Arrow Bowen Pipeline

ENVIRONMENTAL IMPACT STATEMENT – SOILS ASSESSMENT REPORT

- Rev 0
- 10 November 2011

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Contents

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1. Introduction

Arrow Energy Pty Ltd commissioned Sinclair Knight Merz to undertake an assessment of selected soil properties along the proposed Arrow Bowen Pipeline (ABP), focussing on those characteristics pertinent to construction and rehabilitation with particular emphasis on susceptibility to erosion ('the Investigation').

The proposed pipeline ('the project') is approximately 580 km in length and includes a mainline (AB) which is approximately 477 km long and three laterals (Dysart, Saraji & Elphinstone). The mainline runs from Red Hill, approximately 90 km north of Moranbah in central Queensland to a junction with the proposed Arrow Surat Pipeline at a proposed gas gathering station approximately 22 km southwest of Gladstone. The three laterals consist of; the Elphinstone Lateral (EL) approximately 52 km in length, the Saraji Lateral (SL) approximately 25.8 km in length and the Dysart Lateral (DL) approximately 25.7 km in length.

A desktop investigation has studied the soils occurring along the proposed pipeline route which has then been followed by a field investigation to ground truth the desktop findings. The results are interpreted in the context of the logistics of pipeline trench excavation, availability of topsoil for soil surface rehabilitation, presence of Strategic Cropping Land / Good Quality Agricultural Land and susceptibility to erosion during pipeline construction and post-rehabilitation.

This assessment of soil conditions along the pipeline is based on coarse resolution Australian Soil Classification mapping. There are consequently limitations to the applicability of this assessment. Limitations may include:

- The dominant soil from each unit may occupy a very limited area (perhaps 20%) within that unit. Any analysis based on an interpretation of the dominant soil is therefore of restricted value.
- It is normal for there to be a very large variation of soil types within each Australian Soil Classification map unit i.e. some units have up to 20 soils listed.
- Many landscape processes (e.g. erosion, salinisation) do not correlate in a simple way (if at all) with the Australian Soil Atlas units because the description of soils is based on profile morphology. Profile morphology may have a poor or complex relationship with soil processes.

An attempt has been made to mitigate the identified limitations by sampling and interpreting a range of soils to make judgements on soil character and behaviour for particular areas.

1.1. Scope of work

The scope of works for the soil assessment and survey were as follows:

- undertake a desktop assessment using published data (listed in **Section 2.1**) to delineate major soil types, topsoil depth, erosion potential and Good Quality Agricultural Land classes
- undertake a field investigation to:
  - describe soils as per Australia Soil Classification (ASC);
  - ground-truth ASC orders as mapped in desk study;
  - determine the susceptibility to erosion of the soils' surface and subsurface; and
  - predict likely areas of Strategic Cropping Land (SCL) and ground-truth Good Quality Agricultural Land (GQAL) classes.

This report presents the results of the desktop and field investigation and provides a discussion of the Investigation results in relation to the project.

2. Methodology

2.1. Desktop Study

Published resources used to describe soils, erosion, topsoil thickness and land suitability include:

- CSIRO Land and Water (2001) Present Annual Hillslope Erosion;
- CSIRO Land and Water (2001) Soil Thickness for Australian areas of Intensive Agriculture for layer 1 (A Horizon – Topsoil);
- DERM (2011) Strategic Cropping Land – Trigger Map C1 and C4
- DERM (2010) Good Quality Agricultural Land Mapping; and
- DERM (2006) Queensland Dominant Soils Digital Map originally published by Department of Natural Resources, Mines and Water.

2.2. Field Investigations

Fieldwork investigations were conducted over the period 15 to 24 August 2011. Soil was described at 36 sample locations and observations were made at 2 other locations. Sample locations were decided upon by desktop analysis of soil orders. Where possible, samples were located near soil order boundaries rather than within polygons. Locations were chosen to provide a representative sample of mapped Australian Soil Classifications. Therefore 15 samples were taken from Sodosols, 3 from Chromosols, 1 from Hydrosols, 2 from Kandsols, 3 Rudosols and 12 from Vertosols. Sample locations were further determined by accessibility. **Appendix A** shows the sampling site locations.

Boreholes were advanced using a hand auger, with 15 advanced to a maximum depth of 1.5 m below ground level (bgl) and 21 to a maximum depth of 0.6 m bgl to confirm the depth of the A Horizon (topsoil) and B Horizon (subsoil). Soil samples were collected at each soil horizon (at roughly 300 mm and 600 mm depth) and placed in appropriate laboratory-supplied containors and sent to the laboratory.

2.2.1. Soil Descriptions

The geomorphic setting, local relief, erosion extent and slope of each site were described and soil profiles were photographed. **Table 2-1** shows the descriptors used for each soil horizon according to the Australian Soil Classification.

- **Table 2-1 Australian Soil Classification Descriptors**

Descriptor	Application
Horizon Depth	Weathering characteristics, soil development
Field Colour	Permeability, susceptibility to dispersion / erosion
Field Texture Grade	Erodibility, hydraulic conductivity, moisture retention, root penetration
Boundary Distinctness and Shape	Erosional / Despositional status, textural grade
Consistence Force	Structural stability. dispersion, ped formation
Structure Ped and Size	Soil structure, root penetration, permeability, aeration
Stones – Amount and Size	Water holding capacity, hydraulic conductivity, weathering status, erosional / dispositional character

The morphology of surveyed soil was compared to the mapped ASC Order (Isbell, 2002). This ground-truthing exercise provided a measure of reliability of the desktop assessment. Results of ground-truthing are provided in the sample location logs presented in **Appendix B**.

2.2.2. Laboratory soil analysis

Selected samples were submitted to Australian Laboratory Services (ALS), a NATA accredited laboratory for a range of analyses as described in **Table 2-2**.

- **Table 2-2 Australian Soil Classification Descriptors**

Analyte	Application
pH	Useful indicator of other soil properties (e.g. values >8.5 usually indicate high exchangeable sodium levels and the presence of carbonates) and of the need for amendment with lime. Some plants tolerate a wide range of pH, while some are sensitive to acidity and some to alkalinity. The availability of some nutrients will be affected by soil pH.
Electrical Conductivity and Chloride Content	EC is used to appraise soil salinity. The electrical conductance increases with soluble salt content and thus allows simple interpretation of readings in relation salt tolerance of crops. The chloride anion is usually present in soil in association with sodium and is an important constituent of many salty soils. Its high mobility makes it a valuable indicator of the direction of salt and water movement, and it can be specifically toxic to some plants.
Cation Exchange Capacity and Exchangeable Ca, Mg, K, Na (Cations)	The amounts and relative proportions of the exchangeable cations in soil have important effects on both physical and chemical properties. High levels of exchangeable sodium cause dispersion and increased swelling, reducing water movement and affecting near surface aeration whereas exchangeable calcium flocculates colloids and will reduce swelling tendencies. Excessively high or low concentrations of one or the other of the cations may result in nutritional disturbances to germinating plants. Exchangeable cations are held in the soil at negatively charged surfaces and are exchanged by all ‘strong’ cations.

Analyte	Application
	The total amount that can be held is designated the cation exchange capacity.
Soluble Ca, Mg, Na, K,	Knowledge of soluble cations and anions and their relative proportions is valuable in assessing saline and alkaline soils and their response to various treatments. Other anions may also be toxic to plants. Bicarbonate is a normal constituent of saline and sodic soil extracts.
Sulphur: Total S and Sulfate SO_4^{2-}	Mineral necessary for plant growth. Sulphur is converted by bacterial action to the available sulfate form
Alkalinity (Total, Bicarbonate, Carbonate)	Bicarbonate is important for soil structure(calcium ions occupy cation exchange sites displacing sodium ions)
Nutrients: Nitrite + Nitrate , Total Kjeldahl Nitrogen, Total Nitrogen, Total Phosphorus	These nutrients are good indicators of the fertility status of the soil

In addition, soil from location 14, which is mapped as Hydrosol, was analysed for Acid Neutralising Capacity and Chromium Reducible Sulfur in order to assess for the possible presence of acid sulfate soils.

3. Investigation Results

3.1. Soil Erosion Potential – Sodic Soils

Soil erodibility is a function of a soil's physical and chemical properties in determining its capacity to absorb rainfall and minimise runoff. Sections of pipeline are likely to be susceptible to erosion and if not managed appropriately will likely lead to loss of land productivity and degradation of water quality in neighboring streams and water storages.

The presence of excessive amounts of exchangeable sodium (relative to the other exchangeable cations) reverses the process of aggregation and causes soil aggregates to disperse into their constituent individual soil particles. This is known as deflocculation and occurs in sodic soils.

Sodicity or Exchangeable Sodium Percentage (ESP) is a measure of the proportion of sodium ions present in a soil; it is expressed as a percentage as:

$$ESP = \frac{\text{Exchanable Sodium}}{\text{Cation Exchange Capacity}} \qquad \text{EQ1}$$

It has a significant effect on the physical properties of a soil. At high sodicity, soils have a tendency to lose aggregation and to develop clay dispersion, impermeability, surface crusting and poor aeration.

When ESP values are medium to high (6 to > 15) and Mg/Ca ratio >1, there is a greater susceptibility to dispersion (Baker 1991). Non-saline soils ($EC_{1:5}$ <400 µS/cm) which are sodic are also more likely to disperse. However in general, soil ESP exceeding 6% at the surface (15% at depth) warrant consideration as potentially dispersible soils which will influence surface structure and water movement.

The results of the fieldwork show that several sample locations are likely to contain soils that are susceptible to erosion by dispersion as identified in **Table 3-1**.

- **Table 3-1 Erosion susceptible soils identified during fieldwork**

Analyte	Sample ID	1	2	3	5	6_2	7	12	14	15	15
	Depth (m)	0.4-0.5	0.1-0.2	0.3-0.4	0.4-0.5	0.8-0.9	0.3-0.4	0.2-0.3	0.3-0.4	0.3-0.45	0.55-0.66
	Approx AB	AB37	AB90	AB98	SL20	AB165	AB228	AB375	AB431	AB465	AB465
Electrical Conductivity	µS/cm	256	19	207	784	1110	142	22	1680	509	800
Exchangeable Sodium	meq/100g	6.3	0.3	3.3	8.1	9.6	2.7	0.8	10.6	7.3	13.5
Cation Exchange Capacity	meq/100g	80	1.3	11	48.2	75	35.5	6.2	50.9	31.2	40.1
ESP(approximate)		~8%	~23%	~30%	~17%	~13%	~8%	~13%	~21%	~23%	~34%
Exchangeable Calcium	meq/100g	31.8	0.7	1.2	26.2	38.6	21.5	3.2	22.4	5.4	5.5
Exchangeable Magnesium	meq/100g	41.7	0.2	6.2	13.6	26	11.1	2.2	17.4	18.2	20.9
Exchangable Mg:Ca ratio		1.31	0.29	5.17	0.52	0.67	0.52	0.69	0.78	3.37	3.80
Susceptible to Erosion		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Pipeline construction will involve vegetation clearance and topsoil stripping (stockpiled separately), exposing subsoil which could potentially lead to surface crusting and soil loss through dispersion, sheet wash erosion and gullying (even on gentle gradients where topsoil is thin). In some cases, the sodic layer is close to the soil surface, therefore it is important to identify topsoil stripping depth and avoid mixing of topsoil and subsoil which could degrade agricultural land. Some sodic soils along the alignment may also be prone to tunnel erosion in which the subsoil material is suspended in water percolating through it, gradually removing soil and forming a pipe or tunnel. These tunnels eventually collapse and form a gully that can advance rapidly even on gentle slopes (Murtha & Reid, 1976). Once exposed, preventing further degradation of subsoil is expensive and success rates are low (RCA, 1996).

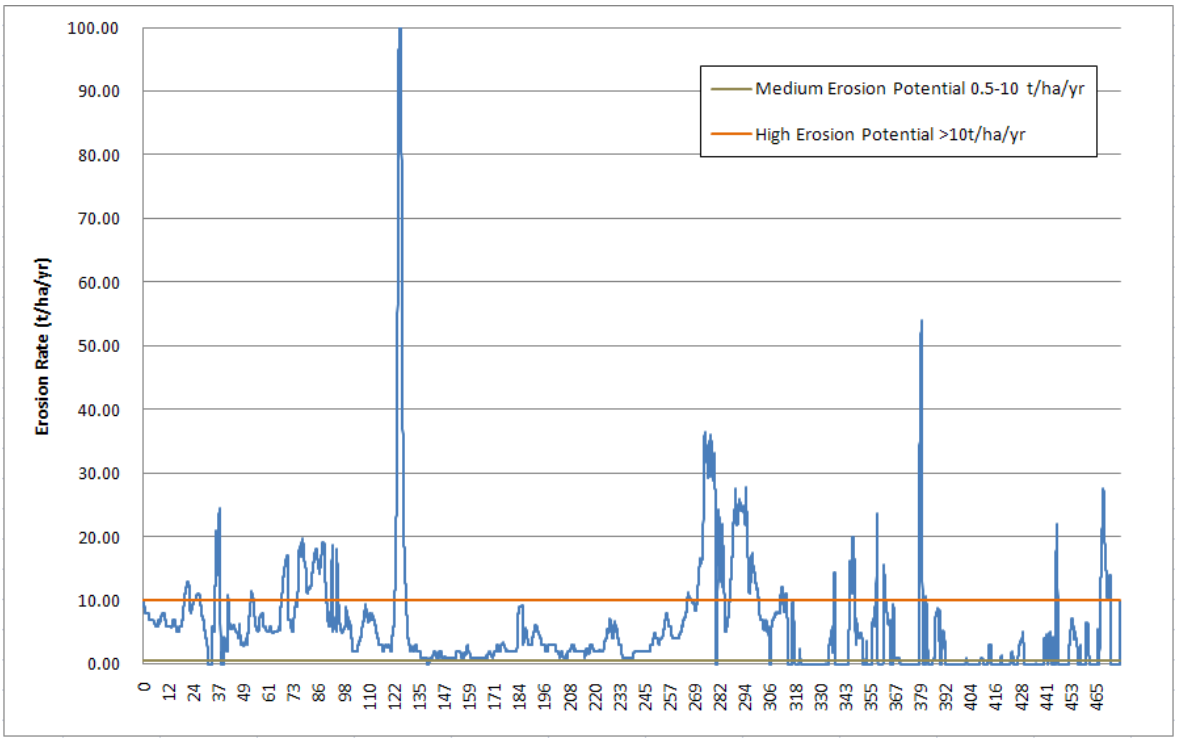
3.2. Soil Erosion Potential - Hillslope Erosion

This section discusses possible hillslope erosion along the mainline and laterals.

In addition to soil dispersion particularly associated with sodic soils, sections of the alignment are likely to be susceptible to hillslope erosion. Sheet and rill erosion rates on hillslopes are largely a function of soil type, rainfall intensity, land cover and slope.

A hillslope erosion map of Australia showing erosion values in tonnes per hectare per year (t/ha/yr) has been produced as a product of the "Water-borne erosion and sediment transport" project conducted by the National Land and Water Resources Audit (NLWRA), 2001. The methodology used to produce this map is detailed in **Appendix D**. **Figure 3-2 Appendix A** shows estimated erosion ratings along the ABP mainline based on the hillslope erosion map of Australia. Erosion ratings (as used in Australian Agriculture Assessment 2001 reporting) are categorised as High (>10

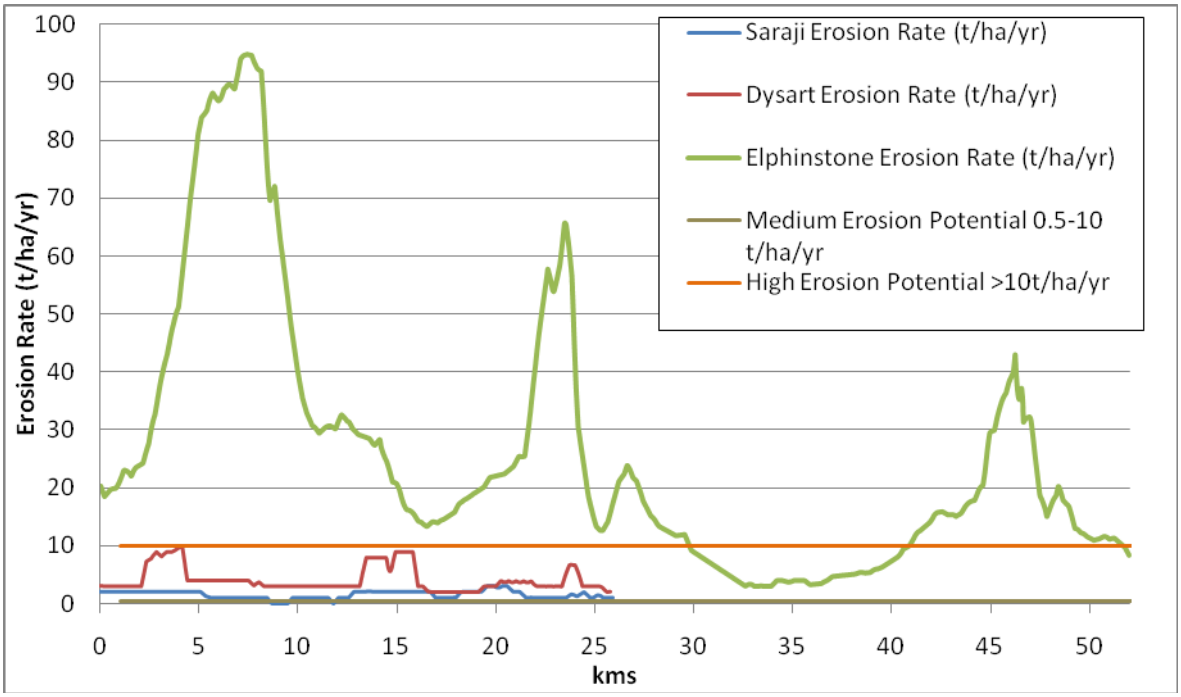
t/ha/yr), Medium (between 0.5 and 10 t/ha/yr) and Low (<0.5 t/ha/yr),. **Figure 3-1** shows erosion along the ABP mainline.



- **Figure 3-1: Predicted hillslope erosion rate along ABP mainline**

The majority of the mainline pipeline route (61%) traverses land that has a medium potential for hillslope erosion. An estimated 16% of the land is highly erodible and 23% has a low erosion potential.

The erosion potential of the laterals is shown in **Figure 3-2**. The Saraji Lateral traverses land that is predominately of medium erosion potential (95%) and a small amount of land that has a low erosion potential (5%). The Dysart Lateral traverses land that is entirely of medium erosion potential. The Elphinstone Lateral traverses land that is predominately of high erosion potential (78%) with the remainder being of medium erosion potential (22%).



- **Figure 3-2 Predicted hillslope erosion rate along ABP Laterals**

The areas of the pipeline with high estimated erosion rates are listed in **Table 3-2.** The geology (discussed in Section 4.2.1.3 of the Environmental Impact Statement), soil type, and slope are provided along with an assessment of the primary erosion driver.

- **Table 3-2 ABP sections with high hillslope erosion potential (>10 t/ha/yr) and geomorphology**

Pipeline Distance	Elevation (mAHD)	Dominant Geology	Soil Type	Slope (angle) %	Primary Erosion Driver
AB0 to AB0.06	350	Mafic Rocks	Sodosol	3.2	Sodic soil
AB20.4 to AB22.9	379-401	Rewan Group, Mafic Volcanic Rocks	Sodosol	0.7-4.9	slope
AB25.16 to AB28.3	414-433	Mafic Volcanic Rocks	Sodosol	0.7-4.3	slope
AB35.2 to AB38	368-411	Colluvium	Sodosol	0.7-2.5	Sodic soil
AB52.9 to AB54.5	293-301	Colluvium	Sodosol	0.3-3.1	Sodic soil
AB67.9 to AB71	276-341	Rewan Group	Sodosol	0.2-10	slope
AB75.7 to AB89.9	256-350	Rewan Group, Mafic Volcanic Rocks	Sodosol	0.6-13	slope
AB92.1 to AB92.8	251-255	Alluvium	Sodosol	0.2-1.3	Sodic soil
AB94.7 to AB95.6	244-254	Sand plain	Vertosol	1.7-4	slope
AB123.1 to AB128.7	200-254	Sand plain	Sodosol	0.4-5	slope
AB265.9 to AB268.1	114-122	Lizzie Creek Volcanics	Vertosol	0.3-3.0	External

SINCLAIR KNIGHT MERZ

Pipeline Distance	Elevation (mAHD)	Dominant Geology	Soil Type	Slope (angle) %	Primary Erosion Driver
AB268.3 to AB268.5	118-119	Lizzie Creek Volcanics	Vertosol	0.5-0.7	External
AB270.7 to AB279.8	118-180	Lizzie Creek Volcanics, Alluvium	Vertosol, Rudosol	0.4-10.4	slope
AB280.8 to AB284	118-151	Back Creek Group, Alluvium	Rudosol	0.4-4.7	slope
AB286.6 to AB300.9	120-187	Back Creek Group , Carmila Beds	Rudosol, Sodosol	0.4-8.8	slope
AB311.4 to AB312.7	56-65	Colluvium	Rudosol	0.7-3.4	slope
AB314 to AB314.4	65-71	Rockwood Volcanics	Rudosol	3-4.5	slope
AB337.5 to AB338	54-57	Craigilee Beds, Rockhampton Group	Chromosol	3.2-5.2	slope
AB345.1 to AB347.9	42-88	Craigilee Beds, Rockhampton Group	Chromosol	1.5-6.5	slope
AB357.9 to AB358.1	54-55	Mount Alma Formation	Chromosol	0.4-1.3	External
AB358.3 to AB358.8	55-67	Alluvium	Chromosol	1.1-5.7	slope
AB361.7 to AB362.8	70-86	Mount Salmon Volcanics	Chromosol, Sodosol	0.9-8	slope
AB379.1 to AB380.8	56-80	Mount Alma Formation	Sodosol	1.1-9.7	slope
AB382.5 to AB382.6	34	Alluvium	Sodosol	0.6-1.2	Sodic soil
AB445.7 to AB446.7	5_12	Alluvium	Sodosol	0.5-2	Sodic soil
AB467.4 to AB472.5	48-104	Rockhampton Group	Sodosol	1.2-12	slope
EL0 to EL29.7	242-374	Rewan Group, Sedimentary Rocks, Sand plain	Sodosol	0.4-6.6	slope
EL40.8 to EL51.6	247-300	Rewan Group, Sedimentary Rocks	Vertosol	0.9-7.8	slope

External = rainfall intensity, land cover or slope length

3.3. Topsoil Thickness

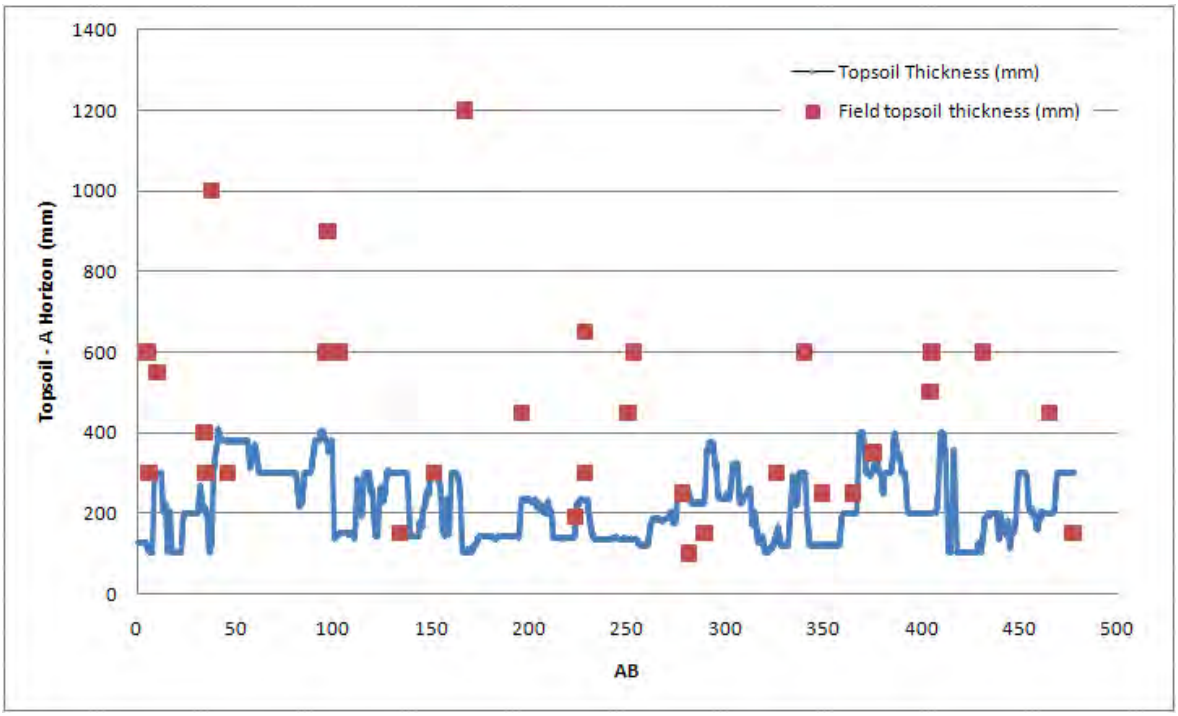
Soil sample logs showing depth of A Horizon are provided in **Appendix B** and soil laboratory results are provided in **Appendix C**.

