LC	5%	n.a.	nil

Laboratory Data	Site No. SB-26			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265209	0.0 - 0.1	5.7	29	27	5.5	3.0	0.13	0.14	0.52

Site No.	SB-27	Sampled: 9/11/2008		
Map Ref.	0314503E 7372759N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-15%, quartz, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	27 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	10YR 4/2	nil	ZCL/LC	5%	n.a.	nil

Laboratory Data	Site No. SB-27			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265210	0.0 - 0.15	6.1	40	34	7.0	5.9	0.33	0.52	1.5

Site No.	SB-28	Sampled: 9/11/2008		
Map Ref.	0314906E 7372494N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	20 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.1	n.a.	5YR 5/2	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data	Site No. SB-28			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265211	0.0 - 0.1	6.0	31	17	3.2	2.1	2.6	0.19	1.1

Site No.	SB-29	Sampled: 9/11/2008		
Map Ref.	0314881E 7372374N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	30 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	5YR 3/4	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data	Site No. SB-29			Exchangeable cations (meqv. 100g)					
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265212	0.0 - 0.15	6.2	48	25	7.0	4.0	0.38	0.25	0.99

Site No.	SB-30	Sampled: 9/11/2008		
Map Ref.	0314607E 7372420N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		30-50%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	HSL	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	58 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.05	n.a.	5YR 3/2	nil	ZCL/LC	15-20%	n.a.	nil

Laboratory Data	Site No. SB-30			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265213	0.0 - 0.05	6.0	47	49	21.5	7.5	0.38	0.23	0.47

Site No.	SB-31	Sampled: 9/11/2008		
Map Ref.	0315257E 7372297N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		30-40%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	26 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.05	n.a.	5YR 4/1	nil	ZCL/LC	20%	n.a.	nil

Laboratory Data	Site No. SB-31			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265214	0.0 - 0.05	5.4	21	25	3.4	2.8	0.22	0.19	0.75

Site No.	SB-32	Sampled: 9/11/2008		
Map Ref.	0315628E 7372502N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor rill erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	5 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	5YR 4/1	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data	Site No. SB-32			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265215	0.0 - 0.15	5.6	37	15	2.5	1.9	0.28	0.22	1.5

Site No.	SB-33	Sampled: 9/11/2008		
Map Ref.	0316004E 7372508N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor rill erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	20 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.1	n.a.	10YR 4/2	nil	ZCL/LC	2-3%	n.a.	nil

Laboratory Data	Site No. SB-33			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265216	0.0 - 0.1	5.9	51	30	3.9	4.2	0.51	0.38	1.3

Site No.	SB-34	Sampled: 9/11/2008		
Map Ref.	0316500E 7372378N	**Microrelief**		None
Run-off	2 - 3	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		20-30%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	30 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.05	n.a.	10YR 4/2	nil	ZCL/LC	10-15%	n.a.	nil

Laboratory Data	Site No. SB-34			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265217	0.0 - 0.05	6.1	35	29	9.0	4.8	0.51	0.14	0.48

Site No.	SB-35	Sampled: 9/11/2008		
Map Ref.	0316882E 7372212N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		30-40%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	26 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.05	n.a.	10YR 4/2	nil	ZCL/LC	10-15%	n.a.	nil

Laboratory Data	Site No. SB-35			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265218	0.0 - 0.05	5.8	30	23	5.5	4.0	0.25	0.21	0.93

Site No.	SB-36	Sampled: 9/11/2008		
Map Ref.	0317382E 7371513N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	24 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	10YR 6/2	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data	Site No. SB-36			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265219	0.0 - 0.15	5.8	33	9.0	0.20	1.4	0.23	0.29	3.2

Site No.	SB-37	Sampled: 10/11/2008		
Map Ref.	0316618E 7370506N	**Microrelief**		None
Run-off	2 - 3	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	low	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Red-brown earth
Elevation (m)	23 m		**PPF**	
			Aust.	Red brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	10YR 6/2	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data	Site No. SB-37			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265220	0.0 - 0.15	5.7	32	11	0.17	1.4	0.23	0.27	2.5

Site No.	SB-38	Sampled: 10/11/2008		
Map Ref.	0316632E 7370759N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	31 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 4/2	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data	Site No. SB-38			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265221	0.0 - 0.2	5.6	43	26	0.55	4.2	0.56	0.26	0.99

Site No.	SB-39	Sampled: 10/11/2008		
Map Ref.	0316368E 7370882N	**Microrelief**		None
Run-off	2-3	**Erosion**		(PG1,1) Water: Minor gully, rill erosion
Permeability	low	**Surface coarse fragments**		20-30%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest/ medium density sapling understory	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	21 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	5YR 3/2	nil	ZCL/LC	5-10%	n.a.	nil