Topsoils (A horizons) are defined as the surface soil layers in which organic matter accumulates, and may include dominantly organic surface layers (O and P horizons).The depth of topsoil is important because, with their higher organic matter contents, topsoils generally have more suitable properties for agriculture, including higher permeability, higher levels of soil nutrients and

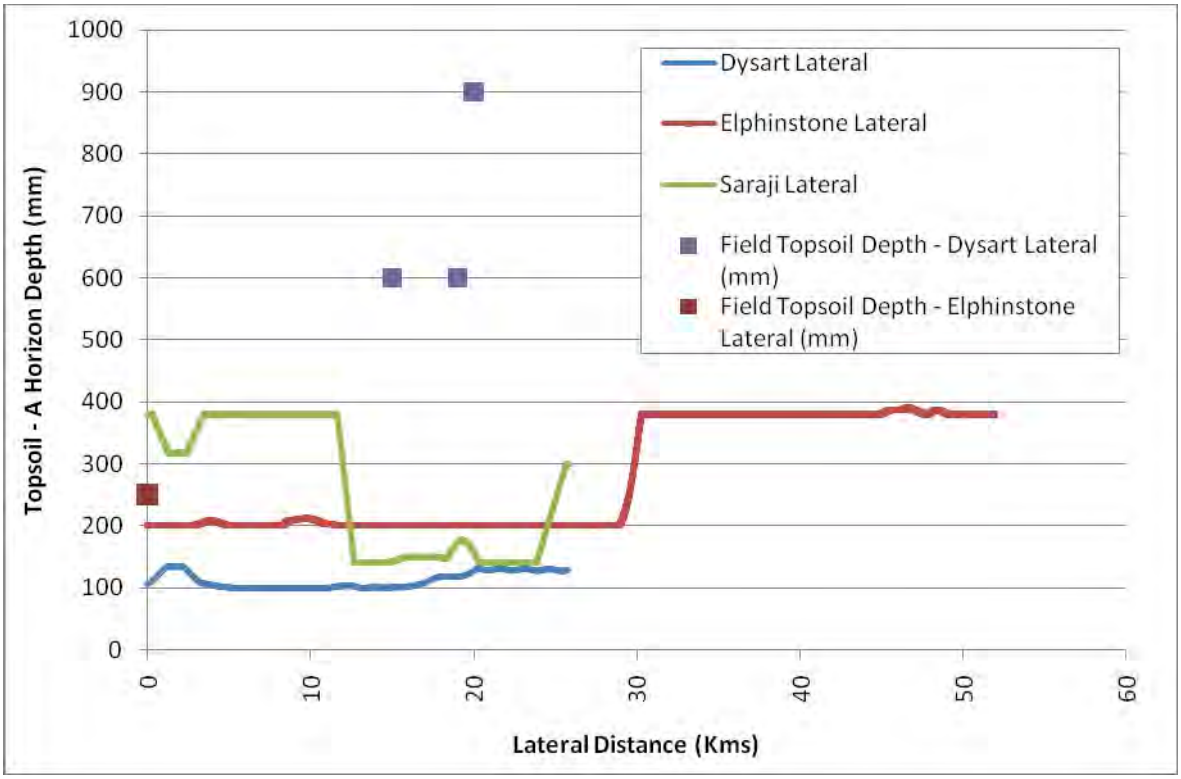
increased nutrient retention. In general, topsoil depths within landscapes are strongly related to topography, the shape and slope of the land. Thicker topsoils are typically found in the river valleys where soils accumulate on floodplains and at the footslopes of ranges (zones of deposition), while soils on hillslopes (zones of erosion) tend to be shallow.

CSIRO, Land and Water has estimated soil thickness for Australian areas of intensive agriculture for layer 1 (A Horizon – Topsoil). The topsoil thickness map, presented as 0.01 degree grid cells, was created by combining national and state level digitised land systems maps and soil surveys linked to look-up tables listing soil type and corresponding attribute values. The CSIRO map is provided in **Figure 3-3 Appendix A** showing the project area.

Topsoil depth at each Sample Location is provided in **Appendix E**. Topsoil depth along the ABP mainline and laterals has been graphed from existing mapping and field investigations as shown in **Figure 3-3** and **Figure 3-4**.



- **Figure 3-3 Mapped topsoil thickness along ABP mainline and topsoil thickness found at Sampling Locations (mm)**



- **Figure 3-4 Mapped topsoil thickness along ABP laterals and topsoil thickness found at Sampling Locations (mm)**

Figure 3-3 shows that approximately 50% of the sample locations had topsoil depths similar to mapped depths while at the remainder of the locations, topsoil depth was deeper than mapped. Field investigation of topsoil thickness at the three Locations along the Dysart Lateral, shown in **Figure 3-4**, shows that topsoil was found to be thicker than mapped values. Topsoil thickness found during field work at location 3-2 near the northern end of the Elphinstone Lateral was also slightly thicker than mapped topsoil thickness.

The field investigation found that topsoil depth varied from 100 mm to 900 mm across the 36 survey sites along the ABP route. Topsoil depths, classified according to observed ASC orders, are presented in **Table 3-3**, and indicate considerable variability both within and between orders.

- **Table 3-3 Field Investigation Topsoil Summary**

ASC Observed	Number of Sites Sampled	Minimum Topsoil Depth (mm)	Maximum Topsoil Depth (mm)	Average Topsoil Depth (mm)
Vertosols	4	300	600	413
Sodosols	18	150	1200	536
Chromosols	1	250	250	250
Rudosols	3	100	250	167
Kandosols	1	190	190	190

3.4. ABP Pipeline Australian Soil Classification Orders

According to DERM, Queensland Dominant Soils (2006) digital mapping, the proposed pipeline route (mainline and laterals) traverses six dominant ASC Orders (refer to **Figure 1 Appendix A**). The total distance and percentage coverage of dominant ASC Orders along the pipeline are shown in **Table 3-4**.

- **Table 3-4 Proposed pipeline length and percentage underlain by mapped ASC Orders**

Mapped ASC Order	Pipeline Length (km)	Pipeline %
Vertosols	185.3	32
Sodosols	290.3	50
Chromosols	39.0	7
Rudosols	39.2	7
Kandosols	12.0	2
Hydrosols	16.0	3
Total	581	100

Ground-truthing results are presented in **Appendix E** which shows mapped ASC at each sample location (from DERM mapping), observed ASC orders during fieldwork and topsoil depth. Twenty-seven of the 36 observed soils conformed to the expected soil profile forms predicted by existing soil maps and eight profiles could not be discerned due to refusal in shallow ground during augering or signs of human disturbance of the soil. Therefore 97% of the soils that could be classified conformed to the existing mapping. Sample Locations 14 was mapped as a Hydrosol was observed to be a Sodosol based on high sodicity of the upper B2 horizon and proximity to mapped Sodosol areas.

3.5. Characteristics of ASC Orders along Proposed ABP Route

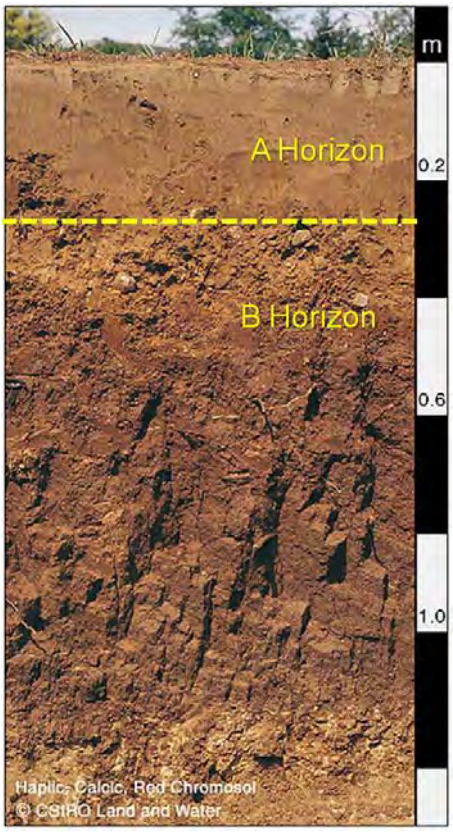
3.5.1. Chromosols

Chromosols occur on landforms ranging from undulating plains to hilly areas, and are derived from diverse rock types. They are characterised by a strong texture contrast between topsoil and subsoil, and are often brightly coloured (McKenzie et al., 2004).

Chromosols comprise 7% (39 km) of the total pipeline route. They occur between AB 322.06 and AB 361.08.

Chromosols observed along the pipeline route are, in general, derived from felsic igneous rocks and occur in an isolated area east of the Boomer Range. They were recognised during field sampling as silty clays with sand and have varying topsoil depths.

An example of a typical Chromosol profile in Australia is shown in **Figure 3-5** and a characteristic soil landscape along the ABP route is shown in **Figure 3-6**.



- **Figure 3-5 Example Chromosol Profile**

- **Figure 3-6 Chromosol Landscape near AB326**

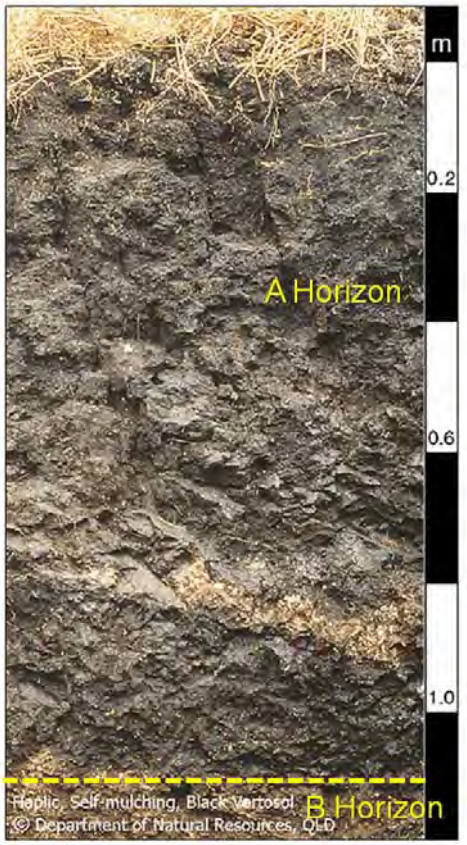
3.5.2. Vertosols

Vertosols generally occupy undulating plains and extensive floodplains of inland streams, and are derived from alluvial clayey sediments, shales, mudstones and limestone, and basalts. They are characterised by high clay content, and when dry, crack to a considerable depth (McKenzie *et al.*, 2004).

Vertosols are mapped in the region, and comprise 32% (185.3 km) of the total pipeline route.

The observed Vertosols display characteristic features: occurrence on plains and floodplains and their associated alluvial sediments, and strongly developed structure and high clay content. The majority of Vertosols appear to be used for cropping (corn and cotton crops observed during field investigation).

An example of a typical Vertosol profile in Australia is shown in **Figure 3-7** and a characteristic soil landscape along the ABP route is shown in **Figure 3-8**.



- **Figure 3-7 Example Vertosol Profile**

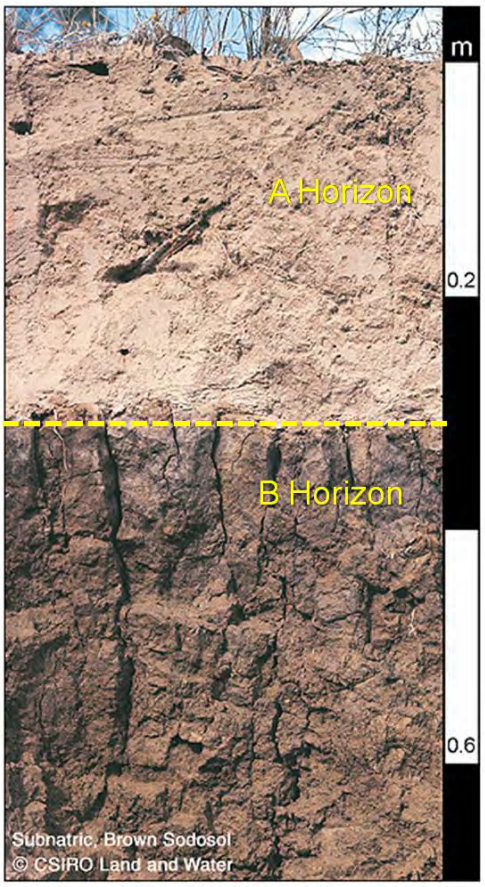
- **Figure 3-8 Vertosol Landscape near AB98**

3.5.3. Sodosols

Sodosols are widely distributed in eastern Queensland and are associated with dry climates. They are formed on alluvial and part-colluvial deposits, as well as igneous, sedimentary and metamorphic rocks (McKenzie *et* al., 2004). They are characterised by a strong texture contrast between topsoil and subsoil, with clayey, sodic (ESP of over 6% in the upper 0.2 m of the B Horizon) and often highly dispersive subsoils (Isbell 2002). The relatively impermeable subsoil which inhibits plant root penetration, hard-setting topsoils and susceptibility to tunnel and gully erosion all pose significant management issues.

Sodosols comprise 50% (290.3 km) of the total pipeline route. Where exposed in road cuttings and creek banks, some Sodosols showed evidence of deep erosion and various stages of rilling and gullying. The subsoils (B Horizon) of Sodosols are susceptible to collapse and transport, and readily disperse under sustained water application.

An example of a typical Sodosol profile in Australia is shown in **Figure 3-9**. A characteristic soil landscape along the ABP route is shown in **Figure 3-10**a along with land that has been eroded (possibly by dispersion) between location 3-1 and 4 shown in **Figure 10b.**



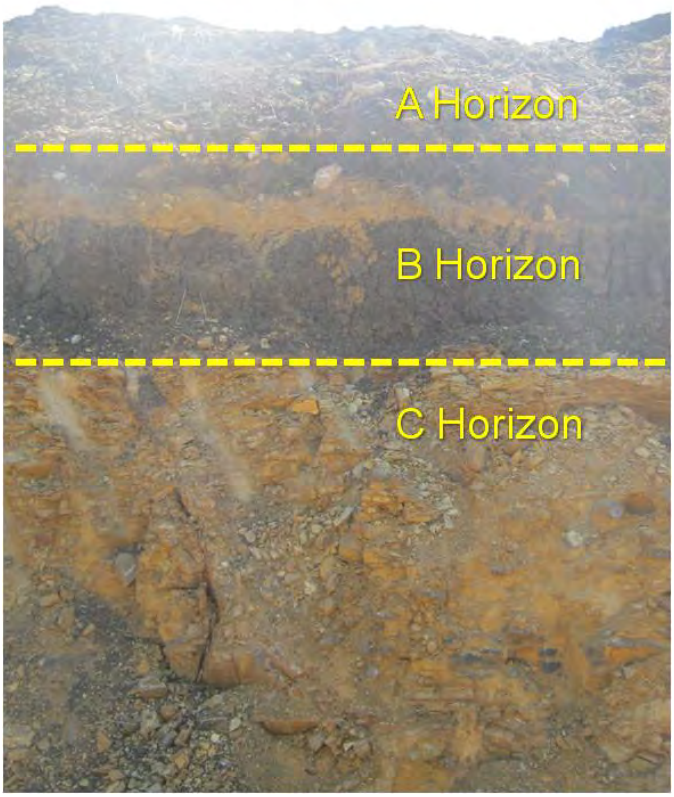
- **Figure 3-9 Example Sodosol Profile**

- **Figure 3-10a (left) Sodosol Landscape near AB276 and Figure 3-10b (right) erosion between Location 3-1 and Location 4 near AB123**

3.5.4. Kandosols

Kandosols are found on extensive, level to gently undulating plains and on mesas, often in association with ferricrete deposits. Parent materials are quartz-rich, often being sedimentary rocks, and their alteration products, and derived alluvium. They are often very deep (>3 m) and clay-rich and only relatively small areas of Kandosols are used for extensive agriculture in Australia (mainly in western Australia and New South Wales). The majority of Kandosols are used for sparse grazing of sheep and cattle on native pastures growing on low fertility soils (McKenzie *et al.*, 2004).

Kandosols comprise 2% (11.5 km) of the total pipeline route. They occur between AB 218.14 – AB 229.64. **Figure 3-11** and **Figure 3-12** show a characteristic Kandosol soil profile and landscape observed along the ABP route.



- **Figure 3-11 Kandosol Profile at Location 6-1 (near AB223)**

- **Figure 3-12 Kandosol Landscape (near AB223)**

3.5.5. Rudosols

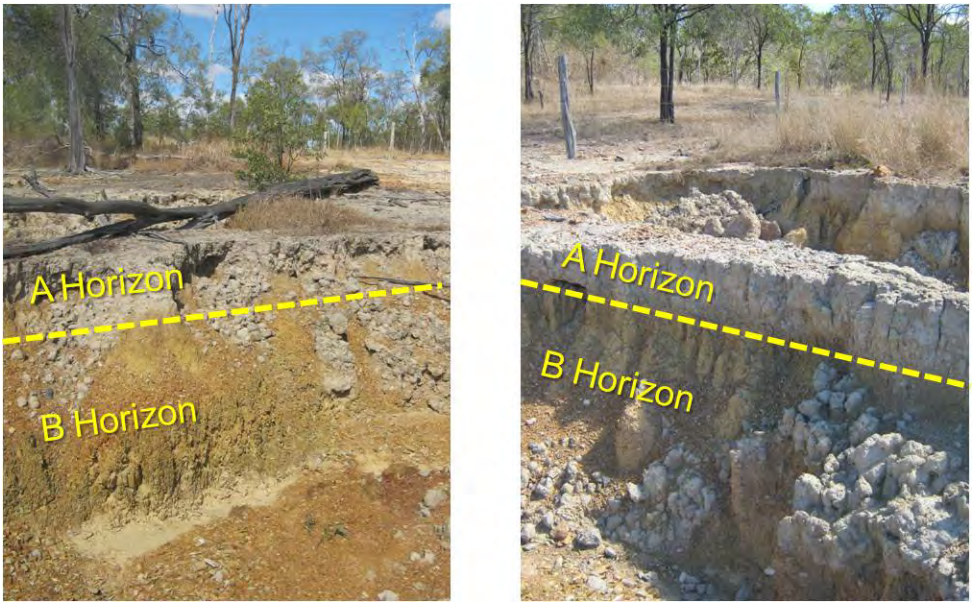
Rudosols in Queensland consist largely of gravelly loams, and show little or no pedological development, apart from topsoil and perhaps some subsoil in bedrock fissures. They are often characteristic of dynamic alluvial environments and very rocky environments. They often grade into Tenosols which show more pedological development (McKenzie *et al.*, 2004).

Rudosols comprise 8% (39.2 km) of the total pipeline route. They occur between AB273.88 to AB322.04.

These soils are generally thin and poorly developed, mainly because they occur in areas vulnerable to erosion.

Rudosols occur in the steeper hill country of the Broadsound Range west of Marlborough. Topsoil thickness in the three Rudosol sample locations varied between 100 mm and 250 mm, reflecting the rocky and potentially erosive environment.

Figure 3-13 and **Figure 3-14** show characteristic Rudosol profiles and landscape along the proposed ABP route.



- **Figure 3-13a (left) and Figure 3-14b (right) Rudosol Profiles near AB277**

- **Figure 3-14 Rudosol Landscape near AB290**

3.5.6. Hydrosols

According to existing mapping, Hydrodols along the pipeline occur near the Port Alma area between AB426 and AB441 (3% of total pipeline). However the field investigation revealed soil to be a Sodosol at location 14 within this area suggesting that Hydrosols may not extend as far inland as mapped, or only extend inland along waterlogged low lying areas. These soils present potential

acid sulfate soil management issues i.e. management of excavations to minimize soil exposure, management of groundwater level, application of neutralizing agent gypsum. Acid scalds occur where pyrite is oxidised near the surface and a permanent bare patch of soil is created after vegetation die back. This scald is then susceptible to erosion.

The Investigation included the analysis of two soil samples from Sample 14 (14/0.3-0.4 m and 14/0.6-0.7 m) located within the low laying area shown in **Appendix A Figure 3-1**. These samples did not contain detectable levels of oxidisable sulfur.

If encountered on the pipeline route, they will be identifiable by waterlogging, mottling of clay-rich material and vegetation that is adapted to waterlogged conditions.

3.5.7. Identification of Good Quality Agricultural Land

This section discusses the land use suitability of the project area in terms of Good Quality Agricultural Land (GQAL) and Strategic Cropping Land. The tabulated results of laboratory soil testing are provided in **Appendix C** and Laboratory reports are provided in **Appendix F** and a discussion of the results in the context of GQAL is provided below.

GQAL is land that is capable of sustainable use for agriculture, with a reasonable level of inputs, and without causing degradation of land or other natural resources. GQAL is defined within State Planning Policy 1/92: Development and the conservation of agricultural land as '*land used for crop or animal production, but excluding intensive animal uses such as feedlots, piggeries, poultry farms and plant nurseries based on either hydroponics or imported growth media*'.

Queensland State Planning guidelines, 'The Identification of Good Quality Agricultural Land' (DPI, DHLGP, 1993) identifies four classes of agricultural land within Queensland. Based on GQAL mapping produced by DERM (DERM 2011), the extent to which the pipeline transects each category is described in **Table 3-5**.

- **Table 3-5: Description of existing land classes (based on DERM GQAL mapping)**

Class	Description	Approximate Area (ha) *	Percentage of Pipeline & Laterals Route*	ASC
Class A Crop Land	Crop land - Land that is suitable for current and potential crops with limitations to production which range from none to moderate levels.	181	10%	Sodosol, Vertosol, Chromosol
Class B Limited Crop Land	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	57	3%	Sodosol, Vertosol,

Class	Description	Approximate Area (ha) *	Percentage of Pipeline & Laterals Route*	ASC
	considered suitable for cropping.			
Class C Pasture Land	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.	1,500	86%	Sodosol, Vertosol, Chromosol, Kandosol, Rudosol
Class D Non-agricultural Land	Non-agricultural land - Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage.	0.5	<1%	Sodosol

* The approximate areas and percentages of GQAL traversed by the pipeline route are based on a 30 m wide ROW.

The majority of the land (86%) affected by the clearing of the Right of Way (ROW) is classed as Pasture Land (Class C) GQAL. The remainder is Class A (10%) which is most suited for cropping, Class B (3%) and Class D (<1%).

The majority of the Saraji Lateral passes through Vertosols that are Class A GQAL land that is currently used for dryland cropping and plantations according to DERM Land Use Mapping (2004). This accounts for 51 ha of the total 181 ha of Class A Crop Land transected by the pipeline. This area is within Vertosols which are prone to degradation through compaction.

Soil fertility and physical properties

Cations (especially Ca, Mg, K) held on the soil exchange complex constitute a nutrient reserve for plants. As plant roots remove nutrients from the soil they are replaced in the exchange complex from the pool of exchangeable nutrients.

The total values of exchangeable cations are not absolute indicators of cation availability for plant growth, although, as a rough guide, soils will have sufficiency when levels are:

- Exchangeable Ca > 0.2 mg/kg;
- Exchangeable Mg > 0.2 mg/kg;
- Exchangeable K > 0.02 mg/kg in arid and semi-arid soils (Crack and Isbell 1970);
- Exchangeable K > 0.025 mg/kg in sands and sandy loams (Skene 1956); and
- Exchangeable K > 0.03 mg/kg in loams and clay loams (Rayment 1983a).

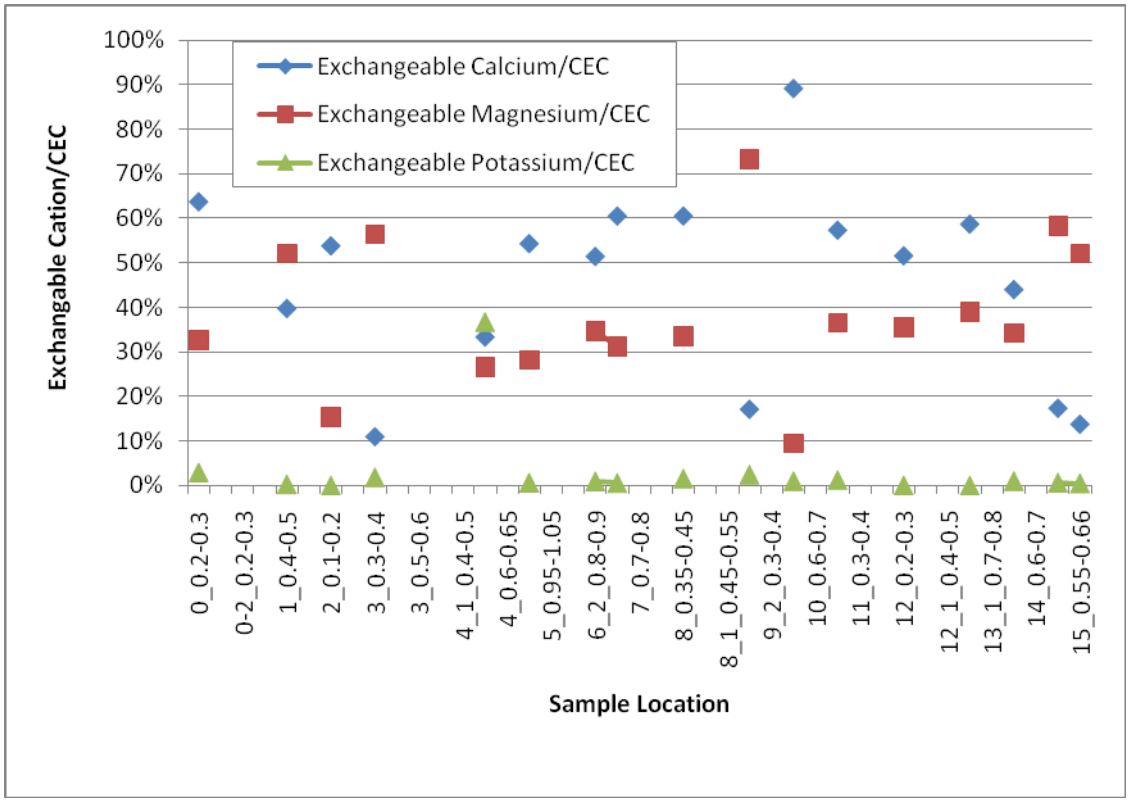
There is considerable evidence, however, that for neutral soils, the proportions of the various cations of total CEC are more relevant to plant performance than total levels provided the levels are above those of the sufficiency level. A guide to desirable ranges for many plants is:

- Exchangeable Ca/CEC 65-80%
- Exchangeable Mg/CEC 10-15%
- Exchangeable K/CEC 1-5% [1]
- Exchangeable Na/CEC 0-1%

The proportion of exchangeable cations within soil can be used in the assessment of physical properties. If calcium is dominant (relative to magnesium and sodium) the soil is more likely to have good physical properties, and is an important statement in land use studies.

The results displayed in **Figure 3-15** highlight values that did not meet the cation sufficiency levels described above. All of the samples had exchangeable cation levels that fell outside of the ideal soil fertility ranges.

[1] if >10% of CEC then potassium may cause Mg deficiency. if <1% of CEC leading to scorched margins of oldest leaves and spots surrounded by pale zones



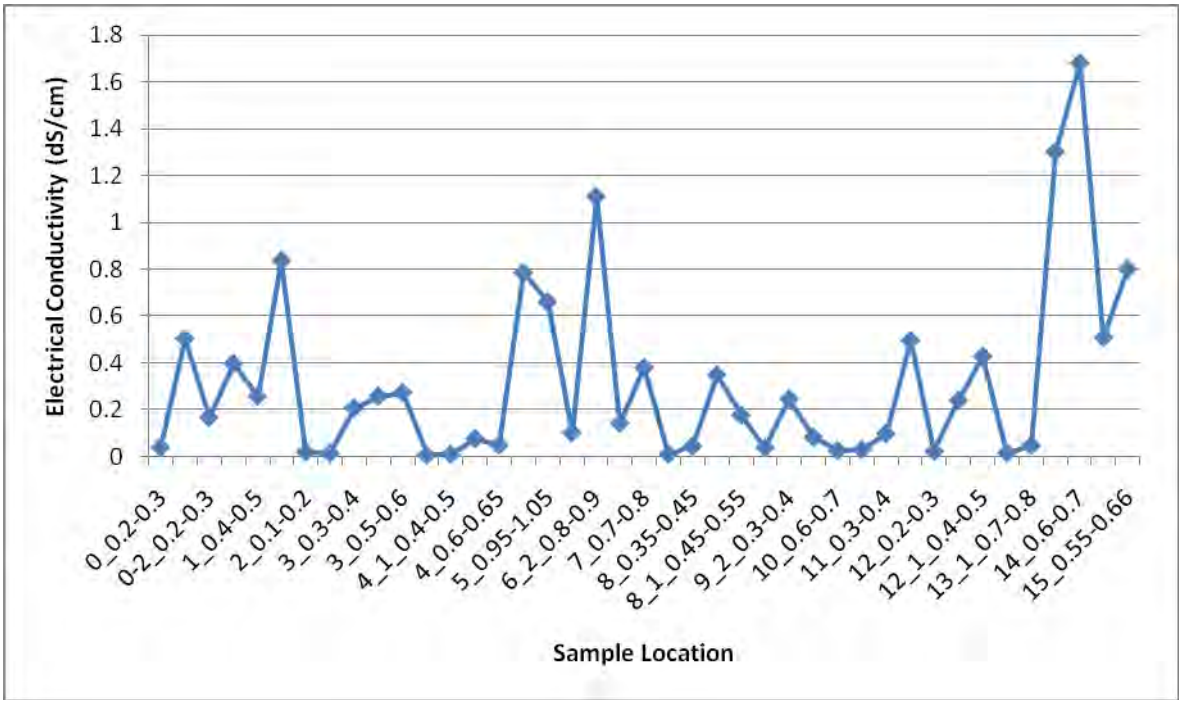
- **Figure 3-15 Sample Exchangeable Cation/CEC**

Sulfur

Most of the sulfur (S) in soils is present as part of the soil organic matter (normally 70-90% of the total S). Sulfur is not available to plants in this form, but is released by bacterial action converting it to the sulfate ion ($S0_4^{2-}$). Total S levels of between 0.001 to 0.072% have been found in surface soil layers in northern Queensland (Baker 1991). A total S level of over 0.02% is preferable (Baker 1991) and $S0_4^{2-}$ levels of over 8 mg/kg may indicate sulfate anion sufficiency (Potash & Phosphate Institute, 1994). Seven samples had sufficient sulfate levels while the remaining ten samples had no detectable sulfate (detection limit 10 mg/kg) and are therefore unlikely to have sulfate levels above the sufficiency level of 8 mg/kg.

Soil Salinity

The soluble salt content, or salinity, within a given soil horizon is measured by determining the electrical conductivity of the soil. Tolerance to salinity of crops and other plants is inferred from clay content. Suitability of the soil for salt tolerant crops (at sample locations that have also been tested for cations and nutrients) has been estimated using electrical conductivity and soil clay content based on Shaw 1999 (see results table **Appendix C)**. The conductivity values for sample locations are summarised in **Figure 3-16**. The results show a range of soil content that does not show a relationship with ASC orders.



- **Figure 3-16 Electrical Conductivity at Sample Locations (dS/cm)**

Sodosols had salinity levels which ranged from very low to extreme, indicating that some of these Sodosols could support crops with no salt tolerance while others would be generally too saline for cropping. The Sodosol at Location 14 is classed as too saline for cropping and would therefore be Class C GQAL.

Similarly Vertosols had salinity levels which ranged from very low to very high. The Kandosol had a low salintiy, while the Rudosol had medium salinity. The Chromosol soils samples had very low to medium salt levels.

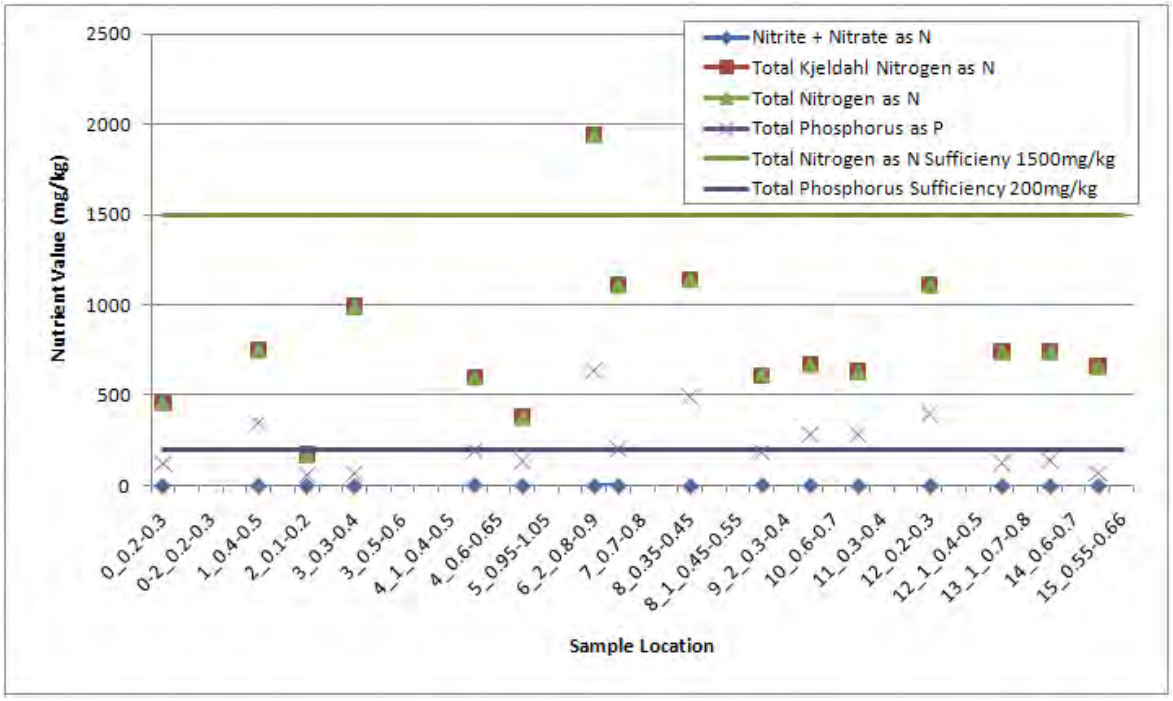
Soil Nutrients

Phosphorus – phosphorus is a macronutrient, and in soils of low levels may be a critical element in determining land use. However in some soils (not all soils) levels can be adjusted by the use of an appropriate fertiliser. Only certain fractions of phosphorus are available to plants. Total P measures the overall reservoir of phosphorus in the soil (both soluble and insoluble) and can give a rough indication of potential availability to plants. Plants will generally have sufficiency in phosphorus if total P levels are over 200 mg/kg (Baker 1991). Values of phosphorus in soils samples ranged from 55 mg/kg to 632 mg/kg with 50% having sufficiency in phosphorus.

Nitrogen – The conversion of organic nitrogen to mineral nitrogen (nitrate and ammonium) available to plants is dependant on microbiological activity. The majority of total N within the

organic matter fraction is not available to plants. Release is strongly correlated with temperature, moisture, pH and phosphorus. In general if total nitrogen is less than 0.15% (1,500 mg/kg) then fertiliser should be added (Baker 1991).

All but one of the soil samples had nitrogen levels below ideal concentrations for cropping purposes and therefore soils in this area would require fertiliser addition to be suitable for cropping.



- **Figure 3-17 Nutrient Concentrations in Soil Samples (mg/kg)**

3.5.8. Identification of Strategic Cropping Land

Agricultural land resources are important to Queensland as they support regional communities and provide a resource base for food and fibre production. In this regard, DERM have proposed criteria for identifying strategic cropping land (DERM 2011). This document is currently under public consultation and the outcomes of the review may affect the assessment made in this section.

The guidelines proposed for assessing if land is Strategic Cropping Land differ slightly for regions of Queensland. Sample 14 and Sample 15 are located in the Coastal Queensland area and the remainder of the sample locations are within the Western Cropping Area. The criteria relevant for the project area are described in

Table 3-6**.**

- **Table 3-6 Summary of criteria for identifying strategic cropping land (DERM 2011)**

Criteria	Criteria and thresholds	
	Western Cropping	Coastal Queensland
1. Slope	≤3%	≤5%
2. Rockiness	≤20% for rocks >60 mm diameter	
3. Gilgai microrelief	<50% of land surface being gilgai microrelief of >500 mm in depth	
4. Soil depth	≥600 mm	
5. Soil wetness	Has favourable drainage (no waterlogged layers within 300 mm of the ground surface).	
6. Soil pH	For non-rigid soils, the soil at 300 mm and 600 mm soil depth must be greater than pH 5.0. For rigid soils, the soil at 300 mm and 600 mm soil depth must be within the range of pH 5.1 to pH 8.9, inclusive.	
7. Salinity	Chloride content <800 mg/kg within 600 mm of the soil surface	$EC_{1:5}$ <0.56 dS/m within 600 mm of the soil surface
8. Soil water storage	≥100 mm to a soil depth or soil physico-chemical limitation of ≤1000 mm	≥75 mm to a soil depth or soil physico-chemical limitation of ≤1000 mm

Soil water storage capacity can be assessed using the look-up table in the Strategic Cropping Guidelines document and is based on soil textures. The table lists the average estimated amount of water expected to be stored in each 100 mm increment of soil according to soil type. Therefore based on the table, all the sample locations fail to meet the criteria as they have insufficient clay content in the top 1m to allow sufficient water holding capacity.

Slope for the sample locations has been computed using a 90 m Digital Elevation Model. Rockiness and Gilgai microrelief were not encountered at the sample sites along the proposed alignment.

Comparison of the field investigation results with these guidelines did not identify any of the sample sites as being Strategic Cropping Land (SCL). This was primarily due the soils insufficient water storage capacity. **Table 3-7** shows a comparison of the 24 laboratory soil samples with the criteria and indicates whether the criteria were met along with the qualification as SCL.

Vertosols generally have good water storage capacity and drainage due to their clay rich content. The SCL recommendations for the estimation of plant available water capacity are not a true reflection of plant available water. Plant available water is a function of the initial moisture content, rainfall distribution and frequency and evapotranspiration. Plant available water demands are also a function of crop type and land management (i.e. is the site irrigated)

The criteria do not stipulate a requirement for minimum annual rainfall in order to allow sustainable cropping without reliance on bore water. According to Bureau of Meteorology mapping (2007) the project area has an annual rainfall of over 600 mm/yr which could be considered sufficient for cropping purposes.

- **Table 3-7 Strategic Cropping Land Assessment of ABP Pipeline**

Sample	Slope	soil depth	soil wetness	soil pH	Salinity	Soil water storage	Assessment
0/0.2-0.3	P	P	P	P	P	F	Not SCL
0-2/0.2-0.3	F	P	P	P	P	F	Not SCL
1/0.4-0.5	F	P	P	P	P	F	Not SCL
1-1/1-1.2	P	n/a	P	P	F	F	Not SCL
2/0.1-0.2	P	P	P	P	P	F	Not SCL
3/0.3-0.4	P	P	P	P	P	F	Not SCL
3-2/0.5-0.6	P	P	P	P	F	F	Not SCL
4-1/0.4-0.5	P	P	P	P	P	F	Not SCL
4/0-0.1	P	P	P	P	P	F	Not SCL
5/0.4-0.5	P	P	P	P	F	F	Not SCL
6-1/0.4-0.5	P	P	P	P	P	F	Not SCL
6-2/0.8-0.9	P	P	P	P	F	F	Not SCL
7/0.7-0.8	P	P	P	P	P	F	Not SCL
7-1/0.4-0.5	P	P	P	P	P	F	Not SCL
8/0.85-0.95	P	P	P	P	P	F	Not SCL
8-1/0.45-0.55	P	P	P	P	P	F	Not SCL
9-2/0.3-0.4	P	P	P	P	P	F	Not SCL
10/0.6-0.7	P	P	P	P	P	F	Not SCL
11/1.0-1.1	F	P	P	P	F	-	Not SCL
12/0.3-0.4	P	P	P	P	P	F	Not SCL
12-1/0.4-0.5	P	P	P	P	P	-	Not SCL
13-1/0.7-0.8	P	P	P	P	P	F	Not SCL
14/0.3-0.4	P	P	P	P	F	-	Not SCL
15/0.55-0.66	P	P	P	P	F	-	Not SCL

n/a: unable to determine as hand auger not advanced beyond 500 mm depth
P indicates pass of criteria. F indicates fail

4. Discussion/Summary

4.1. Soil Classifications

The ground-truthing exercise demonstrated that the available soil maps are largely reliable in representing ASC Orders (89% accuracy). This is an important result, because general soil properties encapsulated in the ASC Orders can be used in wider landscape interpretation of potential impacts of pipeline construction on soils. Orders are particularly valuable for identifying areas vulnerable to erosion through collapse and dispersion (i.e. Sodosols) and hillslope erosion (i.e. Rudosols and other soils on steeper slopes).

4.2. Topsoil Thickness

As well as providing a growth medium for plants and pasture, topsoil protects underlaying soil from erosion (particularly dispersive Sodosols). Once stripped of topsoil, the subsoil is susceptible to sheet wash and gully erosion. The presence of topsoil in steeper areas also aids soil retention, particularly where vegetation is also present. Topsoil is therefore critical to erosion control and is also important for revegetation purposes and weed management.

The results from this survey indicate that topsoil depth is variable. Topsoil is expected to be thick on the alluvial plains of the Dawson-Fitzroy region and becomes shallow in hilly areas of the Broadsound Range and Denham and Kerlong Ranges. In gully deposits and on lower slopes, topsoils can be expected to be thicker where they accumulate material transported from upslope.

It is important that maximum topsoil is collected and soil handling, storage and replacement is conducted correctly and in a manner conducive to retaining or enhancing natural soil physical and chemical properties. Recommendations for soil management during pipeline construction are provided in **Section 5**.

4.3. Erosion Potential for ABP Pipeline

Sodosols

Sodosols underlie 50% (290.3 km) of the proposed pipeline route according to DERM mapping however field investigations have shown that may be more widespread. The locations of Sodosols are along the pipeline are as follows:

- AB18.3 – AB92.4
- AB109.3 – AB133.1
- AB146.7 – AB164.68
- AB294.1 – AB299.68
- AB361.1 – AB425.84

- AB441.4– AB477.26
- EL0 – E 47.3
- SL0 – S17.46

Sodosols have formed on a range of parent materials, occupying valley floors and lower slopes. They are characterised by a texture contrast profile with an abrupt or clear change in clay content between the upper layers and the subsoil. These soils tend to have poor drainage characteristics due to very dense and slowly permeable subsoils. The dense subsoil also restricts root penetration. The soils have poor fertility, but are currently used for cropping at Locations 13 and 13-1 presumably with fertiliser inputs.

Sodosols pose the most significant erosion risk due to high exchangeable sodium levels leading to subsoil structure collapse after wetting. Where pipeline trenching is to occur in any areas that are adjacent to already incised stream and gullies, this poses significant risk of accelerated and expanded erosion in the absence of sound soil management.

Chromosols

Texture contrast Chromosols underlie 7% (39 km) of the total pipeline route and occur in an isolated area east of the Boomer Range and have a loamy texture with sand and gravels fractions with some basalt fragments. Chromosols do not generally pose a high erosion risk however, preventing downslope transport of soil fines should be considered on steeper slopes.

Vertosols

Clay-rich Vertosols underlie 32% (185 km) of the proposed pipeline route. Vertosols in this region have strongly developed structure and tend to be high in topsoil organic matter, which lend them high stability and resilience to disturbance. This is a key reason Vertosols can be used for intensive cropping. Although erosion issues are likely to be minimal for these soils, Vertosols can be vulnerable to compaction by vehicles and machinery when they are wet. This may in turn lead to structural collapse which will remain after drying, and which may compromise water availability and plant growth through increased root penetration resistance.

Otherwise, these soils are the most resilient and pose the least issues for pipeline construction and surface rehabilitation.

Rudosols

The remainder of the proposed pipeline route is underlain by Rudosols (7%, 39.2 km) and these soils are generally thin and poorly developed, mainly because they occur in the steeper hill country of the Broadsound Range and are vulnerable to erosion. Soil cover in these areas is variable, with many areas comprised of mosaics of exposed bedrock and thin topsoils. Where soil is to be disturbed, care must be taken to prevent downslope movement of material.

4.3.1. Other Soils

Kandosols underlie 2% (12 km) of the proposed pipeline route and are generally uniform throughout the profile and lack structure. They are usually loamy with a gradual increase in clay content at depth. They are generally very permeable, well drained and highly erodible if left bare and therefore require erosion management controls.

The field investigation has classified soil at location 14 as a Sodosol with non-detectable levels of oxidisable sulfur. This differs from existing soil mapping which classifies this area as a Hydrosol, possibly indicating that Hydrosols do not extend sufficiently far inland in the Port Alma area to pose an acid sulfate soil risk to the pipeline. Hydrosols, if present, are located on flat to undulating terrain and generally have high clay contents meaning they are unlikely to erode, however, acid scalds may be subject to wind erosion.

4.3.2. Hillslope Erosion

Hillslope erosion mapping by CSIRO indicates that annual hillslope erosion yields are high (>10t/ha/yr) at locations that generally correspond to steeper hilly sections of the pipeline for example, the Kerlong Range, Broadsound and Boomer Ranges (refer to **Table 3-2** for AB Sections with high erosion potential).

Construction practices aimed at reducing erosion and sediment transport will be adopted at all times and in the areas of high erosion potential additional measures will be taken as outlined in **Section 5**.

4.4. Land Use Suitability

The field investigation did not identify any land classed as strategic cropping land according to the proposed DERM criteria (2011).

The majority of the pipeline transects sodosols that are Class C GQAL (86%) which the field investigation has shown to have a low potential for cropping purposes and are mainly used for cattle and sheep grazing. These soils tend to limit plant growth due to poor water infiltration, increased mechanical resistance to root growth, and poor water availability in the soil profile[2]. As discussed in **Section 3.1** Sodic soils are also more prone to erosion, increasing the risk of topsoil loss and therefore the inevitable decline in soil fertility.

[2] The properties of Sodosols can be improved by increasing the organic carbon content, as well as replacing the sodium ions by applying inorganic products

Installation of the pipeline and ancillary infrastructure, if not managed appropriately, has the potential to permanently degrade GQAL through land clearing, loss of topsoil/organic matter, topsoil/subsoil mixing, reduced moisture holding capacity and subsoil compaction.

Rehabilitation of disturbed land will be carried out as soon as practicable after laying the pipeline to return the land as near as possible to pre-disturbance productivity levels. Recommended soil management procedures are discussed in **Section 5**.

5. Conclusions and Recommendations

The results of the pipeline soil assessment indicate the following:

- The mapped ASC Orders were ground-truthed in 92% of field observations at the mapped scales. This provides a large measure of confidence in the existing mapping.
- Topsoil depth is highly variable (0.1-1m) both within and between ASC Orders at the observed sites. This is due to varying factors such as climate, inherent nutrient status of the rock parent material, local geomorphic position and erosion status, and nature of site vegetation. Topsoil is likely to vary considerably along the pipeline route from approximately 100mm up to 900mm.
- A high percentage of soils (approximately 50% Sodosols) are highly susceptible to erosion through surface crusting and dispersion if not managed and rehabilitated appropriately.
- Sections of high hillslope erosion potential occur along the pipeline which require appropriate erosion control practices.
- The soils requiring most attention will be dispersive Sodosols, because these have the most potential for surface crusting and downstream effects in waterways through sediment runoff. Soils in steeper areas identified as having high hillslope erosion potential will also require careful management to prevent downslope transport

In light of these findings, the Construction Environmental Management Plan (CEMP) will include strategies for soil management, erosion control and rehabilitation. It is anticipated that these controls will be sufficient to mitigate any significant erosion problems and minimize the risk of degradation of GQAL.

Soil Management

The observed variability in topsoil thickness means that it is difficult to provide a standard recommended stripping depth. The most important component of topsoil is organic matter, and its accumulation depth is dependent on local site conditions such as vegetation cover, drainage, land use history and inherent soil fertility. These can vary even within a single paddock. Accordingly, it is recommended that:

- reconnaissance of topsoil depth on individual properties be undertaken in consultation with landowners to ensure maximum topsoil stripping depths for future rehabilitation based on visual observation of the A horizon;
- topsoil will be stockpiled separately to subsoil;
- no inversion of soil profiles as a result of construction;

- best practice topsoil management guidelines should be applied to the project i.e. topsoil is to be stockpiled separately in windrows. These are to have gaps (which coincide with gaps in other mounds of material) to allow for drainage and stock / vehicle access as required.
- consultation with landowners on erosion and other soil management issues specific to their properties to facilitate rehabilitation success and prevent ongoing management issues i.e. reduced grazing in rehabilitation areas until grass cover returned;
- the ROW will be allowed to regenerate naturally with hydromulch in areas of high predicted hillslope erosion, and in areas with a history of erosion, seeding with fast-growing species will be undertaken in liaison with landholders;
- banks are used to divert water away from the easement where required;
- where Vertosols are present, equipment will be restricted to the ROW where possible;
- backfilling is to be carried out to avoid inversion of soil profiles. The backfilled trench is to be compacted as necessary to minimize subsidence, topsoil returned and spread evenly across the ROW;
- surface roughness will be encouraged when spreading topsoil. Compacted areas will need to be ripped or scarified prior to spreading topsoil and rehabilitation as required;
- liaison with landholders to kept stock off the rehabilitating easement.; and
- Kandosols need to be managed carefully to ensure that rock fragments are not mixed into the topsoil and subsoil where it does not occur naturally. It is proposed to utilise a portable rock crusher to crush rock to <75 mm for return to the trench.

The following recommendations are made to mitigate risk of impact to GQAL and the surrounding environment due to soil erosion.

General erosion management measures

In general, erosion and sediment control measures will be incorporated into an Erosion and Sediment Control Plan and will include:

- minimising open areas of excavation;
- maintaining sediment control devices along drainage lines to prevent the transport of sediment from the site;
- stockpiling materials (including topsoil) away from drainage lines to prevent the transport of sediment from site;
- controlling drainage of camp sites, sewage effluent discharge areas, maintenance and storage areas (including hardstand areas and pipe stockpile locations) by surface drains and bunds;
- suppressing dust during construction using a water truck ; and
- managing traffic in construction zones in accordance with the TMP (refer to Section 4.3.2);

- placement of diversion drains to divert stormwater away from the restored pipeline easement may also be required in areas where slope >5%;
- adequate monitoring and follow-up work following construction to ensure any initiated erosion is arrested early; and
- progressive revegetation (i.e. as soon as possible after disturbance) during construction and operation to reduce potential erosion risk.

High predicted hillslope erosion areas and steep slopes >5% – erosion management measures

In addition to the measures described above, in areas which are subject to high erosion potential (>10 t/ha/yr) (listed in **Table 3-2**) and on hilly areas with slopes >5% (listed in **Appendix G**), stormwater diversion banks / drains (whoa-boys) will be placed diagonally across the ROW to divert stormwater to adjacent undisturbed grassed areas following completion of construction. Spacing of such diversion berms will vary according to topography and drainage flows, with more frequent spacing where slopes are >5%.