Laboratory Data	Site No. SB-39			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265222	0.0 - 0.15	5.7	30	23	0.60	2.3	0.31	0.30	1.3

Site No.	SB-40	Sampled: 10/11/2008		
Map Ref.	0316249E 7370499N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low - moderate	**Surface coarse fragments**		20-30%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		10%
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown-red earth
Elevation (m)	29 m		**PPF**	
			Aust.	Red acidic Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 2/2	2-5%, orange	ZCL/LC	5-10%	n.a.	nil

Laboratory Data	Site No. SB-40			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265223	0.0 - 0.2	5.1	22	34	1.1	1.8	0.33	0.17	0.51

Site No.	SB-41	Sampled: 10/11/2008		
Map Ref.	0316501E 7370125N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	low	**Surface coarse fragments**		10-20%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest, moderate density sapling understory	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	16 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	5YR 3/2	nil	ZCL/LC	2-5%	n.a.	nil
	0.2 – 0.4	n.a.	5YR 3/4	nil	ZCL/LC	2-5%	n.a.	nil

Laboratory Data		Site No. SB-41			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265224	0.0 - 0.2	6.2	36	28	7.0	4.7	0.44	0.22	0.79
1265225	0.2 - 0.4	6.3	27	38	9.0	7.4	0.28	0.35	0.92

Site No.	SB-42	Sampled: 10/11/2008		
Map Ref.	0316501E 7369751N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	low	**Surface coarse fragments**		5 - 10%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Red-brown earth
Elevation (m)	19 m		**PPF**	
			Aust.	Red brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	10YR 6/2	nil	ZCL/LC	1-2%	n.a.	nil
	0.15 – 0.3	n.a.	10YR 6/2	nil	ZCL/LC	1-2%	n.a.	nil

Laboratory Data	Site No. SB-42			Exchangeable cations (meqv. 100g)					
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265226	0 - 0.15	5.9	41	8.2	1.6	1.6	0.12	0.39	4.8
1265227	0.15 – 0.3	6.2	53	10	2.4	2.2	0.13	0.57	5.7

Site No.	SB-43	Sampled: 10/11/2008		
Map Ref.	0316497E 7369492N	**Microrelief**		None
Run-off	2 - 3	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	low	**Surface coarse fragments**		40 - 50%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	32 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.15	n.a.	5YR 3/2	nil	ZCL/LC	10-15%	n.a.	nil

Laboratory Data	Site No. SB-43			Exchangeable cations (meqv. 100g)					
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265228	0 - 0.15	5.4	30	28	3.2	2.8	0.11	0.21	0.75

Site No.	SB-44	Sampled: 10/11/2008		
Map Ref.	0316113E 7369631N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	moderate	**Surface coarse fragments**		20 - 30%, indurated mudstone
Drainage	Moderately well drained	**Rock Outcrop**		Nil
Landform	CHE	**Substrate**		indurated mudstone
Vegetation	Open forest	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	8 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	10YR 2/2	nil	ZCL/LC	15-20%	n.a.	nil

Laboratory Data	Site No. SB-44			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265229	0.0 - 0.2	6.0	29	25	6.0	2.0	0.24	0.16	0.64

Site No.	SB-45	Sampled: 10/11/2008		
Map Ref.	0316156E 7370344N	**Microrelief**		None
Run-off	2	**Erosion**		(PG1,1) Water: Minor gully erosion
Permeability	Low	**Surface coarse fragments**		5 - 10%, indurated mudstone
Drainage	Poorly drained	**Rock Outcrop**		Nil
Landform	RIS	**Substrate**		indurated mudstone
Vegetation	Open woodland	**Groundwater**		n/a
Site disturbance	none	**Soil Classification**	**GSG**	Brown grey earth
Elevation (m)	17 m		**PPF**	
			Aust.	Grey brown Chromosol

Soil Description

Horizon	Depth (m)	Boundary	Colour	Mottles	Texture	Coarse Fragments	Structure	Segregations
A1	0 - 0.2	n.a.	5YR 3/2	nil	ZCL/LC	1-2%	n.a.	nil

Laboratory Data	Site No. SB-1			Exchangeable cations (meqv. 100g)				
Lab. No.	**Depth (m)**	**pH (1:5) H_2O**	**EC (1:5) µScm-1**	**CEC**	**Ca**	**Mg**	**K**	**Na**	**ESP (%)**
1265230	0.0 - 0.2	6.0	25	17	2.4	2.6	0.33	0.22	1.3

Soil Analytical Results