6. References

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Appendix A Figures

ARROW BOWEN PIPELINE PRELIMINARY ROUTE (REV D)

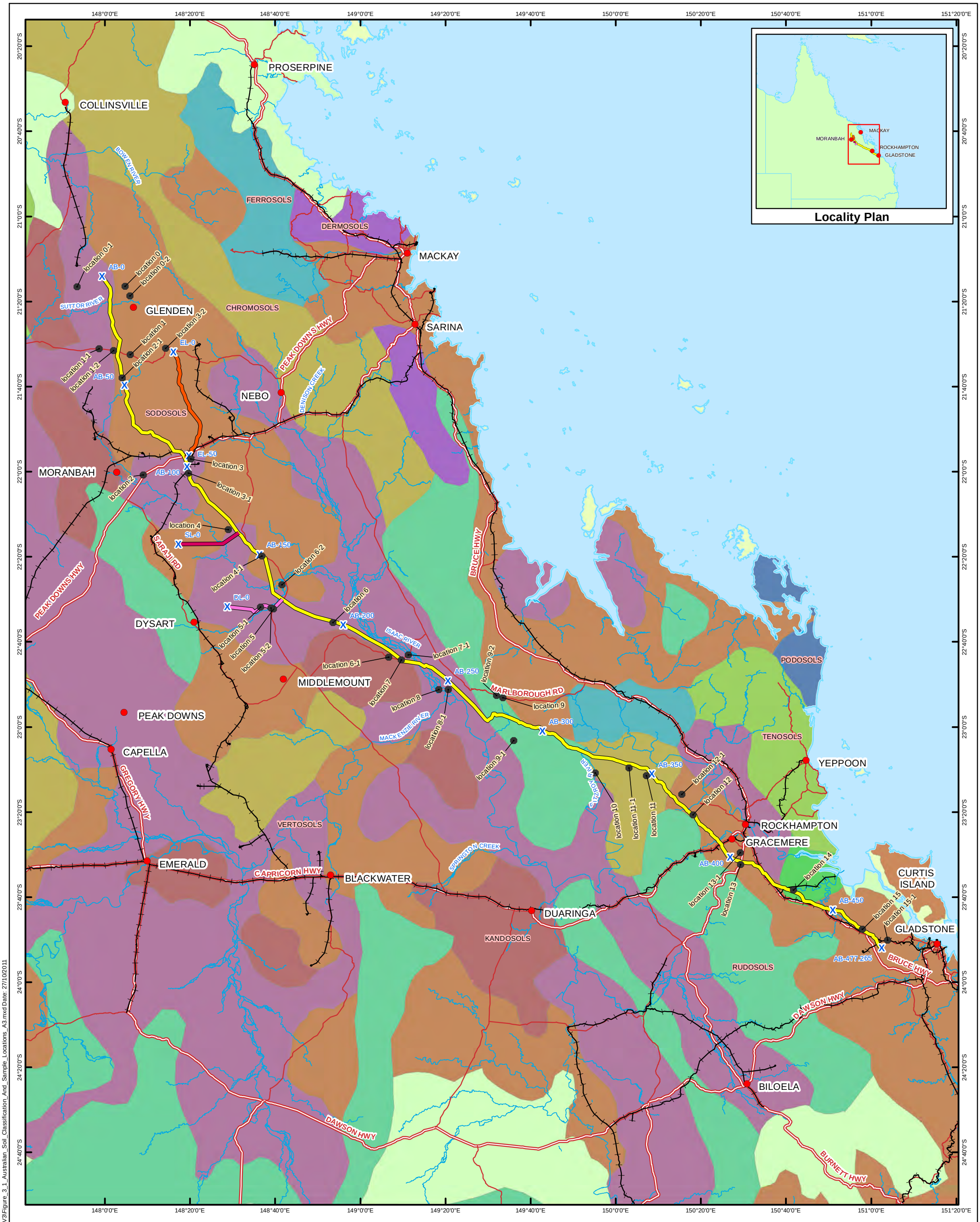

Figure 3 - 1: Australian soil classification and sample locations

Legend

- Localities
- Kilometre Points
- AB Mainline Rev D
- Dysart Lateral Rev D
- Elphinstone Lateral Rev D
- Saraji Lateral Rev D
- Railways
- Highways
- Major Roads
- Major Watercourses

SOIL

- CHROMOSOLS
- DERMOSOLS
- FERROSOLS
- HYDROSOLS
- KANDOSOLS
- PODOSOLS
- RUDOSOLS
- SODOSOLS
- TENOSOLS
- VERTOSOLS

Data Sources:
StreetPro: Localities, Roads, Railways
DERM: Major Watercourses
Department of Natural Resources, Mines and Water: Soil
Data Supplied by Arrow Energy:
ABP Mainline RevD,ABP Lateral RevD Kilometre Points
Data Digitised by SKM: Soil Sampling Locations

N

0 25 50
Kilometres

Scale: 1:1,500,000 @ A3
Coordinate System: GCS GDA 1994

Document: I:\ENVR\Projects\EN02962\SpatialArcGIS\V3\Figure_3_1_Australian_Soil_Classification_And_Sample_Locations_A3.mxd Date: 27/10/2011

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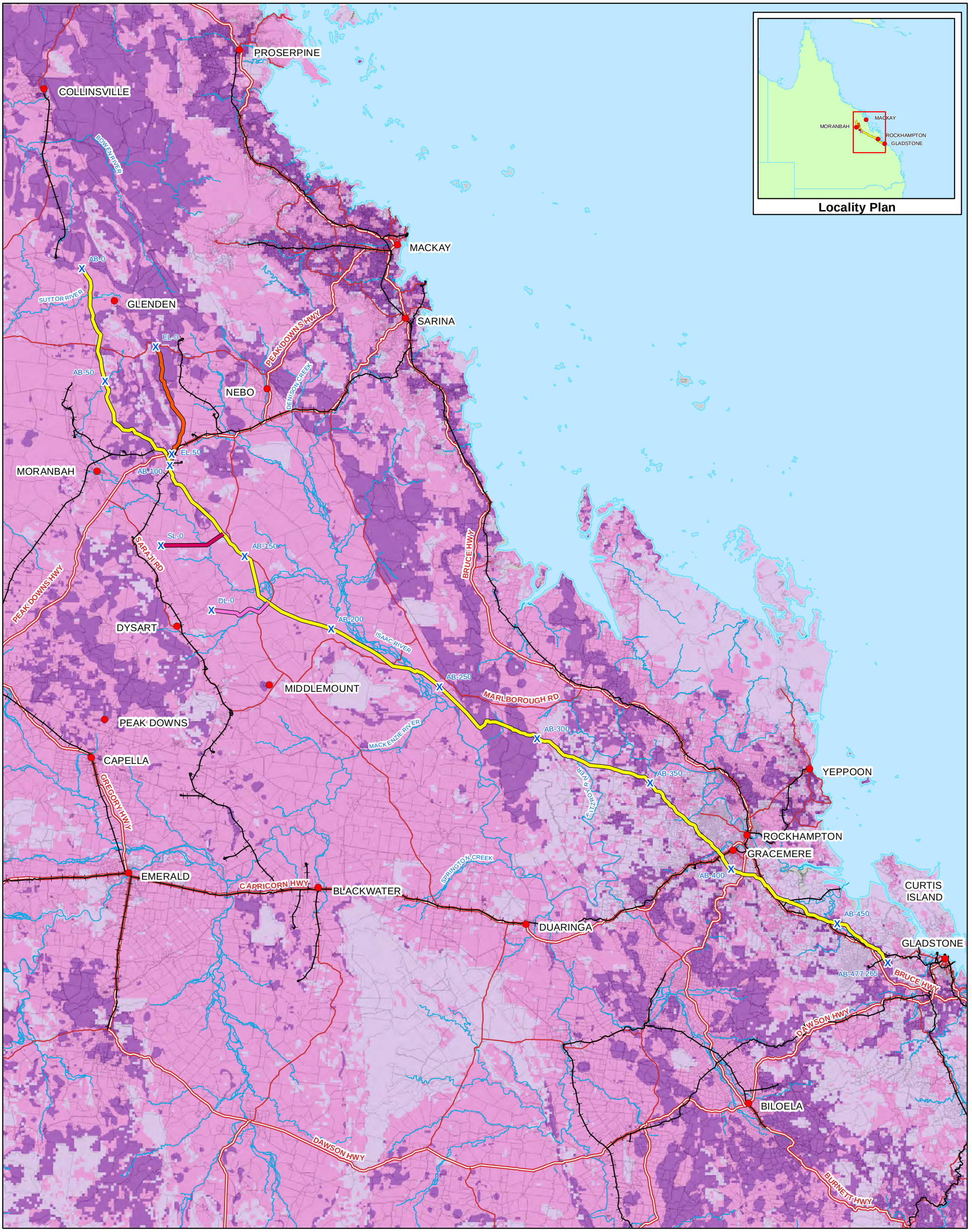

Figure 3 - 2: Erosion ratings (predicted hillslope erosion)

Legend

- Localities
- Kilometre Points
- AB Mainline Rev D
- Dysart Lateral Rev D
- Elphinstone Lateral Rev D
- Saraji Lateral Rev D
- Railways
- Highways
- Major Roads
- Major Watercourses
- Cadastre

Annual Hillslope Erosion (t/ha/yr)

- Low: 0 - 0.5
- Medium: 0.5 - 10
- High: 10 - 100

Data Sources:
StreetPro: Localities, Roads, Railways
DERM: Cadastre, Major Watercourses,
CSIRO: Annual Hillslope Erosion
Data Supplied by Arrow Energy:
ABP Mainline RevD,ABP Lateral RevD
Kilometre Points

N

0 25 50
Kilometres

Scale: 1:1,500,000 @ A3
Coordinate System: GCS GDA 1994

Document: I:\ENVRProjects\EN02962\SpatialArcGISV3\Figure_3_2_Erosion_ratings_A3.mxd Date: 27/10/2011

ARROW BOWEN PIPELINE PRELIMINARY ROUTE (REV D)

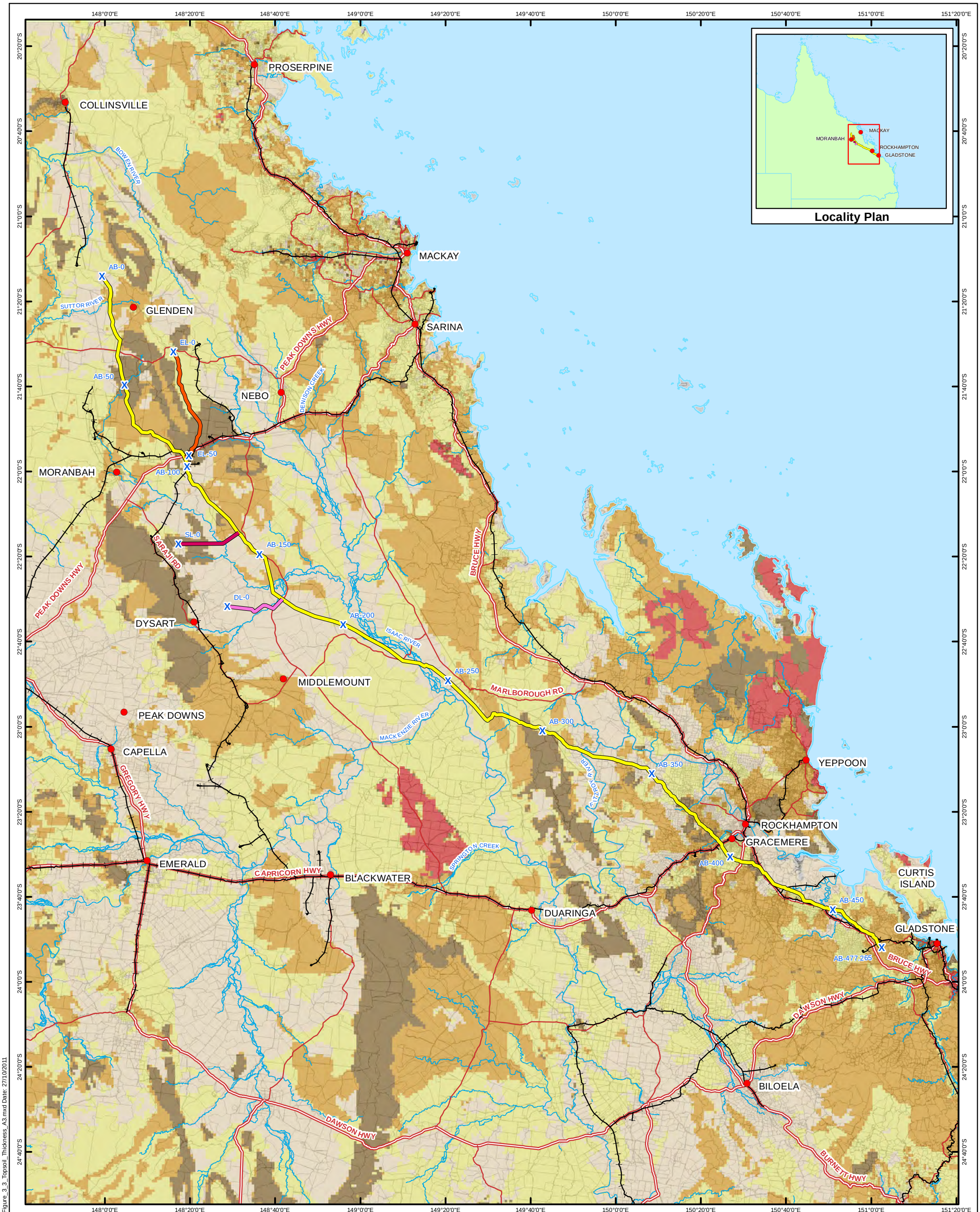

Figure 3 - 3: Topsoil thickness (horizon A) mm

Legend

- Localities
- Kilometre Points
- AB Mainline Rev D
- Dysart Lateral Rev D
- Elphinstone Lateral Rev D
- Saraji Lateral Rev D
- Railways
- Highways
- Major Roads
- Major Watercourses
- Cadastre

Soil Thickness of Layer (A Horizon - Top Soil)

- 50 - 150
- 150 - 250
- 250 - 350
- 350 - 450
- 450 - 1,100

Data Sources:
StreetPro: Localities, Roads, Railways
DERM: Cadastre, Major Watercourses,
CSIRO: Soil Thickness of Layer A
Data Supplied by Arrow Energy:
ABP Mainline RevD,ABP Lateral RevD
Kilometre Points

N

0 25 50
Kilometres

Scale: 1:1,500,000 @ A3
Coordinate System: GCS GDA 1994

Document: I:\ENVR\Projects\EN02962\Spatial\ArcGIS\V3\Figure_3_3_Topsoil_Thickness_A3.mxd Date: 27/10/2011

NOT FOR CONSTRUCTION

ARROW BOWEN PIPELINE PRELIMINARY ROUTE (REV D)

Figure 3 - 4: Good Quality Agricultural Land within the project area

Legend

- Localities
- Kilometre Points
- AB Mainline Rev D
- Dysart Lateral Rev D
- Elphinstone Lateral Rev D
- Saraji Lateral Rev D
- Railways
- Highways
- Major Roads
- Major Watercourses
- Cadastre

Good Quality Agricultural Land

- A (Crop Land)
- B (Limited Crop Land)
- C1; C2; C3 (Pasture Land)
- D (Non-agricultural land)

Data Sources:
StreetPro: Localities, Roads, Railways
DERM: Cadastre, Major Watercourses, Good Quality Agricultural Land
Data Supplied by Arrow Energy:
ABP Mainline RevD,ABP Lateral RevD
Kilometre Points

N

arrow energy go further

0 25 50
Kilometres

Scale: 1:1,500,000 @ A3
Coordinate System: GCS GDA 1994

Document: I:\ENVR\Projects\EN02962\Spatial\ArcGIS\V3\Figure_3_4_Good_Quality_Agricultural_Land_within_the_project_area_A3.mxd Date: 27/10/2011

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Appendix B Sample Location Logs

Project: ABP **Job Number** EN02962	**Date:** 15 August 2011	**Location:** 15-1	**Coordinates:** 23°50'6" S - 151°3'53" E 56S 302904.6 E - 7362678.4 N

Natural Vegetation: Sparse vegetation long grass and eucalypt trees

Land Use: agricultural (grazing), railway track, main road

Topography: flat	**Erosion:** no visible erosion	**Drainage:** no visible nearby creeks and / or rivers
Remarks:	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-150	Silty clay, dry, low to medium plasticity	trace coarse gravel	10 YR	4/3		not	massive	clayey	Firm	medium drained, some rootlets	Sharp	A	na
150-250	Silty clay, dry, low plasticity	some coarse sands and fine gravels	5YR	4/4		not	massive	clayey	Stiff	poorly drained	Sharp	B1	na
250-300	Silty clay, dry, low plasticity	some coarse sands and fine gravels	5YR	5/8		not	massive	clayey	Stiff	poorly drained	Diffuse	B2	na

Project: ABP **Job Number** EN02962	**Date:** 15 August 2011	**Location:** 15	**Coordinates:** 23°47'32.09394" S - 150°57'58.17602" E 56S 292775.66 E - 7367289.97 N

Natural Vegetation: Long grass and eucalypt trees



Land Use: agricultural (grazing)

Topography: flat

Erosion: no visible erosion

Drainage: small dry creek / gully 100 m west

Remarks: gravels encountered at 750mm potentially road base from road reserve - low to no recovery - hand auger terminated at 800mm. Overburden potentially reworked local soils.

ASC Mapped: Sodosol

ASC Ground Truth: Sodosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-450	Silty clay, dry, low plasticity	Trace fine grained sands	10 YR	4/1		not	massive	clayey	Firm to Stiff	Poorly drained, trace rootlets	Sharp	A - disturbed	15 / 0.3-0.45
450-750	Silty clay, moist, high plasticity	Trace coarse sands	10 YR Gley 1	5/2 5/1		not	massive	clayey	Very Stiff	poorly drained	Sharp	B2 - disturbed	15 / 0.55-0.65
750-800	Gravel in clay matrix				 				Loose			AN	

Project: ABP **Job Number** EN02962	**Date:** 15 August 2011	**Location:** 14	**Coordinates:** 23°38'19" S - 150°41'47" E 56S 265033.5 E - 7383836.7 N

Natural Vegetation: Long grass and eucalypt and wattyl trees

Land Use: agricultural (grazing)

Topography: flat	**Erosion:** no visible erosion	**Drainage:** no visible creeks / gully in the vicinity of the site
Remarks:	**ASC Mapped: Hydrosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-50	Silty clay, dry , low plasticity	Some gravels	7.5 YR	3/3		not	massive	clayey	Stiff	medium drained, rootlets / roots throughout	Diffuse	A1	na
50-600	Silty clay, dry , low plasticity	none visible	2.5 Y	4/1		not	massive	clayey	Very Stiff	poorly drained	Diffuse	A2	14 / 0.3-0.4
600-1100	Silty clay, dry , low plasticity	Trace sub-rounded fine gravels and coarse sands	10YR	4/1		not	massive	clayey	Very Stiff	poorly drained	Diffuse	B1	14 / 0.6-0.7
1100-1300	Silty clay, dry , low plasticity	Trace coarse sands which are white carbonate deposits	10YR	4/1		not	massive	clayey	Very Stiff	poorly drained	Diffuse	B2	na

Project: ABP **Job Number** EN02962	**Date:** 15 August 2011	**Location:** 13-1 (alternate location to 13)	**Coordinates:** 23°29'32.95178" S - 150°29'17.45375" E 56S 243471.92 E - 7399717.93 N

Natural Vegetation: Long grass and Eucalypt trees.



Land Use: Agricultural (cropping)

Topography: gently undulating plain	**Erosion:** slight erosion along creek bed	**Drainage:** creek bed 100m west
Remarks: long grass and some gravels from gravel road on surface. Refusal at 800mm - hand auger terminated.	**ASC Mapped: Sodosol**	**ASC Ground Truth: Unable to Discern**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-450	Clayey silt, dry non plastic	no visible sands or gravels	10 YR 2.5 Y	3/3 2.5/1		not	massive	silty	friable	well drained	Sharp	A1 - disturbed	13-1 / 0.3-0.4
450-500	Sandy silt with gravels	50% fine to coarse sands and small gravels	10 YR	4/3		not	massive	silty	friable	well drained	Sharp	A2	na
500-650	Gravelly silt	trace sand, coarse red gravels	10 YR (yellow mottles)	4/4		pedal	weak	silty	friable	well drained	Sharp	B1	13-1 / 0.5-0.55
650-800	Sandy Clay, low plasticity	fine to coarse sands, trace fine gravels	2.5 Y	5/4		pedal	weak	clayey	firm	medium to poorly drained	Sharp	B2	13-1 / 0.7-0.8

Project: ABP **Job Number** EN02962	**Date:** 15 August 2011	**Location:** 13 - near substation along Burnett Highway	**Coordinates:** 23°32'13.52978" S - 150°29'20.93971" E 56S 243657.30 E - 7394778.32 N

Natural Vegetation: Very sparse vegetation, short grass, some eucalypt trees



Land Use: agricultural (cropping), substation

Topography: flat on location, gentle hill to the west, mountain to the south	**Erosion:** no visible erosion	**Drainage:** no visible creeks / gully in the vicinity of the site

Remarks: gravels encountered at 700mm potentially road base from road reserve - low to no recovery - hand auger terminated at 700mm. Overburden potentially reworked local soils. Moved to alternate location 13-1	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-250	Silty clay, dry , low plasticity	Trace fine grained quartz sands	10 YR	3/2		not	massive	clayey	Very Stiff	poorly drained, trace rootlets	Diffuse	A1 - disturbed	na
250-600	Silty clay, dry , low plasticity	Trace of fine charcoal (black) nodules	10 YR (with white carbonate mottles throughout)	4/3		not	massive	clayey	Very Stiff	poorly drained	Diffuse	A2 - disturbed	13 / 0.25-0.3
600-700	Silty vlay, slightly moist, high plasticity	Trace of fine charcoal (black) nodules	10YR (reddish when dry)	4/6		not	massive	clayey	Very Stiff	poorly drained	Sharp	B - disturbed	13 / 0.6-0.7
700	Gravels	coarse and angular										AN	

Project: ABP **Job Number** EN02962	**Date:** 16 August 2011	**Location:** 12-1	**Coordinates:** 23°15'47.5" S - 150°15'31.5" E 56S 219546.00 E - 7424691.55 N

Natural Vegetation: Sparse native tree cover and long grass



Land Use: Agricultural (grazing)

Topography: gently undulating hills	**Erosion:** no visible signs of erosion	**Drainage:** some small dry / not flowing creeks when accessing location
Remarks:	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-250	Sandy clay, dry, low plasticity	50% fine grained sands, trace gravels	7.5 YR	4/6		pedal	weak	clayey	Very dense	poorly drained	sharp	A	na
250-600	Silty clay, dry, low plasticity	none visible	2.5 Y (with small orange mottles and specs of white carbonate deposits)	3/1		not	massive	clayey	Stiff	poorly drained	sharp	B	12-1 / 0.4-0.5

Project: ABP **Job Number** EN02962	**Date:** 16 August 2011	**Location:** 12	**Coordinates:** 23°20'338" S - 150°18'8" E 56S 224170.14 E - 7415981.48 N

Natural Vegetation: Native Bushland (eucalypts and wattyls) and grassed areas



Land Use: Agricultural (grazing)

Topography: gently undulating plain

Erosion: some deep eosion near Deep Creek

Drainage: some small creeks when accessing location

Remarks: * 0-200mm profile likely to be disturbed surface soils

ASC Mapped: Sodosol

ASC Ground Truth: Sodosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-200 *	Clayey silt, dry non plastic	no visible sands or gravels	10 YR	5/3		not	massive	silty	friable	poorly drained (trace rootlets)	Sharp	A1	12 / 0.1-0.2
200-350	Clayey silt, dry non plastic	trace coarse sands	10 YR	7/1		not	massive	silty	friable	poorly drained	Sharp	A2	12 / 0.2-0.3
350-1100	Silty clay, dry low, low plasticity	from 600mm trace fine to medium gravels (basalt fragments)	10 YR (with small red iron and yellow mottles)	5/6		not	massive	clayey	very stiff	poorly drained	Sharp	B	12 / 0.3-0.4

Project: ABP **Job Number** EN02962	**Date:** 16 August 2011	**Location:** 11-1 (near 8 mile creek)	**Coordinates:** 23°9'37" S - 150°3'5" E 56S 198092.01 E - 7435679.62N

Natural Vegetation: Native bushland (euclypt trees and others)

Land Use: Agricultural (grazing - cattle)

Topography: gently undulating plains	**Erosion:** no visible erosion	**Drainage:** surrounding small creeks (dry or stagnant)

Remarks:

ASC Mapped: Chromosol

ASC Ground Truth: Unable to Discern

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-600	Silty clay, dry, low plasticity (slightly moist from 300 mm)	none visible	7.5 YR (trace small iron stones from 300mm)	2.5/2		not	massive	clayey	very stiff	poorly drained (root at 400mm)	none	A	na

Project: ABP **Job Number** EN02962	**Date:** 16 August 2011	**Location:** 11 (1km west of 2 mile ck)	**Coordinates:** 23°11'22" S - 150°71'12" E 56S 205174.96 E - 7432585.29 N

Natural Vegetation: Native bushland (euclypt trees)



Land Use: Agricultural (grazing - cows, llamas, sheep)

Topography: flat on location, undulating plains and hills around

Erosion: visible erosion along 2 mile creek

Drainage: 2 mile creek 1km east

Remarks:

ASC Mapped: Chromosol

ASC Ground Truth: Chromosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-250	Silty clay, dry, low plasticity	trace medium gravels (basalt fragments)	2.5 Y (with small orange mottles and specs of white carbonate deposits)	2.5/1		not	massive	clayey	very stiff	poorly drained	sharp	A	11 / 0.15-0.25
250-1000	Silty clay, dry, intermediate plasticity	none visible	Gley 1	2.5 / 10Y		not	massive	clayey	firm	poorly drained	sharp / diffuse	B1	11 / 0.3-0.4
1000-1300	Silty clay, dry, low plasticity	trace fine grained sands and fine to medium gravels	5 Y (with some white carbonate specs)	4/1		not	massive	clayey	firm to stiff	medium drained	sharp	B2	11 / 1.0-1.1

Project: ABP **Job Number** EN02962	**Date:** 16 August 2011	**Location:** 10 (north of Fitzroy River)	**Coordinates:** 23°10'44" S - 149°55'14" E 55S 798989.09 E - 7433676.57 N

Natural Vegetation: Sparse native bushland (eucalypt trees and grass)



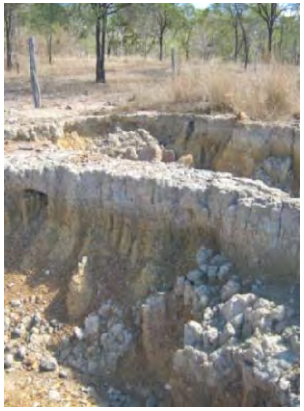
Land Use: Agricultural (grazing - cattle)

Topography: flat / gently undulating on location, sharp drop along the Fitzroy River banks	**Erosion:** some visible at location and along the Fitzroy River	**Drainage:** Fitzroy River 500 m east
Remarks:	**ASC Mapped: Chromosol**	**ASC Ground Truth: Chromosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-300	Silty clay, dry, intermediate plasticity	large gravel at 200 mm	10 YR	5/3		not	massive	clayey	stiff	medium drained	sharp	A	10 / 0.2-0.3
300-600	Sand with little clay	fine grained sands	10 YR	3/2		not	massive	sandy	dense	well drained	diffuse	B1	10 / 0.3-0.4
600-1100	Clayey sand	fine grained sands	10 YR	5/2		not	massive	sandy	dense	well drained	diffuse	B1	10 / 0.6-0.7
1100-1400	Sandy clay, moist, low plasticity	50 % fine grained sands	10 YR (with charcoal, orange and red iron mottles)	7/3		not	massive	clayey	firm	medium drained	diffuse	B1	na
1400-1500	Clay with some sand	30 % fine grained sands	2.5 Y (with orange mottles)	5/2		not	massive	clayey	firm	poorly drained	diffuse	B2	na

Project: ABP **Job Number** EN02962	**Date:** 17 August 2011	**Location:** 9-2	**Coordinates:** 22°52'34.34" S - 149°32'1.05" E 55S 759945.37 E - 7467948.84 N

Natural Vegetation: Native bushland



Land Use: Agricultural (grazing - cattle)

Topography: gently undulating plains

Erosion: erosion at sampling location (along marlborough - sarina rd)

Drainage: Apis Ck a few kms east

Remarks:

ASC Mapped: Rudosol

ASC Ground Truth: Rudosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-250	Silty clay, dry, low plasticity	trace fine angular gravels	10 YR	5/2		not	massive	clayey	very stiff	poorly drained	sharp	A	9-2 / 0.1-0.2
250-500	Clay with gravels, dry, low plasticity	50 % fine to coarse angular gravels	10 YR	5/8		not	massive	clayey	very stiff	poorly drained	sharp	B	9-2 / 0.3-0.4
500-1100	Weathered mudstone	none visible	2.5 Y (red and orange veins throughout)	6/3		pedal	fractured / sharp	rocky	hard to very hard	poorly drained	sharp	C	na

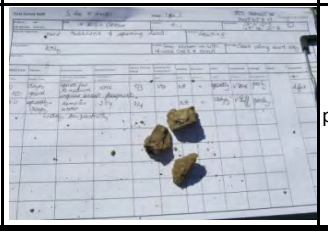
Project: ABP **Job Number** EN02962	**Date:** 17 August 2011	**Location:** 9-1	**Coordinates:** 23°3'8.9" S - 149°36'1.75" E 55S 766462.58 E - 7448302.02 N

Natural Vegetation: Native bushland (eucalypt trees and others)



Land Use: Agricultural (grazing - cattle)

Topography: hilly	**Erosion:** some visible erosion on hills and along the creek bed and roads	**Drainage:** dry creek leading to location
Remarks:	**ASC Mapped: Rudosol**	**ASC Ground Truth: Rudosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-150	Clayey gravels	fine to medium gravels, angular basalt fragments	10 YR	5/3		not	massive	gravelly	very dense	poorly drained	diffuse	A	na
150-350	Gravelly clay, dry, low plasticity	fine to medium gravels, angular basalt fragments	2.5 Y	7/4		not	massive	clayey	very stiff	poorly drained	diffuse	B1	na
350-450	Clayey gravels	fine to coarse sub-angular gravels (basalt / shale fragments)	2.5 Y	7/4		pedal	weak	gravelly	very dense	poorly drained	diffuse	B2	na

Project: ABP **Job Number** EN02962	**Date:** 17 August 2011	**Location:** 9	**Coordinates:** 22°53'4.4" S - 149°33'28" E 55S 762406.07 E - 7466981.79 N

Natural Vegetation: Native bushland (eucalypt trees and others)



Land Use: Agricultural (grazing - cattle)

Topography: flat	**Erosion:** no visible erosion	**Drainage:** small creeks leading to location
Remarks: hand auger terminated at 0.5 m - profile falling in and very dense - poor to no recovery with hand auger	**ASC Mapped: Rudosol**	**ASC Ground Truth: Rudosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-100	Clayey silt, dry, non plastic	little small gravels	5 Y	2.5/1		not	massive	silty	friable	poorly drained	sharp	A	9 / 0-0.1
100-400	Silty clay, dry, low plasticity	none visible	2.5 Y (with black mottles throughout)	5/2		not	massive	clayey	very stiff	poorly drained	diffuse	B1	9 / 0.2-0.3
400-500	Clayey gravels	fine to coarse sub-angular gravels	2.5 Y	7/4		pedal	weak	gravelly	very dense	poorly drained	diffuse	B1	9 / 0.4-0.5

Project: ABP **Job Number** EN02962	**Date:** 17 August 2011	**Location:** 8-1	**Coordinates:** 22°51'7.85" S - 149°20'38.65" E 55S 740531.78 E - 7470931.96 N

Natural Vegetation: Long grass



Land Use: Agricultural (grazing - cattle) and powerline

Topography: flat

Erosion: none visible

Drainage: small creek to the east and waterhole

Remarks:

ASC Mapped: Vertosol

ASC Ground Truth: Vertosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-550	Silty clay, dry, low plasticity	some fine to coarse sub-angular red gravels with trace coarse sand size black and white carbonate nodules	2.5 Y	5/2		not	massive	clayey	stiff to very stiff	poorly drained (trace rootlets)	diffuse	A1	8-1 / 0.45-0.55
550-600	Silty clay, dry, low plasticity	trace black nodules (rounded, medium grained)	2.5 Y	6/1		not	massive	clayey	very stiff	poorly drained	diffuse	A2	na

Project: ABP **Job Number** EN02962	**Date:** 17 August 2011	**Location:** 8	**Coordinates:** 22°51'10.15" S - 149°18'24.7" E 55S 736711.5 E - 7470921.32 N

Natural Vegetation: Native bushland (eucalypt trees and others)



Land Use: Agricultural (grazing - cattle)

Topography: flat

Erosion: none visible on location - erosion along the creek beds

Drainage: series of small dried up creeks on the way once the Isaac River is crossed

Remarks:

ASC Mapped: Vertosol

ASC Ground Truth: Vertosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-450	Silty clay, dry, low plasticity	none visible	10 YR	4/2		not	massive	clayey	stiff	poorly drained (trace rootlets)	sharp	A	8 / 0.35-0.45
450-800	Silty clay, dry, low plasticity - 50% of soil is former root system (charcoal) in clay matrix	none visible	Gley	2.5 / N		not	massive	clayey	very stiff	poorly drained	diffuse	B1	8 / 0.5-0.6
800-1400	Silty clay, dry, low plasticity	none visible	10 YR (with trace charcoal)	5/2		not	massive	clayey	very stiff	poorly drained	diffuse	B2	8 / 0.85-0.95

Project: ABP **Job Number** EN02962	**Date:** 18 August 2011	**Location:** 7-1	**Coordinates:** 22°42'59" S - 149°11'16" E 55S 724715.24 E - 7486212.40 N

Natural Vegetation: Native bushland and long grass




Land Use: Agricultural (grazing - cattle)

Topography: gently undulating plains	**Erosion:** some erosion along the creek and road	**Drainage:** water hole and creek few 100ms to the east
Remarks:	**ASC Mapped: Vertosol**	**ASC Ground Truth: Vertosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-300	Sandy clay, moist, low plasticity	50% fine grained sands	10 YR	5/3		not	massive	clayey	firm	medium drained	sharp	A	na
300-600	Sandy clay, moist, low plasticity	50% fine grained sands, some small rounded black nodules	10 YR	7/3	 	not	massive	clayey	firm	medium drained	sharp	B	na

Project: ABP **Job Number** EN02962	**Date:** 18 August 2011	**Location:** 7	**Coordinates:** 22°44'12" S - 149°9'37" E 55S 721810.49 E - 7483951.16 N

Natural Vegetation: Native bushland and scrubs



Land Use: Agricultural (grazing - cattle)
Potential pyrite flakes noted in borehole. Possibly from transported alluvial material

Topography: generally flat with undulating plains in the background

Erosion: none visible on location

Drainage: no visible creeks or gullies on location or in the vicinity

Remarks: refusal at 1.2 m depth - weathered profile

ASC Mapped: Kandosol

ASC Ground Truth: Unable to Discern

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-450	Silty clay, dry, low plasticity	trace fine to medium grained sands	10 YR (with trace iron mottles and small black nodules)	4/2		not	massive	clayey	very stiff	poorly drained (trace rootlets)	diffuse	A1	7 / 0.3-0.4
450-650	Silty clay, dry, low plasticity	some fine to medium grained sands	2.5 Y (with white carbonate staining throughout)	5/2		not	massive	clayey	very stiff	poorly drained	diffuse	A2	7 / 0.55-0.65
650-800	Sandy clay, dry low plasticity	ca. 40% sand, medium grained, fine to medium size gravels, sub rounded	2.5 Y (with white carbonate red iron specs)	5/2		not	massive	clayey	stiff	poorly drained	sharp	B1	7 / 0.7-0.8
800-1100	Sand with trace clay	sand is fine to medium grained, some fine gravels	2.5 Y	4/4		not	massive	sandy	dense	well drained	diffuse	B2	7 / 0.8-0.9
1100-1200	Clayey sand	sand is fine to medium grained, no gravels	2.5 Y	4/4		not	massive	sandy	dense	medium drained	diffuse	B2	na

Project: ABP **Job Number** EN02962	**Date:** 18 August 2011	**Location:** 6-2	**Coordinates:** 22°26'30.6" S - 148°41'37" E 55S 674288.166 E - 7517282.05 N

Natural Vegetation: Native medium dense bushland



Land Use: Agricultural: grazing (cattle and horses)

Topography: generally flat

Erosion: limited erosion on location - eroded along creek bed

Drainage: creek few 100m east of site

Remarks: alternate location to 6 where soil map indicated potential similar soils

ASC Mapped: Sodosol

ASC Ground Truth: Sodosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-1200	Silty clay, dry to moist, high plasticity	none observed	5 Y	4/1		not	massive	clayey	stiff to very stiff	medium drained	sharp	B	6-2 / 0.8-0.9

Project: ABP **Job Number** EN02962	**Date:** 18 August 2011	**Location:** 6-1	**Coordinates:** 22°43'35" S - 149°6'42.53" E 55S 716890.52 E - 7485220.70 N

Natural Vegetation: Sparse tree cover and long grass



Land Use: Agricultural: grazing

Topography: generally flat	**Erosion:** limited erosion	**Drainage:** small dry creek few 100m east of site
Remarks: area excacated near the sampling location with three distinctive horizons	**ASC Mapped: Kandosol**	**ASC Ground Truth: Kandosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-190	Gravelly sand, dry	fine to corase angular gravels	10 YR	3/4		not	massive	sandy	dense	well drained	sharp	A	na
190-600	Silty clay, moist, high plasticity	none visible	5 Y	2.5/2		not	massive	clayey	firm	poorly drained	sharp	B	6-1 / 0.4-0.5
Geological profile in excavated area													
0-200	Gravelly sand, dry	fine to corase	10 YR	3/4		not	massive	sandy	dense	well drained	sharp	A	na
200-900	Silty clay, moist, high plasticity	none visible	5 Y	2.5/2		not	massive	clayey	firm	poorly drained	sharp	B	na
900-1500	Weathered Basalt and weathered mudstone	rounded Basalt boulders				pedal	weak - fractured	rocky	hard	poorly drained	sharp	C	na

Project: ABP **Job Number** EN02962	**Date:** 18 August 2011	**Location:** 6	**Coordinates:** 22°35'25.2" S - 148°53'37.9" E 55S 694692.05 E - 7500593.11 N

Natural Vegetation: Sparse tree cover (eucalypts and others) and long grass



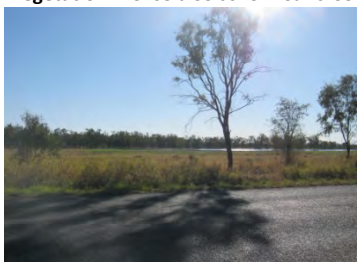
Land Use: Agricultural, grazing and limited cropping (corn, peas)

Topography: generally flat	**Erosion:** limited erosion, more visible erosion along dry creeks and gullies	**Drainage:** some small dry creeks along the way
Remarks:	**ASC Mapped: Vertosol**	**ASC Ground Truth: Unable to Discern**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-200	Sandy clay, dry low plasticity	trace medium to coarse gravels, sand is medium grained and sub-rounded	10 YR	3/2		not	massive	clayey	very stiff	poorly drained	diffuse	A1	na
200-450	Sandy clay, dry low plasticity	no gravels	10 YR	5/2		not	massive	clayey	very stiff	poorly drained	diffuse	A2	6 / 0.3-0.4
450	Refusal on weathered basalt fragments - hand auger abandonned and location moved to 6-2 where potential similar profile												

Project: ABP **Job Number** EN02962	**Date:** 19 August 2011	**Location:** 5-2	**Coordinates:** 22°32'1.29" S - 148°39'2.09" E 55S 669746.30 E - 7507161.57 N

Natural Vegetation: Dense tree cover near creek



Land Use: Agricultural: cropping (corn)

Topography: generally flat	**Erosion:** none visible on location	**Drainage:** water hole, creek few 100m west
Remarks:	**ASC Mapped: Vertosols**	**ASC Ground Truth: Unable to Discern**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-450	Silty clay, dry, low plasticity (as per location 5)	trace fine grained sands	10YR (400mm: red mottles throughout)	4/2		not	massive	clayey	very stiff	poorly drained	diffuse	A	na
450-600	As above, moist, high plastcity	trace fine grained sands	10YR (400mm: red mottles throughout)	4/2		not	massive	clayey	very stiff	poorly drained	diffuse	A	na

Project: ABP **Job Number** EN02962	**Date:** 19 August 2011	**Location:** 5-1	**Coordinates:** 22°31'45.8" S - 148°36'36.1" E 55S 665579.46 E - 7507682.55 N

Natural Vegetation: Tree cover in background



Land Use: Agricultural: cropping (corn and cotton)

Topography: generally flat	**Erosion:** none visible on location	**Drainage:** none visible near location
Remarks:	**ASC Mapped: Vertosol**	**ASC Ground Truth: Unable to Discern**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-100	silty clay, moist high plasticity	none visible	5 Y	4/1		not	massive	clayey	firm	well drained	diffuse	A - disturbed	na
100-150	Sandy clay, dry low plasticity	ca. 40% fine grained sands	7.5 YR	4/1		not	massive	clayey	medium dense	well drained	diffuse	A - disturbed	na
250-600	silty clay, moist high plasticity (as per location 5 and 5-2)	trace very fine grained sands	5 Y	4/1		not	massive	clayey	soft	poorly drained	diffuse	A	na

Project: ABP **Job Number** EN02962	**Date:** 19 August 2011	**Location:** 5	**Coordinates:** 22°32'13.3" S - 148°39'36.6" E 55S 670726.86 E - 7506780.12 N

Natural Vegetation: Sparse tree cover



Land Use: Agricultural: cropping (corn and peas)

Topography: generally flat

Erosion: none visible on location

Drainage: none visible near location

Remarks: layer of red gravelly sand had been scraped and was sitting on the side of the location - gravels were river pebbles, sand wa fine grained, fine to coarse, rounded

ASC Mapped: Vertosol

ASC Ground Truth: Vertosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-900	Silty clay, dry, low plasticity	trace fine grained sands	10YR (400mm: red mottles throughout)	4/2		not	massive	clayey	very stiff	poorly drained	sharp	A	5 / 0.4-0.5
900-1200	Sandy clay, dry low plasticity	ca. 40 to 50% fine grained sands	7.5 YR	6/3		not	massive	clayey	stiff to very stiff	poorly drained	sharp	B	5 / 0.95-1.05

Project: ABP **Job Number** EN02962	**Date:** 19 August 2011	**Location:** 4-1	**Coordinates:** 22°19'44" S - 148°36'56" E 55S 666394.65 E - 7529872.88 N

Natural Vegetation: Sparse tree cover to the west, denser to the east



Land Use: Agricultural: grazing and some quarries

Topography: generally flat	**Erosion:** none visible on location	**Drainage:** none visible near location
Remarks:	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-300	Clayey sand, dry	sand is fine grained	2.5 YR	4/6		not	massive	sandy	very dense	well drained	sharp	A	4-1 / 0.1-0.2
300-650	Sand with trace clay	sand is fine grained	7.5 YR	4/3		not	massive	sandy	very dense	well drained	sharp	B	4-1 / 0.4-0.5

Project: ABP **Job Number** EN02962	**Date:** 19 August 2011	**Location:** 4	**Coordinates:** 22°13'34.5" S - 148°28'58" E 55S 652832.84 E - 7541382.50 N

Natural Vegetation: Sparse tree cover



Land Use: Agricultural: grazing

Topography: generally flat | **Erosion:** some erosion along surface drainage | **Drainage:** shallow drain along the road

Remarks: | **ASC Mapped: Sodosol** | **ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-150	Clayey sand, dry	sand is fine grained, trace medium sub-angular gravels	5 YR	5/6		not	massive	sandy	very dense	poorly drained	sharp	A	4 / 0-0.1
150-510	Clayey sand, dry	sand is fine grained	7.5 YR	5/3		not	massive	sandy	very dense	poorly drained	diffuse	B1	4 / 0.3-0.4
550-1150	Sandy clay, dry low plasticity	sand is fine grained, trace medium to coarse sub-rounded gravels	10 YR	6/4		not	massive	sandy / clayey	very dense	poorly drained	diffuse	B2	4 / 0.6-0.65
1150-1300	Silty clay, dry low platicity	ca. 20% sand	10 YR (dark red mottles and small black rounded iron stone)	6/6		not	massive	clayey	very stiff	poorly drained	diffuse	B2	na

Project: ABP **Job Number** EN02962	**Date:** 21 August 2011	**Location:** 3-2	**Coordinates:** 21°30'56.6" S - 148°14'16.4" E 55S 628211.83 E - 7620267.05 N

Natural Vegetation: Native scrubland - tip of Lake Elphinstone



Land Use: grazing and recreational (Lake) and bird sancturay

Topography: flat on location and hilly surroundings	**Erosion:** limited erosion	**Drainage:** creeks and lake system in the vicinity
Remarks:	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-250	sand with trace clay	fine grained	10 YR	4/4		not	massive	sandy	loose to medium dense	well drained	sharp	A	na
250-450	Silty clay, dry low plasticity	trace fine grained sands	10 YR	5/1 - 4/1		not	massive	clayey	firm to stiff	poorly drained	sharp	B1	na
450-600	Silty clay, moist, high plasticity	none observed	2.5 Y	5/2	 	not	massive	clayey	firm	poorly drained	sharp	B2	3-2 / 0.5-0.6

Project: ABP **Job Number** EN02962	**Date:** 20 August 2011	**Location:** 3-1	**Coordinates:** 22°0'16.3" S - 148°19'39.8" E 55S 637052.78 E - 7566076.65 N

Natural Vegetation: Sparse tree cover and scrubland



Land Use: Agricultural: grazing and mining and CSG exploration

Topography: flat	**Erosion:** visible erosion along dry creek beds	**Drainage:** some small dry creeks and gullys in the vicinity
Remarks:	**ASC Mapped: Vertosol**	**ASC Ground Truth: Vertosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-200	Clayey silty sand, dry	sand is fine grained	7.5 YR	5/4		not	massive	sandy	loose to dense	well drained (trace rootlets)	diffuse	A1	na
200-600	Silty sand	sand is fine grained, some rounded snall to medium river pebbles at 600mm	7.5 YR	6/6		not	massive	sandy	loose to dense	well drained	diffuse	A2	na

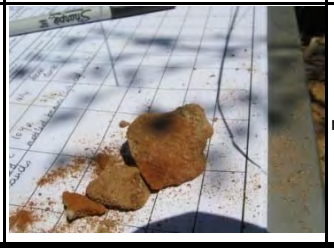
Project: ABP **Job Number** EN02962	**Date:** 20 August 2011	**Location:** 3	**Coordinates:** 21°57'0.1" S - 148°20'13.3" E 55S 638067.09 E - 7572102.43 N

Natural Vegetation: Native bushland and scrubs

Land Use: Agricultural: grazing and mining / railway corridor




Topography: gently undulating plains	**Erosion:** visible erosion on side of the road	**Drainage:** series of small dry creek beds
Remarks:	**ASC Mapped: Vertosol**	**ASC Ground Truth: Vertosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-200	Silty sand, dry	fine grained	10 YR	4/4		not	massive	sandy	loose to dense	well drained (rootlets throughout)	diffuse	A1	na
200-900	Silty sand, dry	fine grained sands and trace medium to coarse rounded sands	10 YR	7/4		not	massive	sandy	loose to dense	poorly drained	diffuse	A2	3 / 0.3-0.4
900-1200	Sandy clay, dry low plasticity	ca. 30 % very fine grained sands	2.5 YR (made up of red and white mottles throughout, red is clayey silt and red is silty sand)	6/8		not	massive	sandy	dense to very dense	poorly drained	sharp	B	3 / 1.0-1.2

Project: ABP **Job Number** EN02962	**Date:** 21 August 2011	**Location:** 2-1	**Coordinates:** 21°37'53.7" S - 148°4'5.1" E 55S 610536.75 E - 7607572.1 N

Natural Vegetation: Sparse native bush and grass field



Land Use: grazing coal mining

Topography: flat	**Erosion:** visible erosion along creeks and roads	**Drainage:** dry creek 300 m west
Remarks:	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-300	Sand loam	ca. 30 % fine grained sands	10 YR	3/3		not	massive	clayey / spongy	very soft when wet, otherwise very stiff	well drained (rootlets throughout)	sharp	A	na
300-800	Clayey sand	ca. 50 to 60 % fine grained sands with trace coarse sands	7.5 YR	4/4		not	massive	sandy	dense	poorly drained	sharp	B	na

Project: ABP **Job Number** EN02962	**Date:** 20 August 2011	**Location:** 2	**Coordinates:** 22°0'42.3" S - 148°9'2.7" E 55S 618778.26 E - 7565425.89 N

Natural Vegetation: Native bushland and scrubland



Land Use: grazing and Burton coal mine

Topography: gently undulating plains | **Erosion:** limited erosion | **Drainage:** some dry gully

Remarks: | **ASC Mapped: Vertosol** | **ASC Ground Truth: Vertosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-250	Sand	fine to medium grained	7.5 YR	4/3	 	not	massive	sandy	loose to dense	well drained (rootlets throughout)	sharp	A1	2 / 0.1-0.2
250-600	Sand	fine to medium grained - trace coarse sands	7.5 YR	6/2		not	massive	sandy	loose to dense	well drained	sharp	A2	2 / 0.4-0.5
600-1500	silty clay with sand, dry, intermediate plasticity	ca. 20% sand, content decreasing with depth, sub-rounded	10 YR (mottled red, light grey and orange)	6/4	 	not	massive	clayey	soft	poorly drained	sharp	B	2 / 0.65-0.7

Project: ABP **Job Number** EN02962	**Date:** 21 August 2011	**Location:** 1-2	**Coordinates:** 21°31'27.8" S - 148°2'4.26" E 55S 607140.25 E - 7619459.39 N

Natural Vegetation: Native bush with dense tree cover



Land Use: grazing - exploratory drilling for wards well

Topography: flat

Erosion: no visible erosion

Drainage: no visible drainage

Remarks:

ASC Mapped: Vertosol

ASC Ground Truth: Vertosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-200	Silty sand	fine grained, trace coarse rounded sands	5 YR	3/2		not	massive	sandy	loose to medium dense	well drained	diffuse	A1	na
200-400	Silty sand	fine grained	5 YR	4/2		not	massive	sandy	medium dense	well drained	diffuse	A2	na
400-600	Silty clay, dry, low plasticity	some fine grained sands throughout	10 YR	5/4	 	not	massive	clayey	firm	poorly drained	sharp	B	na

Project: ABP **Job Number** EN02962	**Date:** 21 August 2011	**Location:** 1-1	**Coordinates:** 21°31'3.9" S - 147°58'38.4" E 55S 601222.09 E - 7620232.23 N

Natural Vegetation: Native bush (sparse) and grass field



Land Use: grazing - exploratory drilling for wards well

Topography: flat	**Erosion:** visible erosion along creeks	**Drainage:** small dry creek in the vicinity
Remarks:	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-400	Silty clay, dry, low plasticity	none visible	10 YR	4/1		not	massive	clayey	firm to stiff	poorly drained	sharp	A	na
400-500	Gravelly sand with trace clay and silt	fine to coarse gravels, sand is fine grained (potentially former creek bed deposits)	10 YR	5/3		pedal	weak	gravelly / sandy	very dense	well drained	sharp	B	na

Project: ABP **Job Number** EN02962	**Date:** 21 August 2011	**Location:** 1	**Coordinates:** 21°32'29.7" S - 148°5'59" E 55S 613894.10 E - 7617510.49 N

Natural Vegetation: Native bush and grass field



Land Use: grazing - exploratory drilling for wards well

Topography: flat with mount Burton to the east

Erosion: visible erosion along creeks - some minor erosion along road

Drainage: small flowing creek 50 m to the east

Remarks:

ASC Mapped: Sodosol

ASC Ground Truth: Sodosol

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-1000	Silty clay, dry, low to intermediate plasticity	trace fine grained sands	5Y (with trace white carbontae mottles throughout)	2.5 / 2		not	massive	clayey	firm to stiff	medium drained (some rootlets)	diffuse	B1	1 / 0.4-0.5
1000-1400	Silty clay, dry, low plasticity	some mediun to coarse grained sands and trace fine gravels, sub-rounded	2.5 Y	4/1		not	massive	clayey	stiff	poorly drained	diffuse	B2	1 / 1.1-1.2

Project: ABP **Job Number** EN02962	**Date:** 22 August 2011	**Location:** 0-2	**Coordinates:** 21°18'37.7" S - 148°5'52" E 55S 613857.67 E - 7643093.59 N

Natural Vegetation: Sparse bushland with trees and shrubs



Land Use: cattle grazing

Topography: flat and gently undulating plains	**Erosion:** visible erosion along the road	**Drainage:** series of small dry or stagnant creeks leading to location
Remarks:	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-550	Silty clay, dry, intermediate plasticity	trace fine gravels from 300mm, black, rounded	10 YR	4/3	 	not	massive	clayey	firm to stiff	poorly drained	sharp	A	0-2 / 0.2-0.3
550-1100	Silty clay, dry, low plasticity	trace fine grained sand from 1000mm	7.5 YR	5/4 - 5/6		not	massive	clayey	stiff	poorly drained	sharp	B	0-2 / 0.6-0.65

Project: ABP **Job Number** EN02962	**Date:** 22 August 2011	**Location:** 0-1	**Coordinates:** 21°16'27" S - 147°53'30" E 55S 592513.10 E - 7647235.08 N

Natural Vegetation: Native bush with medium dense tree cover



Land Use: cattle grazing - Newlands mine 5 km west

Topography: flat	**Erosion:** visible erosion along dry creek beds	**Drainage:** series of small dry creeks leading to location
Remarks:	**ASC Mapped: Vertosol**	**ASC Ground Truth: Unable to Discern**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-600	Silty clay, dry, intermediate plasticity	trace fine to coarse grained sands, rounded	5 YR	5/8	 	not	massive	clayey	firm to stiff	poorly drained (trace rootlets)	sharp	A	na

Project: ABP **Job Number** EN02962	**Date:** 22 August 2011	**Location:** 0	**Coordinates:** 21°16'20.4" S - 148°4'43" E 55S 611906.98 E - 7647328.60 N

Natural Vegetation: Native bush with medium dense tree cover



Land Use: cattle grazing


Topography: gently undulating plains	**Erosion:** visible erosion along creek beds and road	**Drainage:** series of small creeks either dry or with stagnant water
Remarks:	**ASC Mapped: Sodosol**	**ASC Ground Truth: Sodosol**

Depth (mm)	Texture	Coarse Fraction	Munsell Colour	Value / Chroma Rating	Photograph	Pedality	Structure	Fabric	Consistence	Drainage	Boundaries	Horizons	Sample
0-300	Silty sand, dry	fine grained	7.5 YR	4/4		not	massive	sandy	loose to medium dense	well drained	sharp	A	0 / 0.2-0.3
300-600	clayey silt, dry, non plastic	trace very fine grained sands	10 YR	4/3		not	massive	silty	friable	poorly drained	sharp	B1	0 / 0.4-0.45
600-850	Silty clay, dry, intermediate plasticity	some fine grained sands throughout	10 YR	4/2		not	massive	clayey	soft to firm	poorly drained	diffuse	B2	0 / 0.7-0.8
850-1400	sandy clay, dry, low plsaticity	ca. 40 % fine grained sands	10 YR	5/4		not	massive	clayey	medium dense / soft	medium to well drained	diffuse	B2	na

Appendix C Soil Laboratory Results

Analyte	Units	Soil Sufficiency Criteria	LOR	0	0	0-2	0-2	1	1	2	2	3	3
				0.2-0.3	0.7-0.8	0.2-0.3	0.6-0.65	0.4-0.5	1.1-1.2	0.1-0.2	0.65-0.7	0.3-0.4	1.0-1.1
ASC				Sodosol	Vertosol	Sodosol	Sodosol	Sodosol	Sodosol	Vertosol	Vertosol	Vertosol	Vertosol
Moisture Content (dried @ 103°C)	%		1	8.6	14.5	10.5	19.6		19.7	6.4	22.7		8.1
pH Value	pH Unit		0.1	7.5	9	9	9	9.4	9.4	7.4	7	5.2	5.2
Electrical Conductivity @ 25°C	µS/cm		1	38	503	167	397	256	837	19	13	207	257
Electrical Conductivity @ 25°C	dS/m			0.038	0.503	0.167	0.397	0.256	0.837	0.019	0.013	0.207	0.257
Soil Salinity Rating				Medium				Medium		Very Low		Medium	
Infered Plant Response				Moderately tolerant crops				Moderately tolerant crops		none		Moderately tolerant crops	
Exchangeable Cations													
Exchangeable Calcium	meq/100g		0.1	8.8				31.8		0.7		1.2	
Exchangeable Calcium/CEC		65-80%		64%				40%		54%		11%	
Exchangeable Magnesium	meq/100g		0.1	4.5				41.7		0.2		6.2	
Exchangeable Magnesium/CEC		10-15%		33%				52%		15%		56%	
Exchangeable Potassium	meq/100g		0.1	0.4				0.2		<0.1		0.2	
Exchangeable Potassium/CEC		1-5%		3%				0%		-		2%	
Exchangeable Sodium	meq/100g		0.1	<0.1				6.3		0.3		3.3	
Exchangeable Sodium/CEC		0-1%		-				8%		23%		30%	
Cation Exchange Capacity	meq/100g		0.1	13.8				80		1.3		11	
ESP				-				8%		23%		30%	
Alkalinity													
Total Alkalinity as CaCO3	mg/kg		1	353				1300		52		104	
Bicarbonate Alkalinity as CaCO3	mg/kg		1	353				979		52		104	
Carbonate Alkalinity as CaCO3	mg/kg		1	<1				314		<1		<1	
Inorganics													
Sulfate as SO4 2-	mg/kg	8mg/kg	10	<10				<10		<10		120	
Sulfur - Total as S (LECO)	%	0.2%	0.01										
Chloride	mg/kg	600mg/kg	10	10	720	<10	530	10	900	20	40	330	230
Soluble Major Cations													
Calcium	mg/kg		10	10				<10		<10		<10	
Magnesium	mg/kg		10	<10				<10		<10		<10	
Sodium	mg/kg		10	<10				350		20		180	
Potassium	mg/kg		10	<10				<10		<10		<10	
Ca:Mg ratio				-				-		-		-	
Nutrients													
Nitrite + Nitrate as N (Sol.)	mg/kg		0.1	1.1				0.8		0.1		<1.0	
Total Kjeldahl Nitrogen as N	mg/kg		20	460				750		170		990	
Total Nitrogen as N	mg/kg	1500mg/kg	20	460				750		170		990	
Total Phosphorus as P	mg/kg	200mg/kg	2	122				344		55		65	

Analyte	Units	Soil Sufficiency Criteria	LOR	3	4_1	4_1	4	4	5	5	6_1	6_2	7	7
				0.5-0.6	0.1-0.2	0.4-0.5	0-0.1	0.6-0.65	0.4-0.5	0.95-1.05	0.4-0.5	0.8-0.9	0.3-0.4	0.7-0.8
ASC				Vertosol	Sodosol	Sodosol	Sodosol	Sodosol	Vertosol	Vertosol	Kandosol	Sodosol	Kandosol	Kandosol
Moisture Content (dried @ 103°C)	%		1	21.5	5.6	14	8	13.3		13.4	26.9	22.4	21.2	11
pH Value	pH Unit		0.1	8.8	6.8	6.7	6.9	7.7	8.5	8.5	8.5	8.3	8.4	9.2
Electrical Conductivity @ 25°C	µS/cm		1	273	6	8	76	49	784	660	102	1110	142	379
Electrical Conductivity @ 25°C	dS/m			0.273	0.006	0.008	0.076	0.049	0.784	0.66	0.102	1.11	0.142	0.379
Soil Salinity Rating							Low		Very High			High	Low	
Infered Plant Response							Moderately sensitive crops		Very tolerant crops			Tolerant crops	Moderately sensitive crops	
Exchangeable Cations														
Exchangeable Calcium	meq/100g		0.1				1		26.2			38.6	21.5	
Exchangeable Calcium/CEC		65-80%					33%		54%			51%	61%	
Exchangeable Magnesium	meq/100g		0.1				0.8		13.6			26	11.1	
Exchangeable Magnesium/CEC		10-15%					27%		28%			35%	31%	
Exchangeable Potassium	meq/100g		0.1				1.1		0.3			0.7	0.2	
Exchangeable Potassium/CEC		1-5%					37%		1%			1%	1%	
Exchangeable Sodium	meq/100g		0.1				<0.1		8.1			9.6	2.7	
Exchangeable Sodium/CEC		0-1%					-		17%			13%	8%	
Cation Exchange Capacity	meq/100g		0.1				3		48.2			75	35.5	
ESP							-		17%			13%	8%	
Alkalinity														
Total Alkalinity as CaCO3	mg/kg		1				39		548			379	588	
Bicarbonate Alkalinity as CaCO3	mg/kg		1				39		548			379	588	
Carbonate Alkalinity as CaCO3	mg/kg		1				<1		<1			<1	<1	
Inorganics														
Sulfate as SO4 2-	mg/kg	8mg/kg	10				20		60			530	<10	
Sulfur - Total as S (LECO)	%	0.2%	0.01											
Chloride	mg/kg	600mg/kg	10	1700	<10	<10	200	90	1370	910	40	1840	290	400
Soluble Major Cations														
Calcium	mg/kg		10				<10		60			120	<10	
Magnesium	mg/kg		10				<10		30			90	<10	
Sodium	mg/kg		10				<10		880			1160	120	
Potassium	mg/kg		10				80		<10			<10	<10	
Ca:Mg ratio							-		2.00			1.33	-	
Nutrients														
Nitrite + Nitrate as N (Sol.)	mg/kg		0.1				4.6		0.7			0.7	<1.0	
Total Kjeldahl Nitrogen as N	mg/kg		20				600		380			1940	1110	
Total Nitrogen as N	mg/kg	1500mg/kg	20				600		380			1940	1110	
Total Phosphorus as P	mg/kg	200mg/kg	2				191		135			632	200	

Analyte	Units	Soil Sufficiency Criteria	LOR	7_1	8	8	8_1	9_2	9_2	10	10	11	11
				0.4-0.5	0.35-0.45	0.85-0.95	0.45-0.55	0.1-0.2	0.3-0.4	0.2-0.2	0.6-0.7	0.15-0.25	0.3-0.4
ASC				Vertosol	Vertosol	Vertosol	Vertosol	Rudosol	Rudosol	Chromosol	Chromosol	Chromosol	Chromosol
Moisture Content (dried @ 103°C)	%		1	12.9	19.8	22	17.2	1.1	1.3	15.6	13.8	17.1	16.6
pH Value	pH Unit		0.1	7.1	7.8	8.2	8.8	5.2	6.8	7.7	8	7.8	7.1
Electrical Conductivity @ 25°C	µS/cm		1	9	44	348	177	37	245	82	25	29	97
Electrical Conductivity @ 25°C	dS/m			0.009	0.044	0.348	0.177	0.037	0.245	0.082	0.025	0.029	0.097
Soil Salinity Rating					Very low			Medium		Very low		Medium	
Infered Plant Response					none			Moderaely tolerant crops		none		Moderaely tolerant crops	
Exchangeable Cations													
Exchangeable Calcium	meq/100g		0.1		23.5			0.7		27.4		14	
Exchangeable Calcium/CEC		65-80%			61%			17%		89%		57%	
Exchangeable Magnesium	meq/100g		0.1		13			3		2.9		8.9	
Exchangeable Magnesium/CEC		10-15%			34%			73%		9%		36%	
Exchangeable Potassium	meq/100g		0.1		0.6			0.1		0.3		0.3	
Exchangeable Potassium/CEC		1-5%			2%			2%		1%		1%	
Exchangeable Sodium	meq/100g		0.1		1.6			0.2		0.1		1.2	
Exchangeable Sodium/CEC		0-1%			4%			5%		0%		5%	
Cation Exchange Capacity	meq/100g		0.1		38.8			4.1		30.7		24.4	
ESP					4%			5%		0%		5%	
Alkalinity													
Total Alkalinity as CaCO3	mg/kg		1		287			13		274		196	
Bicarbonate Alkalinity as CaCO3	mg/kg		1		287			13		274		196	
Carbonate Alkalinity as CaCO3	mg/kg		1		<1			<1		<1		<1	
Inorganics													
Sulfate as SO4 2-	mg/kg	8mg/kg	10		<10			<10		<10		<10	
Sulfur - Total as S (LECO)	%	0.2%	0.01										
Chloride	mg/kg	600mg/kg	10	10	220	330	740	40	260	<10	<10	220	40
Soluble Major Cations													
Calcium	mg/kg		10		<10			<10		60		<10	
Magnesium	mg/kg		10		<10			<10		<10		<10	
Sodium	mg/kg		10		30			20		<10		20	
Potassium	mg/kg		10		<10			<10		<10		<10	
Ca:Mg ratio					-			-		-		-	
Nutrients													
Nitrite + Nitrate as N (Sol.)	mg/kg		0.1		<1.0			5.9		3.6		<0.5	
Total Kjeldahl Nitrogen as N	mg/kg		20		1140			610		670		630	
Total Nitrogen as N	mg/kg	1500mg/kg	20		1140			620		670		630	
Total Phosphorus as P	mg/kg	200mg/kg	2		492			181		281		285	

Analyte	Units	Soil Sufficiency Criteria	LOR	11_1	12	12	12_1	13_1	13_1	14	14	15	15
				1.0-1.1	0.2-0.3	0.3-0.4	0.4-0.5	0.3-0.4	0.7-0.8	0.3-0.4	0.6-0.7	0.3-0.45	0.55-0.66
ASC				Chromosol	Sodosol	Sodosol	Sodosol	Sodosol	Sodosol	Sodosol	Hydrosol	Sodosol	Sodosol
Moisture Content (dried @ 103°C)	%		1	19.2	11.5	22.6	15.8	21.7	13				21.9
pH Value	pH Unit		0.1	7.8	7.6	8.3	9.1	7.4	8.3	7.3	7.8	5.9	6.8
Electrical Conductivity @ 25°C	µS/cm		1	495	22	240	427	15	47	1300	1680	509	800
Electrical Conductivity @ 25°C	dS/m			0.495	0.022	0.24	0.427	0.015	0.047	1.3	1.68	0.509	0.8
Soil Salinity Rating					Very low			Very low		Extreme		High	Very high
Infered Plant Response					none			none		Generally too saline		Tolerant crops	Very tolerant cr
Exchangeable Cations													
Exchangeable Calcium	meq/100g		0.1		3.2			13.1		22.4		5.4	5.5
Exchangeable Calcium/CEC		65-80%			52%			59%		44%		17%	14%
Exchangeable Magnesium	meq/100g		0.1		2.2			8.7		17.4		18.2	20.9
Exchangeable Magnesium/CEC		10-15%			35%			39%		34%		58%	52%
Exchangeable Potassium	meq/100g		0.1		<0.1			<0.1		0.5		0.2	0.2
Exchangeable Potassium/CEC		1-5%			-			-		1%		1%	0%
Exchangeable Sodium	meq/100g		0.1		0.8			0.3		10.6		7.3	13.5
Exchangeable Sodium/CEC		0-1%			13%			1%		21%		23%	34%
Cation Exchange Capacity	meq/100g		0.1		6.2			22.3		50.9		31.2	40.1
ESP					13%			1%		21%		23%	34%
Alkalinity													
Total Alkalinity as CaCO3	mg/kg		1		196			209		144		326	653
Bicarbonate Alkalinity as CaCO3	mg/kg		1		196			209		144		326	653
Carbonate Alkalinity as CaCO3	mg/kg		1		<1			<1		<1		<1	<1
Inorganics													
Sulfate as SO4 2-	mg/kg	8mg/kg	10		<10			<10		480		250	310
Sulfur - Total as S (LECO)	%	0.2%	0.01							0.01	0.02		
Chloride	mg/kg	600mg/kg	10	830	50	90	320	40	<10	130	2620	750	1370
Soluble Major Cations													
Calcium	mg/kg		10		<10			<10		110		<10	<10
Magnesium	mg/kg		10		<10			<10		70		10	10
Sodium	mg/kg		10		20			10		1290		630	1040
Potassium	mg/kg		10		<10			<10		20		<10	<10
Ca:Mg ratio					-			-		1.57		-	-
Nutrients													
Nitrite + Nitrate as N (Sol.)	mg/kg		0.1		0.4			<0.5		0.2		<1.0	
Total Kjeldahl Nitrogen as N	mg/kg		20		1110			740		740		660	
Total Nitrogen as N	mg/kg	1500mg/kg	20		1110			740		740		660	
Total Phosphorus as P	mg/kg	200mg/kg	2		396			126		136		66	

Appendix D Hillslope Erosion Map Methodology

The hillslope erosion map was derived using an amended version of the universal soil loss equation (USLE): Erosion = K x R x C x S x L tonnes/ha/year.

The results were truncated to values less than 100 t/ha/year to eliminate those non-realistically high erosion rates due to artefacts of 9" digital elevation model (DEM). The individual factors are described in Lu *et al* 2001 and are summarised as follows:

- K is soil erodibility and is derived from modelled soil data provided by ASRIS project.
- R is rainfall erosivity derived from point data supplied by DNR Queensland.
- C is the cover factor based on,
  - seasonal rainfall derived from QDNR data.
  - ABARES Landuse data at 0.01 deg cell size
  - AVHRR derived NDVI data at 0.05 deg cell size
- S is the slope factor derived by modelling high resolution 20 to 50 m cell DEM and extending this data to cover the river basins containing intensive agriculture.
- L is the slope length factor, derived by modelling high resolution 20 to 50 m cell DEM and extending this data to cover the river basins containing intensive agriculture. Outside this area the L factor was set to 1

Appendix E Sample Location ASC Orders and Topsoil depth

Sample location	ASC Predicted	ASC Observed	Topsoil Depth (mm)
0	Sodosol	Sodosol (3)	300
0-1	Vertosol	Unable to Discern	600
0-2	Sodosol	Sodosol (3)	550
1	Sodosol	Sodosol (2)	Topsoil Removed
1_1	Sodosol	Sodosol (3)	400
1_2	Vertosol	Vertosol (3)	300
2	Vertosol	Vertosol (3)	600
2_1	Sodosol	Sodosol (3)	300
3	Vertosol	Vertosol (3)	900
3_1	Vertosol	Unable to Discern	600
3_2	Sodosol	Sodosol (3)	250
4_1	Sodosol	Sodosol (3)	300
4	Sodosol	Sodosol (3)	150
5	Vertosol	Vertosol (3)	900
5_1	Vertosol	Unable to Discern	600
5_2	Vertosol	Unable to Discern	600
6	Vertosol	Unable to Discern	450
6_1	Kandosol	Kandosol (3)	190
6_2	Sodosol	Sodosol (3)	Topsoil Removed
7	Kandosol	Unable to Discern	650
7_1	Vertosol	Vertosol (3)	300
8	Vertosol	Vertosol (3)	450
8_1	Vertosol	Vertosol (3)	600
9	Rudosol	Rudosol (3)	100
9_1	Rudosol	Rudosol (3)	150
9_2	Rudosol	Rudosol (3)	250
10	Chromosol	Chromosol (3)	300
11	Chromosol	Chromosol (3)	250
11_1	Chromosol	Unable to Discern	600
12	Sodosol	Sodosol (3)	350
12_1	Sodosol	Sodosol (3)	250

Sample location	ASC Predicted	ASC Observed	Topsoil Depth (mm)
13	Sodosol	Sodosol (3)	600
13_1	Sodosol	Unable to Discern	500
14	Hydrosol	Sodosol (3)	600
15	Sodosol	Sodosol (3)	450
15_1	Sodosol	Sodosol (3)	150

Confidence Rating according to Isbell (2002)

2: Analytical data are incomplete but are sufficient to classify the soil with a reasonable degree of confidence

3: No necessary analytical data are available but confidence is fair, based on a knowledge of similar soils in similar environments.

Unable to Discern means either soil has possibly been modified by human impact or borehole had shallow refusal meaning insufficient data available

Topsoil Removed: topsoil not present. Topsoil has previously been removed at these locations near roadside

Appendix F Laboratory Reports

CERTIFICATE OF ANALYSIS

Work Order	: **EB1117162**	Page	: 1 of 12
Client	: **SINCLAIR KNIGHT MERZ**	Laboratory	: Environmental Division Brisbane
Contact	: MS KRISTELLE GENTIL	Contact	: Dean Sullivan
Address	: 32 CORDELIA STREET SOUTH BRISBANE QLD, AUSTRALIA 4101	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: kgentil@globalskm.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 07 3026 8323	Telephone	: +61 7 3243 7144
Facsimile	: +61 0730 267 306	Facsimile	: +61 7 3243 7218
Project	: EN02962 ABP	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 24-AUG-2011
Sampler	: Kristelle Gentil	Issue Date	: 08-SEP-2011
Site	: ----		
		No. of samples received	: 56
Quote number	: EN/003/10	No. of samples analysed	: 41

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

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

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

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

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

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

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

- **ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.**
- **EK059G (Nitrite and Nitrate as Nox): The LOR for samples 01(15 /0.3-0.45),07(13-1/0.3-0.4),14(11/0.15-0.25),20(8/0.35-0.45),29(7/0.3-0.4), and 43(3/0.3-0.4) have been raised due to matrix interference.**
- **EK061 (Total Kjeldahl Nitrogen); Sample EB1117162 048 (Soil 1/0.4-0.5) showed poor spike recovery due to sample heterogeneity. This was confirmed by visual inspection.**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 15 /0.3-0.45 Client sampling date / time: 15-AUG-2011 15:00 EB1117162-001	Client sample ID: 15/0.55-0.66 Client sampling date / time: 15-AUG-2011 15:00 EB1117162-002	Client sample ID: 14/0.3-0.4 Client sampling date / time: 15-AUG-2011 15:00 EB1117162-003	Client sample ID: 14/0.3-0.4 Client sampling date / time: 15-AUG-2011 15:00 EB1117162-004	Client sample ID: 13-1/0.3-0.4 Client sampling date / time: 15-AUG-2011 15:00 EB1117162-007
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**5.9**	**6.8**	**7.3**	**7.8**	**7.4**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**509**	**800**	**1300**	**1680**	**15**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	----	----	**24.6**	**20.0**	----
^ ANC as CaCO3	----	0.1	% CaCO3	----	----	**2.5**	**2.0**	----
Fizz Rating	----	0	Fizz Unit	----	----	**1**	**1**	----
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	----	----	<0.005	<0.005	----
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	----	**21.9**	----	----	**21.7**
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	**5.4**	**5.5**	**22.4**	----	**13.1**
^ Exchangeable Magnesium	----	0.1	meq/100g	**18.2**	**20.9**	**17.4**	----	**8.7**
^ Exchangeable Potassium	----	0.1	meq/100g	**0.2**	**0.2**	**0.5**	----	<0.1
^ Exchangeable Sodium	----	0.1	meq/100g	**7.3**	**13.5**	**10.6**	----	**0.3**
^ Cation Exchange Capacity	----	0.1	meq/100g	**31.2**	**40.1**	**50.9**	----	**22.3**
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	**326**	**653**	**144**	----	**209**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	**326**	**653**	**144**	----	**209**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<1	<1	<1	----	<1
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**250**	**310**	**480**	----	<10
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	----	----	**0.01**	**0.02**	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	**750**	**1370**	**130**	**2620**	**40**
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	<10	<10	**110**	----	<10
Magnesium	7439-95-4	10	mg/kg	**10**	**10**	**70**	----	<10
Sodium	7440-23-5	10	mg/kg	**630**	**1040**	**1290**	----	**10**
Potassium	7440-09-7	10	mg/kg	<10	<10	**20**	----	<10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<1.0	----	**0.2**	----	<0.5
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								

Analytical Results

Sub-Matrix: SOIL				Client sample ID	15 /0.3-0.45	15/0.55-0.66	14/0.3-0.4	14/0.3-0.4	13-1/0.3-0.4
				Client sampling date / time	15-AUG-2011 15:00	15-AUG-2011 15:00	15-AUG-2011 15:00	15-AUG-2011 15:00	15-AUG-2011 15:00
Compound	CAS Number	LOR	Unit		EB1117162-001	EB1117162-002	EB1117162-003	EB1117162-004	EB1117162-007
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		660	----	740	----	740
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		660	----	740	----	740
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		66	----	136	----	126

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 13-1/0.7-0.8 Client sampling date / time: 15-AUG-2011 15:00 EB1117162-009	Client sample ID: 12/0.2-0.3 Client sampling date / time: 16-AUG-2011 15:00 EB1117162-011	Client sample ID: 12/0.3-0.4 Client sampling date / time: 16-AUG-2011 15:00 EB1117162-012	Client sample ID: 12-1/0.4-0.5 Client sampling date / time: 16-AUG-2011 15:00 EB1117162-013	Client sample ID: 11/0.15-0.25 Client sampling date / time: 16-AUG-2011 15:00 EB1117162-014
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.3**	**7.6**	**8.3**	**9.1**	**7.8**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**47**	**22**	**240**	**427**	**29**
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**13.0**	**11.5**	**22.6**	**15.8**	**17.1**
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	----	**3.2**	----	----	**14.0**
^ Exchangeable Magnesium	----	0.1	meq/100g	----	**2.2**	----	----	**8.9**
^ Exchangeable Potassium	----	0.1	meq/100g	----	<0.1	----	----	**0.3**
^ Exchangeable Sodium	----	0.1	meq/100g	----	**0.8**	----	----	**1.2**
^ Cation Exchange Capacity	----	0.1	meq/100g	----	**6.2**	----	----	**24.4**
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	----	**196**	----	----	**196**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	**196**	----	----	**196**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	<1	----	----	<1
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	<10	----	----	<10
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	<10	**50**	**90**	**320**	**220**
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	<10	----	----	<10
Magnesium	7439-95-4	10	mg/kg	----	<10	----	----	<10
Sodium	7440-23-5	10	mg/kg	----	**20**	----	----	**20**
Potassium	7440-09-7	10	mg/kg	----	<10	----	----	<10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	**0.4**	----	----	<0.5
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	**1110**	----	----	**630**
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	**1110**	----	----	**630**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	**396**	----	----	**285**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 11/0.3-0.4 Client sampling date / time: 16-AUG-2011 15:00 EB1117162-015	11/1.0-1.1 16-AUG-2011 15:00 EB1117162-016	10/0.2-0.2 16-AUG-2011 15:00 EB1117162-017	10/0.6-0.7 16-AUG-2011 15:00 EB1117162-019	8/0.35-0.45 17-AUG-2011 15:00 EB1117162-020
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.1**	**7.8**	**7.7**	**8.0**	**7.8**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**97**	**495**	**82**	**25**	**44**
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**16.6**	**19.2**	**15.6**	**13.8**	**19.8**
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	----	----	**27.4**	----	**23.5**
^ Exchangeable Magnesium	----	0.1	meq/100g	----	----	**2.9**	----	**13.0**
^ Exchangeable Potassium	----	0.1	meq/100g	----	----	**0.3**	----	**0.6**
^ Exchangeable Sodium	----	0.1	meq/100g	----	----	**0.1**	----	**1.6**
^ Cation Exchange Capacity	----	0.1	meq/100g	----	----	**30.7**	----	**38.8**
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	----	----	**274**	----	**287**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	**274**	----	**287**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	<1	----	<1
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	<10	----	<10
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	**40**	**830**	<10	<10	**220**
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	**60**	----	<10
Magnesium	7439-95-4	10	mg/kg	----	----	<10	----	<10
Sodium	7440-23-5	10	mg/kg	----	----	<10	----	**30**
Potassium	7440-09-7	10	mg/kg	----	----	<10	----	<10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	**3.6**	----	<1.0
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	**670**	----	**1140**
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	**670**	----	**1140**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	**281**	----	**492**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 8/0.85-0.95 Client sampling date / time: 17-AUG-2011 15:00 EB1117162-022	8-1/0.45-0.55 17-AUG-2011 15:00 EB1117162-023	9-2/0.1-0.2 17-AUG-2011 15:00 EB1117162-027	9-2/0.3-0.4 17-AUG-2011 15:00 EB1117162-028	7/0.3-0.4 18-AUG-2011 15:00 EB1117162-029
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.2**	**8.8**	**5.2**	**6.8**	**8.4**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**348**	**177**	**37**	**245**	**142**
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**22.0**	**17.2**	**1.1**	**1.3**	**21.2**
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	----	----	**0.7**	----	**21.5**
^ Exchangeable Magnesium	----	0.1	meq/100g	----	----	**3.0**	----	**11.1**
^ Exchangeable Potassium	----	0.1	meq/100g	----	----	**0.1**	----	**0.2**
^ Exchangeable Sodium	----	0.1	meq/100g	----	----	**0.2**	----	**2.7**
^ Cation Exchange Capacity	----	0.1	meq/100g	----	----	**4.1**	----	**35.5**
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	----	----	**13**	----	**588**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	**13**	----	**588**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	<1	----	<1
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	<10	----	<10
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	**330**	**740**	**40**	**260**	**290**
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	<10	----	<10
Magnesium	7439-95-4	10	mg/kg	----	----	<10	----	<10
Sodium	7440-23-5	10	mg/kg	----	----	**20**	----	**120**
Potassium	7440-09-7	10	mg/kg	----	----	<10	----	<10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	**5.9**	----	<1.0
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	**610**	----	**1110**
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	**620**	----	**1110**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	**181**	----	**200**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 7/0.7-0.8 Client sampling date / time: 18-AUG-2011 15:00 EB1117162-031	6-1/0.4-0.5 18-AUG-2011 15:00 EB1117162-033	6-2/0.8-0.9 18-AUG-2011 15:00 EB1117162-035	5/0.400-0.500 19-AUG-2011 15:00 EB1117162-036	5/0.95-1.05 19-AUG-2011 15:00 EB1117162-037
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.2	8.5	8.3	8.5	8.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	379	102	1110	784	660
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	11.0	26.9	22.4	----	13.4
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	----	----	38.6	26.2	----
^ Exchangeable Magnesium	----	0.1	meq/100g	----	----	26.0	13.6	----
^ Exchangeable Potassium	----	0.1	meq/100g	----	----	0.7	0.3	----
^ Exchangeable Sodium	----	0.1	meq/100g	----	----	9.6	8.1	----
^ Cation Exchange Capacity	----	0.1	meq/100g	----	----	75.0	48.2	----
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	----	----	379	548	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	379	548	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	<1	<1	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	530	60	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	400	40	1840	1370	910
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	120	60	----
Magnesium	7439-95-4	10	mg/kg	----	----	90	30	----
Sodium	7440-23-5	10	mg/kg	----	----	1160	880	----
Potassium	7440-09-7	10	mg/kg	----	----	<10	<10	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	0.7	0.7	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	1940	380	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	1940	380	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	632	135	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 4-1/0.1-0.2 Client sampling date / time: 19-AUG-2011 15:00 EB1117162-038	4-1/0.4-0.5 19-AUG-2011 15:00 EB1117162-039	4/0-0.1 19-AUG-2011 15:00 EB1117162-040	4/0.6-0.65 19-AUG-2011 15:00 EB1117162-042	3/0.3-0.4 20-AUG-2011 15:00 EB1117162-043
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.8**	**6.7**	**6.9**	**7.7**	**5.2**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**6**	**8**	**76**	**49**	**207**
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**5.6**	**14.0**	**8.0**	**13.3**	----
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	----	----	**1.0**	----	**1.2**
^ Exchangeable Magnesium	----	0.1	meq/100g	----	----	**0.8**	----	**6.2**
^ Exchangeable Potassium	----	0.1	meq/100g	----	----	**1.1**	----	**0.2**
^ Exchangeable Sodium	----	0.1	meq/100g	----	----	<0.1	----	**3.3**
^ Cation Exchange Capacity	----	0.1	meq/100g	----	----	**3.0**	----	**11.0**
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	----	----	**39**	----	**104**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	**39**	----	**104**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	<1	----	<1
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	**20**	----	**120**
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	**200**	**90**	**330**
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	<10	----	<10
Magnesium	7439-95-4	10	mg/kg	----	----	<10	----	<10
Sodium	7440-23-5	10	mg/kg	----	----	<10	----	**180**
Potassium	7440-09-7	10	mg/kg	----	----	**80**	----	<10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	**4.6**	----	<1.0
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	**600**	----	**990**
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	**600**	----	**990**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	**191**	----	**65**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 3/1.0-1.1	2/0.1-0.2	2/0.65-0.7	1/0.4-0.5	1/1.1-1.2
Client sampling date / time				20-AUG-2011 15:00	20-AUG-2011 15:00	20-AUG-2011 15:00	21-AUG-2011 15:00	21-AUG-2011 15:00
				EB1117162-044	EB1117162-045	EB1117162-047	EB1117162-048	EB1117162-049
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	5.2	7.4	7.0	9.4	9.4
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	257	19	13	256	837
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	8.1	6.4	22.7	----	19.7
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	----	0.7	----	31.8	----
^ Exchangeable Magnesium	----	0.1	meq/100g	----	0.2	----	41.7	----
^ Exchangeable Potassium	----	0.1	meq/100g	----	<0.1	----	0.2	----
^ Exchangeable Sodium	----	0.1	meq/100g	----	0.3	----	6.3	----
^ Cation Exchange Capacity	----	0.1	meq/100g	----	1.3	----	80.0	----
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	----	52	----	1300	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	52	----	979	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	<1	----	314	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	<10	----	<10	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	230	20	40	10	900
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	<10	----	<10	----
Magnesium	7439-95-4	10	mg/kg	----	<10	----	<10	----
Sodium	7440-23-5	10	mg/kg	----	20	----	350	----
Potassium	7440-09-7	10	mg/kg	----	<10	----	<10	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	0.1	----	0.8	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	170	----	750	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	170	----	750	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	55	----	344	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 3-2/0.5-0.6	0/0.2-0.3	0/0.7-0.8	0-2/0.2-0.3	0-2/0.6-0.65
Client sampling date / time				21-AUG-2011 15:00	22-AUG-2011 15:00	22-AUG-2011 15:00	22-AUG-2011 15:00	22-AUG-2011 15:00
				EB1117162-050	EB1117162-051	EB1117162-053	EB1117162-054	EB1117162-055
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.8	7.5	9.0	9.0	9.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	273	38	503	167	397
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	21.5	8.6	14.5	10.5	19.6
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	----	8.8	----	----	----
^ Exchangeable Magnesium	----	0.1	meq/100g	----	4.5	----	----	----
^ Exchangeable Potassium	----	0.1	meq/100g	----	0.4	----	----	----
^ Exchangeable Sodium	----	0.1	meq/100g	----	<0.1	----	----	----
^ Cation Exchange Capacity	----	0.1	meq/100g	----	13.8	----	----	----
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	----	353	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	353	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	<1	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	<10	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	1700	10	720	<10	530
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	10	----	----	----
Magnesium	7439-95-4	10	mg/kg	----	<10	----	----	----
Sodium	7440-23-5	10	mg/kg	----	<10	----	----	----
Potassium	7440-09-7	10	mg/kg	----	<10	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	1.1	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	460	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	460	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	122	----	----	----

Analytical Results

Sub-Matrix: SOIL			Client sample ID	7-1/0.4-0.5	----	----	----	----
			Client sampling date / time	18-AUG-2011 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1117162-056	----	----	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.1**	----	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**9**	----	----	----	----
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**12.9**	----	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	**10**	----	----	----	----

Environ

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784-8555 E:samples.sydney@alsenviro.com
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☐ Perth: 10 Hod Way, Malaga WA Ph: 08 9209 7655 E: samples.perth
☐ Launceston: 27 Wellington St, L Ph: 03 6331 2158 E: launceston@

Environmental Division
Brisbane
Work Order
EB1117162

Telephone : +61-7-3243 7222

CLIENT: SKM
OFFICE: Brisbane 32 Cordelia St
PROJECT: EN02962 ABP
ORDER NUMBER: TBA
PROJECT MANAGER: Damian Williams — CONTACT PH: 0421758478
SAMPLER: Kristelle Gentil — SAMPLER MOBILE: 0400269425
COC emailed to ALS? (YES) NO — EDD FORMAT (or default):
Email Reports to: kgentil@globalskm.com
Email Invoice to: Kgentil & dwilliams@globalskm.com
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
☒ Standard TAT (List due date): 5 days TAT from samples reception
☐ URGENT TAT (List due date):
QUOTE NO.: EN/003/10 BK

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY

RELINQUISHED BY: K. Gentil — DATE/TIME: 23 Aug 11 11am
RECEIVED BY: — DATE/TIME: 23/08/11 11:05
RELINQUISHED BY: — DATE/TIME: 23/8/11 1530.
RECEIVED BY: — DATE/TIME: 24/8/11 14:30

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	pH, EC, Chloride content	Carbonate Content	Exc. Cat ex M_3, Na, CEC	Soluble Ca, Mg, Na, K, CO_3, HCO_3, SO_4	Totals	Chromium Reducible Sulfur	ANC	Cold Hold	TN #
1	15/0.3-0.45	15 AUG 11	S	150mL Soil Jar	1	X	X	X	X					X
2	15/0.55-0.66				1	X	X	X	X					
3	14/0.3-0.4				1	X	X	X	X	X	X	X		X
4	14/0.6-0.7				1	X				X	X	X		
5	13/0.25-0.3				1								X	
6	13/0.6-0.7				1								X	
7	13-1/0.3-0.4				1	X	X	X	X					X
8	13-1/0.5-0.55				1								X	
9	13-1/0.7-0.8				1	X								
10	12/0.1-0.2	16 AUG 11			1								X	
11	12/0.2-0.3				1	X	X	X	X					X
12	12/0.3-0.4				1	X								
13	12-1/0.4-0.5				1	X								
				TOTAL	13	9	5	5	5	2	2	2	4	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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☒ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsvilleenvironmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT: SKM

OFFICE: Brisbane 32 Cordelia St

PROJECT: EN02962 ABP

ORDER NUMBER: TBA

PROJECT MANAGER: Damian Williams — CONTACT PH: 0421 758 478

SAMPLER: Kristelle Gentil — SAMPLER MOBILE: 0400269425

COC emailed to ALS? (YES (NO)) — EDD FORMAT (or default):

Email Reports to: kgentil@globalskm.com

Email Invoice to: kgentil & dwilliams@globalskm.com

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
☑ Standard TAT (List due date): 5 days TAT from samples reception
☐ URGENT TAT (List due date):

QUOTE NO.: EN1003/10

COC SEQUENCE NUMBER (Circle)
COC: 1 (2) 3 4 5 6 7
OF: 1 2 3 4 (5) 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes / No / N/A
Temperature on Receipt (°C)
Cooling Method: Ice / Ice Pack / None
Cooling Comments:

RELINQUISHED BY: Kristelle Gentil — DATE/TIME:

RECEIVED BY: — DATE/TIME: 23/8/11 11:05

RELINQUISHED BY: — DATE/TIME: 23/8/11 1530.

RECEIVED BY: Matt — DATE/TIME: 24/8/11 @ 16:30

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	pH, EC 1:5 Content	Carbonate Content	Exc. Cations Ca, Mg, Na & CEC	Soluble Ca, Mg, Na, K CO_3, HCO_3, SO_4	TPH			Cold Hold	
14	11/0.15-0.25	16 AUG 11	S	150mL Soil Jar	1	X	X	X	X	X				
15	11/0.3-0.4				1	X								
16	11/1.0-1.1				1	X								
17	10/0.2-0.3				1	X	X	X	X	X				
18	10/0.3-0.4				1								X	
19	10/0.6-0.7				1	X								
20	8/0.35-0.45	17 AUG 11			1	X	X	X	X	X				
21	8/0.5-0.6				1								X	
22	8/0.85-0.95				1	X								
23	8-1/0.45-0.55				1	X								
24	9/0-0.1				1								X	
25	9/0.2-0.3				1								X	
26	9/0.4-0.5				1								X	
				TOTAL	13	8	3	3	3	3			5	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

(ALS)

ALS Laboratory: please tick →

☐ **Sydney:** 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ **Newcastle:** 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☒ **Brisbane:** 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ **Townsville:** 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ **Melbourne:** 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ **Adelaide:** 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ **Perth:** 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ **Launceston:** 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT: SKM
OFFICE: Brisbane 32 Cordelia St
PROJECT: EN02962 ABP
ORDER NUMBER: TBA
PROJECT MANAGER: Damian Williams — CONTACT PH: 0421 758478
SAMPLER: Kerstelle Gentil — SAMPLER MOBILE: 0400269425
COC emailed to ALS? (YES / NO) — NO circled
EDD FORMAT (or default):
Email Reports to: As page 1
Email Invoice to:
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
☒ Standard TAT (List due date): 5 days TAT from samples reception
☐ URGENT TAT (List due date):

QUOTE NO.: EN/003/10

COC SEQUENCE NUMBER (Circle)
COC: 1 2 (3) 4 5 6 7
OF: 1 2 3 4 (5) 6 7

FOR LABORATORY USE ONLY

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
K. Gentil.	[signature] Oliver	[signature]	Matt
DATE/TIME:	DATE/TIME: 23/8/11 11:05	DATE/TIME: 23/8/11 1530.	DATE/TIME: 24/8/11 @ 14:30

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)
* Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

ALS USE ONLY LAB ID	SAMPLE DETAILS MATRIX: Solid(S) Water(W) SAMPLE ID	DATE / TIME	MATRIX	CONTAINER INFORMATION TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	pH, EC, Cl⁻ content	carbonate content	Exc Cations Ca, Mg, Na & CEC	Soluble Ca, Mg, Na, K, CO3, HCO3, SO4	TN TP			Cold Hold	Additional Information
27	9-2/0.1-0.2	17 AUG 11	S	150mL Soil Jar	1	X	X	X	X	X				
28	9-2/0.3-0.4	↓	↓	↓	1	X								
29	7/ 0.3-0.4	18 AUG 11			1	X	X	X	X	X			X	
30	7/ 0.55-0.65				1									
31	7/ 0.7-0.8				1	X							X	
32	7/ 0.8-0.9				1								X	
33	6-1/0.4-0.5				1	X							X	
34	6/0.3-0.4				1									
35	6-2/ 0.8-0.9	↓			1	X	X	X	X	X			X	
36	5/0.400-0.500	19 AUG 11			1	X	X	X	X	X				
37	5/0.95-1.05				1	X								
38	4-1/0.1-0.2				1	X								
39	4-1/0.7-0.8	↓	↓	↓	1	X								
				TOTAL	13	10	4	4	4	4			5	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT: SKM
OFFICE: Brisbane 32 Cordelia St
PROJECT: EN02962 ABP
ORDER NUMBER: TBA
PROJECT MANAGER: Damian Williams — CONTACT PH: 0421 758 478
SAMPLER: Kerstelle Genti — SAMPLER MOBILE: 0400269425
COC emailed to ALS? (YES) (NO) — EDD FORMAT (or default):
Email Reports to:
Email Invoice to: As page 1

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
☒ Standard TAT (List due date): 5 days TAT from samples reception
☐ URGENT TAT (List due date):

QUOTE NO.: EN0831/10

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 (4) 5 6 7
OF: 1 2 3 4 (5) 6 7

FOR LABORATORY USE ONLY (Circle)
Custody seal intact? Yes / No / N/A
Temperature on receipt (°C)
Cooling Method: Ice / Ice Pack / None
Cooling Agent Present: Yes / No

RELINQUISHED BY: K Genti — DATE/TIME:
RECEIVED BY: — DATE/TIME: 23/8/11 11:05
RELINQUISHED BY: — DATE/TIME: 23/8/11 1530.
RECEIVED BY: Matt — DATE/TIME: 24/8/11 @14:30

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS (MATRIX: Solid(S) Water(W))			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price). Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	pH, EC, Cl- Content	Carbonate Content	Exc. Cations Ca, Mg, Na & CEC	Solu Ble Ca, Mg, Na, K, CO_3, HCO_3, SO	TKN + TP			COLD HOLD	
40	4/ 0-0.1	19 AUG 11	S	150mL Soil Jar	1	X	X	X	X	X				
41	4/ 0.3-0.4	↓	↓	↓	1								X	
42	4/ 0.6-0.65	↓	↓	↓	1	X								
43	3/ 0.3-0.4	20 AUG 11			1	X	X	X	X	X				
44	3/ 1.0-1.1	↓			1	X								
45	2/ 0.1-0.2				1	X	X	X	X	X				
46	2/ 0.4-0.45				1								X	
47	2/ 0.65-0.7	↓			1	X								
48	1/ 0.4-0.5	21 AUG 11			1	X	X	X	X	X				
49	1/ 1.1-1.2	↓			1	X								
50	3-2/ 0.5-0.6	↓	↓	↓	1	X								
51	0/ 0.2-0.3	22 AUG 11			1	X	X	X	X	X				
52	0/ 0.4-0.45	↓	↓	↓	1								X	
				TOTAL	13	10	5	5	5	5			3	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

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☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2156 E: launceston@alsenviro.com

CLIENT: SKM	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☒ Standard TAT (List due date): 5 days TAT from samples reception	FOR LABORATORY USE ONLY (Circle)
OFFICE: Brisbane 32 Cordelia St		☐ URGENT TAT (List due date):	
PROJECT: EN02962 ASP	QUOTE NO.: EN/003/10	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7	
ORDER NUMBER: TBA		OF: 1 2 3 4 5 6 7	
PROJECT MANAGER: Damian Williams	CONTACT PH: 0421 758 478		
SAMPLER: Kristelle Gentil	SAMPLER MOBILE: 0400 269 425	RELINQUISHED BY: K Gentil	RECEIVED BY:
COC emailed to ALS? (YES) (NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: 23/8/11 11.05
Email Reports to:			
Email Invoice to: As per page 1			

RELINQUISHED BY:	RECEIVED BY:
DATE/TIME: 23/8/11 1530.	DATE/TIME: 24/8/11 @ 14:30

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	pH, EC (1:5 content)	Carbonate content	Exc Cations Ca, Mg, Na, ESP	Soluble Ca, Mg, Na, K, CO_3, HCO_3, Cl, SO_4	TN & TP			Cold Hold	
53	0/0.7-0.8	22 AUG 11	S	150mL Soil Jar	1	X								
54	0-2/0.2-0.3	↓	↓	↓	1	X	—							
55	0-2/0.6-0.65	↓	↓	↓	1	X	—							
EXTRA	SAMPLE													
56	7-1/0.4-0.5	18/8/11	S	150ml Soil Jar	1	X								
				TOTAL	4	4								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

QUALITY CONTROL REPORT

Work Order	: **EB1117162**	Page	: 1 of 9
Client	: **SINCLAIR KNIGHT MERZ**	Laboratory	: Environmental Division Brisbane
Contact	: MS KRISTELLE GENTIL	Contact	: Dean Sullivan
Address	: 32 CORDELIA STREET SOUTH BRISBANE QLD, AUSTRALIA 4101	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: kgentil@globalskm.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 07 3026 8323	Telephone	: +61 7 3243 7144
Facsimile	: +61 0730 267 306	Facsimile	: +61 7 3243 7218
Project	: EN02962 ABP	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 24-AUG-2011
Sampler	: Kristelle Gentil	Issue Date	: 08-SEP-2011
Order number	: ----		
		No. of samples received	: 56
Quote number	: EN/003/10	No. of samples analysed	: 41

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
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General Comments

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

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA002 : pH (Soils) (QC Lot: 1928507)									
EB1117162-049	1/1.1-1.2	EA002: pH Value	----	0.1	pH Unit	9.4	9.4	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 1928513)									
EB1117162-013	12-1/0.4-0.5	EA002: pH Value	----	0.1	pH Unit	9.1	9.1	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 1932906)									
EB1117162-051	0/0.2-0.3	EA002: pH Value	----	0.1	pH Unit	7.5	7.6	1.6	0% - 20%
EA002 : pH (Soils) (QC Lot: 1935554)									
EB1117162-007	13-1/0.3-0.4	EA002: pH Value	----	0.1	pH Unit	7.4	7.4	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 1935560)									
EB1117162-009	13-1/0.7-0.8	EA002: pH Value	----	0.1	pH Unit	8.3	8.3	0.0	0% - 20%
EB1117162-056	7-1/0.4-0.5	EA002: pH Value	----	0.1	pH Unit	7.1	7.0	0.0	0% - 20%
EA010: Conductivity (QC Lot: 1928509)									
EB1117162-049	1/1.1-1.2	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	837	831	0.7	0% - 20%
EA010: Conductivity (QC Lot: 1928514)									
EB1117162-013	12-1/0.4-0.5	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	427	411	3.8	0% - 20%
EA010: Conductivity (QC Lot: 1932908)									
EB1117162-051	0/0.2-0.3	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	38	45	16.9	0% - 20%
EA010: Conductivity (QC Lot: 1935556)									
EB1117162-007	13-1/0.3-0.4	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	15	16	6.4	0% - 50%
EA010: Conductivity (QC Lot: 1935561)									
EB1117162-009	13-1/0.7-0.8	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	47	49	4.2	0% - 20%
EB1117162-056	7-1/0.4-0.5	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	9	9	0.0	No Limit
EA013: Acid Neutralising Capacity (QC Lot: 1933775)									
EB1117162-003	14/0.3-0.4	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	24.6	24.0	2.5	0% - 20%
EA026 : Chromium Reducible Sulfur (QC Lot: 1933776)									
EB1117162-003	14/0.3-0.4	EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	0.0	No Limit
EA055: Moisture Content (QC Lot: 1930662)									
EB1117162-004	14/0.3-0.4	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	19.8	18.9	4.9	0% - 50%
EB1117162-038	4-1/0.1-0.2	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	5.6	4.3	25.7	No Limit
EA055: Moisture Content (QC Lot: 1932597)									
EB1117162-009	13-1/0.7-0.8	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	13.0	12.8	1.6	0% - 50%
EB1117162-019	10/0.6-0.7	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	13.8	13.5	1.6	0% - 50%
EA055: Moisture Content (QC Lot: 1932598)									
EB1117162-047	2/0.65-0.7	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	22.7	22.7	0.0	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
ED007: Exchangeable Cations (QC Lot: 1936083)									
EB1117162-001	15 /0.3-0.45	ED007: Exchangeable Calcium	----	0.1	meq/100g	5.4	5.4	0.0	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	18.2	18.6	2.1	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.2	0.3	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	7.3	7.4	1.6	0% - 20%
EB1117162-027	9-2/0.1-0.2	ED007: Exchangeable Calcium	----	0.1	meq/100g	0.7	0.6	0.0	No Limit
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	3.0	2.7	10.1	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.1	0.1	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	0.2	0.2	0.0	No Limit
ED037: Alkalinity (QC Lot: 1928511)									
EB1117162-049	1/1.1-1.2	ED037: Total Alkalinity as CaCO3	----	1	meq/kg	----	927	# Not Determined	0% - 20%
ED037: Alkalinity (QC Lot: 1932910)									
EB1117162-051	0/0.2-0.3	ED037: Total Alkalinity as CaCO3	----	1	meq/kg	353	339	4.0	0% - 20%
ED037: Alkalinity (QC Lot: 1935558)									
EB1117162-007	13-1/0.3-0.4	ED037: Total Alkalinity as CaCO3	----	1	meq/kg	209	209	0.0	0% - 20%
ED040S: Soluble Major Anions (QC Lot: 1928508)									
EB1117162-049	1/1.1-1.2	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	120	170	33.8	0% - 50%
ED040S: Soluble Major Anions (QC Lot: 1932907)									
EB1117162-051	0/0.2-0.3	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	10	0.0	No Limit
ED040S: Soluble Major Anions (QC Lot: 1935555)									
EB1117162-007	13-1/0.3-0.4	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	<10	0.0	No Limit
EB1117162-045	2/0.1-0.2	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	<10	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 1933678)									
EB1117162-003	14/0.3-0.4	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.01	0.01	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 1928512)									
EB1117162-049	1/1.1-1.2	ED045G: Chloride	16887-00-6	10	mg/kg	900	910	0.0	0% - 20%
ED045G: Chloride Discrete analyser (QC Lot: 1928515)									
EB1117162-013	12-1/0.4-0.5	ED045G: Chloride	16887-00-6	10	mg/kg	320	320	0.0	0% - 20%
ED045G: Chloride Discrete analyser (QC Lot: 1932912)									
EB1117162-051	0/0.2-0.3	ED045G: Chloride	16887-00-6	10	mg/kg	10	10	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 1935559)									
EB1117162-007	13-1/0.3-0.4	ED045G: Chloride	16887-00-6	10	mg/kg	40	50	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 1935562)									
EB1117162-009	13-1/0.7-0.8	ED045G: Chloride	16887-00-6	10	mg/kg	<10	<10	0.0	No Limit
EB1117162-056	7-1/0.4-0.5	ED045G: Chloride	16887-00-6	10	mg/kg	10	10	0.0	No Limit
ED093S: Soluble Major Cations (QC Lot: 1928510)									
EB1117162-049	1/1.1-1.2	ED093S: Calcium	7440-70-2	10	mg/kg	----	<10	# Not Determined	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093S: Soluble Major Cations (QC Lot: 1928510) - continued									
EB1117162-049	1/1.1-1.2	ED093S: Magnesium	7439-95-4	10	mg/kg	----	20	# Not Determined	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	----	1020	# Not Determined	0% - 20%
		ED093S: Potassium	7440-09-7	10	mg/kg	----	<10	# Not Determined	No Limit
ED093S: Soluble Major Cations (QC Lot: 1932909)									
EB1117162-051	0/0.2-0.3	ED093S: Calcium	7440-70-2	10	mg/kg	10	30	69.8	No Limit
		ED093S: Magnesium	7439-95-4	10	mg/kg	<10	10	0.0	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Potassium	7440-09-7	10	mg/kg	<10	<10	0.0	No Limit
ED093S: Soluble Major Cations (QC Lot: 1935557)									
EB1117162-007	13-1/0.3-0.4	ED093S: Calcium	7440-70-2	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Magnesium	7439-95-4	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	10	10	0.0	No Limit
		ED093S: Potassium	7440-09-7	10	mg/kg	<10	<10	0.0	No Limit
EB1117162-045	2/0.1-0.2	ED093S: Calcium	7440-70-2	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Magnesium	7439-95-4	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	20	40	72.8	No Limit
		ED093S: Potassium	7440-09-7	10	mg/kg	<10	<10	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1932911)									
EB1117162-051	0/0.2-0.3	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	1.1	1.2	0.0	0% - 50%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1935553)									
EB1117162-007	13-1/0.3-0.4	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.5	<0.5	0.0	No Limit
EB1117162-045	2/0.1-0.2	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.1	0.1	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1935563)									
EB1117162-036	5/0.400-0.500	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.7	0.8	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1935526)									
EB1117162-001	15 /0.3-0.45	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	660	790	16.9	0% - 20%
EB1117162-036	5/0.400-0.500	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	380	400	6.1	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1935529)									
EB1117162-045	2/0.1-0.2	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	170	200	16.6	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1935527)									
EB1117162-001	15 /0.3-0.45	EK067G: Total Phosphorus as P	----	2	mg/kg	66	72	7.9	0% - 20%
EB1117162-036	5/0.400-0.500	EK067G: Total Phosphorus as P	----	2	mg/kg	135	113	18.0	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1935530)									
EB1117162-045	2/0.1-0.2	EK067G: Total Phosphorus as P	----	2	mg/kg	55	48	12.6	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002 : pH (Soils) (QCLot: 1928507)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	99.4	97	103
EA002 : pH (Soils) (QCLot: 1928513)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	99.4	97	103
EA002 : pH (Soils) (QCLot: 1932906)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	99.6	97	103
EA002 : pH (Soils) (QCLot: 1935554)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	99.8	97	103
EA002 : pH (Soils) (QCLot: 1935560)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	100	97	103
EA002 : pH (Soils) (QCLot: 1941274)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	100	97	103
EA010: Conductivity (QCLot: 1928509)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	102	85	115
EA010: Conductivity (QCLot: 1928514)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	90.3	85	115
EA010: Conductivity (QCLot: 1932908)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	97.4	85	115
EA010: Conductivity (QCLot: 1935556)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	94.4	85	115
EA010: Conductivity (QCLot: 1935561)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	92.8	85	115
EA010: Conductivity (QCLot: 1941276)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	93.9	85	115
EA013: Acid Neutralising Capacity (QCLot: 1933775)								
EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	----	9.9 kg H2SO4/t	103	80	122
EA026 : Chromium Reducible Sulfur (QCLot: 1933776)								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	.28 %	83.2	80	120
ED007: Exchangeable Cations (QCLot: 1936083)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1.39 meq/100g	96.1	70	130
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.79 meq/100g	93.0	70	130
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.18 meq/100g	81.0	70	130
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.41 meq/100g	93.9	70	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
ED007: Exchangeable Cations (QCLot: 1936083) - continued								
ED007: Cation Exchange Capacity	----	0.1	meq/100g	----	2.71 meq/100g	96.0	70	130
ED037: Alkalinity (QCLot: 1928511)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	98.0	85	115
ED037: Alkalinity (QCLot: 1932910)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	98.0	85	115
ED037: Alkalinity (QCLot: 1935558)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	98.0	85	115
ED037: Alkalinity (QCLot: 1941278)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	98.0	85	115
ED040S: Soluble Major Anions (QCLot: 1928508)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	101	77	125
ED040S: Soluble Major Anions (QCLot: 1932907)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	88.7	77	125
ED040S: Soluble Major Anions (QCLot: 1935555)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	95.1	77	125
ED040S: Soluble Major Anions (QCLot: 1941275)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	90.4	77	125
ED042T: Total Sulfur by LECO (QCLot: 1933678)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	98.6	70	130
ED045G: Chloride Discrete analyser (QCLot: 1928512)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	104	81	125
ED045G: Chloride Discrete analyser (QCLot: 1928515)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	104	81	125
ED045G: Chloride Discrete analyser (QCLot: 1932912)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	104	81	125
ED045G: Chloride Discrete analyser (QCLot: 1935559)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	104	81	125
ED045G: Chloride Discrete analyser (QCLot: 1935562)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	105	81	125
ED045G: Chloride Discrete analyser (QCLot: 1941279)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	104	81	125
ED093S: Soluble Major Cations (QCLot: 1928510)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
ED093S: Soluble Major Cations (QCLot: 1932909)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
ED093S: Soluble Major Cations (QCLot: 1935557)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
ED093S: Soluble Major Cations (QCLot: 1941277)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1932911)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	99.3	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1935553)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	98.0	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1935563)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	94.0	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1935526)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	534 mg/kg	90.6	70	118
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1935529)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	534 mg/kg	103	70	118
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1935527)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	75 mg/kg	103	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1935530)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	75 mg/kg	113	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1935553)							
EB1117162-011	12/0.2-0.3	EK059G: Nitrite + Nitrate as N (Sol.)	----	10 mg/kg	127	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1935563)							
EB1117162-048	1/0.4-0.5	EK059G: Nitrite + Nitrate as N (Sol.)	----	2.0 mg/kg	79.6	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1935526)							
EB1117162-003	14/0.3-0.4	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	73.5	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1935529)							
EB1117162-048	1/0.4-0.5	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	# 133	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1935527)							
EB1117162-003	14/0.3-0.4	EK067G: Total Phosphorus as P	----	100 mg/kg	129	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1935530)							
EB1117162-048	1/0.4-0.5	EK067G: Total Phosphorus as P	----	100 mg/kg	94.5	70	130

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1117162**	Page	: 1 of 22
Client	: SINCLAIR KNIGHT MERZ	Laboratory	: Environmental Division Brisbane
Contact	: MS KRISTELLE GENTIL	Contact	: Dean Sullivan
Address	: 32 CORDELIA STREET SOUTH BRISBANE QLD, AUSTRALIA 4101	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: kgentil@globalskm.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 07 3026 8323	Telephone	: +61 7 3243 7144
Facsimile	: +61 0730 267 306	Facsimile	: +61 7 3243 7218
Project	: EN02962 ABP	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 24-AUG-2011
Sampler	: Kristelle Gentil	Issue Date	: 08-SEP-2011
Order number	: ----		
		No. of samples received	: 56
Quote number	: EN/003/10	No. of samples analysed	: 41

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

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002 : pH (Soils)							
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 15/0.55-0.66, 14/0.3-0.4	**15-AUG-2011**	**05-SEP-2011**	22-AUG-2011	×	**05-SEP-2011**	05-SEP-2011	✓
Soil Glass Jar - Unpreserved 13-1/0.7-0.8	**15-AUG-2011**	**05-SEP-2011**	22-AUG-2011	×	**06-SEP-2011**	05-SEP-2011	×
Soil Glass Jar - Unpreserved 13-1/0.3-0.4	**15-AUG-2011**	**06-SEP-2011**	22-AUG-2011	×	**06-SEP-2011**	06-SEP-2011	✓
Soil Glass Jar - Unpreserved 14/0.3-0.4	**15-AUG-2011**	**06-SEP-2011**	22-AUG-2011	×	**07-SEP-2011**	06-SEP-2011	×
Soil Glass Jar - Unpreserved 12/0.3-0.4, 11/0.3-0.4, 11/1.0-1.1, 10/0.6-0.7	**16-AUG-2011**	**05-SEP-2011**	23-AUG-2011	×	**06-SEP-2011**	05-SEP-2011	×
Soil Glass Jar - Unpreserved 12/0.2-0.3, 11/0.15-0.25, 10/0.2-0.2	**16-AUG-2011**	**06-SEP-2011**	23-AUG-2011	×	**06-SEP-2011**	06-SEP-2011	✓
Soil Glass Jar - Unpreserved 12-1/0.4-0.5	**16-AUG-2011**	**31-AUG-2011**	23-AUG-2011	×	**05-SEP-2011**	31-AUG-2011	×
Soil Glass Jar - Unpreserved 8/0.85-0.95, 9-2/0.3-0.4	**17-AUG-2011**	**05-SEP-2011**	24-AUG-2011	×	**06-SEP-2011**	05-SEP-2011	×
Soil Glass Jar - Unpreserved 8/0.35-0.45, 9-2/0.1-0.2	**17-AUG-2011**	**06-SEP-2011**	24-AUG-2011	×	**06-SEP-2011**	06-SEP-2011	✓
Soil Glass Jar - Unpreserved 8-1/0.45-0.55	**17-AUG-2011**	**31-AUG-2011**	24-AUG-2011	×	**05-SEP-2011**	31-AUG-2011	×
Soil Glass Jar - Unpreserved 7/0.7-0.8, 7-1/0.4-0.5	**18-AUG-2011**	**05-SEP-2011**	25-AUG-2011	×	**06-SEP-2011**	05-SEP-2011	×
Soil Glass Jar - Unpreserved 7/0.3-0.4, 6-2/0.8-0.9	**18-AUG-2011**	**06-SEP-2011**	25-AUG-2011	×	**06-SEP-2011**	06-SEP-2011	✓
Soil Glass Jar - Unpreserved 6-1/0.4-0.5	**18-AUG-2011**	**31-AUG-2011**	25-AUG-2011	×	**05-SEP-2011**	31-AUG-2011	×
Soil Glass Jar - Unpreserved 5/0.400-0.500, 5/0.95-1.05	**19-AUG-2011**	**05-SEP-2011**	26-AUG-2011	×	**05-SEP-2011**	05-SEP-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002 : pH (Soils) - Continued							
Soil Glass Jar - Unpreserved 4/0.6-0.65	**19-AUG-2011**	**05-SEP-2011**	26-AUG-2011	×	**06-SEP-2011**	05-SEP-2011	×
Soil Glass Jar - Unpreserved 4/0-0.1	**19-AUG-2011**	**06-SEP-2011**	26-AUG-2011	×	**06-SEP-2011**	06-SEP-2011	✓
Soil Glass Jar - Unpreserved 4-1/0.1-0.2, 4-1/0.4-0.5	**19-AUG-2011**	**31-AUG-2011**	26-AUG-2011	×	**05-SEP-2011**	31-AUG-2011	×
Soil Glass Jar - Unpreserved 3/0.3-0.4, 3/1.0-1.1	**20-AUG-2011**	**05-SEP-2011**	27-AUG-2011	×	**05-SEP-2011**	05-SEP-2011	✓
Soil Glass Jar - Unpreserved 2/0.65-0.7	**20-AUG-2011**	**05-SEP-2011**	27-AUG-2011	×	**06-SEP-2011**	05-SEP-2011	×
Soil Glass Jar - Unpreserved 2/0.1-0.2	**20-AUG-2011**	**06-SEP-2011**	27-AUG-2011	×	**06-SEP-2011**	06-SEP-2011	✓
Soil Glass Jar - Unpreserved 1/0.4-0.5, 1/1.1-1.2	**21-AUG-2011**	**05-SEP-2011**	28-AUG-2011	×	**05-SEP-2011**	05-SEP-2011	✓
Soil Glass Jar - Unpreserved 3-2/0.5-0.6	**21-AUG-2011**	**31-AUG-2011**	28-AUG-2011	×	**05-SEP-2011**	31-AUG-2011	×
Soil Glass Jar - Unpreserved 0/0.2-0.3, 0/0.7-0.8, 0-2/0.2-0.3, 0-2/0.6-0.65	**22-AUG-2011**	**06-SEP-2011**	29-AUG-2011	×	**07-SEP-2011**	06-SEP-2011	×

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010: Conductivity								
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 14/0.3-0.4	15/0.55-0.66,	**15-AUG-2011**	**05-SEP-2011**	22-AUG-2011	×	**05-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 13-1/0.7-0.8		**15-AUG-2011**	**05-SEP-2011**	22-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 13-1/0.3-0.4		**15-AUG-2011**	**06-SEP-2011**	22-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 14/0.3-0.4		**15-AUG-2011**	**06-SEP-2011**	22-AUG-2011	×	**07-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 12/0.3-0.4, 11/1.0-1.1,	11/0.3-0.4, 10/0.6-0.7	**16-AUG-2011**	**05-SEP-2011**	23-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 12/0.2-0.3, 10/0.2-0.2	11/0.15-0.25,	**16-AUG-2011**	**06-SEP-2011**	23-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 12-1/0.4-0.5		**16-AUG-2011**	**31-AUG-2011**	23-AUG-2011	×	**05-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved 8/0.85-0.95,	9-2/0.3-0.4	**17-AUG-2011**	**05-SEP-2011**	24-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 8/0.35-0.45,	9-2/0.1-0.2	**17-AUG-2011**	**06-SEP-2011**	24-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 8-1/0.45-0.55		**17-AUG-2011**	**31-AUG-2011**	24-AUG-2011	×	**05-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved 7/0.7-0.8,	7-1/0.4-0.5	**18-AUG-2011**	**05-SEP-2011**	25-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 7/0.3-0.4,	6-2/0.8-0.9	**18-AUG-2011**	**06-SEP-2011**	25-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 6-1/0.4-0.5		**18-AUG-2011**	**31-AUG-2011**	25-AUG-2011	×	**05-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved 5/0.400-0.500,	5/0.95-1.05	**19-AUG-2011**	**05-SEP-2011**	26-AUG-2011	×	**05-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 4/0.6-0.65		**19-AUG-2011**	**05-SEP-2011**	26-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 4/0-0.1		**19-AUG-2011**	**06-SEP-2011**	26-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 4-1/0.1-0.2,	4-1/0.4-0.5	**19-AUG-2011**	**31-AUG-2011**	26-AUG-2011	×	**05-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved 3/0.3-0.4,	3/1.0-1.1	**20-AUG-2011**	**05-SEP-2011**	27-AUG-2011	×	**05-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 2/0.65-0.7		**20-AUG-2011**	**05-SEP-2011**	27-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010: Conductivity - Continued								
Soil Glass Jar - Unpreserved								
2/0.1-0.2		**20-AUG-2011**	**06-SEP-2011**	27-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved								
1/0.4-0.5,	1/1.1-1.2	**21-AUG-2011**	**05-SEP-2011**	28-AUG-2011	×	**05-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved								
3-2/0.5-0.6		**21-AUG-2011**	**31-AUG-2011**	28-AUG-2011	×	**05-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved								
0/0.2-0.3,	0/0.7-0.8,	**22-AUG-2011**	**06-SEP-2011**	29-AUG-2011	×	**07-SEP-2011**	04-OCT-2011	✓
0-2/0.2-0.3,	0-2/0.6-0.65							
EA013: Acid Neutralising Capacity								
Pulp Bag								
14/0.3-0.4,	14/0.3-0.4	**15-AUG-2011**	**30-AUG-2011**	14-AUG-2012	✓	**31-AUG-2011**	26-FEB-2012	✓
EA026 : Chromium Reducible Sulfur								
80* dried soil								
14/0.3-0.4		**15-AUG-2011**	**30-AUG-2011**	14-AUG-2012	✓	**31-AUG-2011**	28-NOV-2011	✓
Pulp Bag								
14/0.3-0.4		**15-AUG-2011**	**30-AUG-2011**	14-AUG-2012	✓	**31-AUG-2011**	28-NOV-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content								
Soil Glass Jar - Unpreserved								
15 /0.3-0.45, 14/0.3-0.4	15/0.55-0.66,	**15-AUG-2011**	**----**	----	----	**26-AUG-2011**	29-AUG-2011	✓
Soil Glass Jar - Unpreserved								
13-1/0.3-0.4,	13-1/0.7-0.8	**15-AUG-2011**	**----**	----	----	**29-AUG-2011**	29-AUG-2011	✓
Soil Glass Jar - Unpreserved								
12-1/0.4-0.5		**16-AUG-2011**	**----**	----	----	**26-AUG-2011**	30-AUG-2011	✓
Soil Glass Jar - Unpreserved								
12/0.2-0.3, 11/0.15-0.25, 11/1.0-1.1, 10/0.6-0.7	12/0.3-0.4, 11/0.3-0.4, 10/0.2-0.2,	**16-AUG-2011**	**----**	----	----	**29-AUG-2011**	30-AUG-2011	✓
Soil Glass Jar - Unpreserved								
8-1/0.45-0.55		**17-AUG-2011**	**----**	----	----	**26-AUG-2011**	31-AUG-2011	✓
Soil Glass Jar - Unpreserved								
8/0.35-0.45, 9-2/0.1-0.2,	8/0.85-0.95, 9-2/0.3-0.4	**17-AUG-2011**	**----**	----	----	**29-AUG-2011**	31-AUG-2011	✓
Soil Glass Jar - Unpreserved								
6-1/0.4-0.5		**18-AUG-2011**	**----**	----	----	**26-AUG-2011**	01-SEP-2011	✓
Soil Glass Jar - Unpreserved								
7/0.3-0.4, 6-2/0.8-0.9,	7/0.7-0.8, 7-1/0.4-0.5	**18-AUG-2011**	**----**	----	----	**29-AUG-2011**	01-SEP-2011	✓
Soil Glass Jar - Unpreserved								
5/0.400-0.500, 4-1/0.1-0.2,	5/0.95-1.05, 4-1/0.4-0.5	**19-AUG-2011**	**----**	----	----	**26-AUG-2011**	02-SEP-2011	✓
Soil Glass Jar - Unpreserved								
4/0-0.1,	4/0.6-0.65	**19-AUG-2011**	**----**	----	----	**29-AUG-2011**	02-SEP-2011	✓
Soil Glass Jar - Unpreserved								
3/0.3-0.4,	3/1.0-1.1	**20-AUG-2011**	**----**	----	----	**26-AUG-2011**	03-SEP-2011	✓
Soil Glass Jar - Unpreserved								
2/0.1-0.2,	2/0.65-0.7	**20-AUG-2011**	**----**	----	----	**29-AUG-2011**	03-SEP-2011	✓
Soil Glass Jar - Unpreserved								
1/0.4-0.5, 3-2/0.5-0.6	1/1.1-1.2,	**21-AUG-2011**	**----**	----	----	**26-AUG-2011**	04-SEP-2011	✓
Soil Glass Jar - Unpreserved								
0/0.2-0.3, 0-2/0.2-0.3,	0/0.7-0.8, 0-2/0.6-0.65	**22-AUG-2011**	**----**	----	----	**29-AUG-2011**	05-SEP-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED007: Exchangeable Cations								
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 14/0.3-0.4,	15/0.55-0.66, 13-1/0.3-0.4	**15-AUG-2011**	**07-SEP-2011**	11-FEB-2012	✓	**07-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved 12/0.2-0.3, 10/0.2-0.2	11/0.15-0.25,	**16-AUG-2011**	**07-SEP-2011**	12-FEB-2012	✓	**07-SEP-2011**	12-FEB-2012	✓
Soil Glass Jar - Unpreserved 8/0.35-0.45,	9-2/0.1-0.2	**17-AUG-2011**	**07-SEP-2011**	13-FEB-2012	✓	**07-SEP-2011**	13-FEB-2012	✓
Soil Glass Jar - Unpreserved 7/0.3-0.4,	6-2/0.8-0.9	**18-AUG-2011**	**07-SEP-2011**	14-FEB-2012	✓	**07-SEP-2011**	14-FEB-2012	✓
Soil Glass Jar - Unpreserved 5/0.400-0.500,	4/0-0.1	**19-AUG-2011**	**07-SEP-2011**	15-FEB-2012	✓	**07-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved 3/0.3-0.4,	2/0.1-0.2	**20-AUG-2011**	**07-SEP-2011**	16-FEB-2012	✓	**07-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved 1/0.4-0.5		**21-AUG-2011**	**07-SEP-2011**	17-FEB-2012	✓	**07-SEP-2011**	17-FEB-2012	✓
Soil Glass Jar - Unpreserved 0/0.2-0.3		**22-AUG-2011**	**07-SEP-2011**	18-FEB-2012	✓	**07-SEP-2011**	18-FEB-2012	✓
ED037: Alkalinity								
Soil Glass Jar - Unpreserved 15 /0.3-0.45,	15/0.55-0.66	**15-AUG-2011**	**05-SEP-2011**	11-FEB-2012	✓	**05-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved 14/0.3-0.4,	13-1/0.3-0.4	**15-AUG-2011**	**06-SEP-2011**	11-FEB-2012	✓	**07-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved 12/0.2-0.3, 10/0.2-0.2	11/0.15-0.25,	**16-AUG-2011**	**06-SEP-2011**	12-FEB-2012	✓	**07-SEP-2011**	12-FEB-2012	✓
Soil Glass Jar - Unpreserved 8/0.35-0.45,	9-2/0.1-0.2	**17-AUG-2011**	**06-SEP-2011**	13-FEB-2012	✓	**07-SEP-2011**	13-FEB-2012	✓
Soil Glass Jar - Unpreserved 7/0.3-0.4,	6-2/0.8-0.9	**18-AUG-2011**	**06-SEP-2011**	14-FEB-2012	✓	**07-SEP-2011**	14-FEB-2012	✓
Soil Glass Jar - Unpreserved 5/0.400-0.500		**19-AUG-2011**	**05-SEP-2011**	15-FEB-2012	✓	**05-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved 4/0-0.1		**19-AUG-2011**	**06-SEP-2011**	15-FEB-2012	✓	**07-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved 3/0.3-0.4		**20-AUG-2011**	**05-SEP-2011**	16-FEB-2012	✓	**05-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved 2/0.1-0.2		**20-AUG-2011**	**06-SEP-2011**	16-FEB-2012	✓	**07-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved 1/0.4-0.5		**21-AUG-2011**	**05-SEP-2011**	17-FEB-2012	✓	**05-SEP-2011**	17-FEB-2012	✓
Soil Glass Jar - Unpreserved 0/0.2-0.3		**22-AUG-2011**	**06-SEP-2011**	18-FEB-2012	✓	**07-SEP-2011**	18-FEB-2012	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED040S : Soluble Sulfate by ICPAES							
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 15/0.55-0.66	**15-AUG-2011**	**05-SEP-2011**	22-AUG-2011	×	**05-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 13-1/0.3-0.4	**15-AUG-2011**	**06-SEP-2011**	22-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 14/0.3-0.4	**15-AUG-2011**	**06-SEP-2011**	22-AUG-2011	×	**07-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 12/0.2-0.3, 11/0.15-0.25, 10/0.2-0.2	**16-AUG-2011**	**06-SEP-2011**	23-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 8/0.35-0.45, 9-2/0.1-0.2	**17-AUG-2011**	**06-SEP-2011**	24-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 7/0.3-0.4, 6-2/0.8-0.9	**18-AUG-2011**	**06-SEP-2011**	25-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 5/0.400-0.500	**19-AUG-2011**	**05-SEP-2011**	26-AUG-2011	×	**05-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 4/0-0.1	**19-AUG-2011**	**06-SEP-2011**	26-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 3/0.3-0.4	**20-AUG-2011**	**05-SEP-2011**	27-AUG-2011	×	**05-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 2/0.1-0.2	**20-AUG-2011**	**06-SEP-2011**	27-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 1/0.4-0.5	**21-AUG-2011**	**05-SEP-2011**	28-AUG-2011	×	**05-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 0/0.2-0.3	**22-AUG-2011**	**06-SEP-2011**	29-AUG-2011	×	**07-SEP-2011**	04-OCT-2011	✓
ED042T: Total Sulfur by LECO							
Pulp Bag 14/0.3-0.4, 14/0.3-0.4	**15-AUG-2011**	**30-AUG-2011**	11-FEB-2012	✓	**30-AUG-2011**	11-FEB-2012	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride Discrete analyser								
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 14/0.3-0.4,	15/0.55-0.66, 13-1/0.7-0.8	**15-AUG-2011**	**05-SEP-2011**	22-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 13-1/0.3-0.4		**15-AUG-2011**	**06-SEP-2011**	22-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 14/0.3-0.4		**15-AUG-2011**	**06-SEP-2011**	22-AUG-2011	×	**07-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 12/0.3-0.4, 11/1.0-1.1,	11/0.3-0.4, 10/0.6-0.7	**16-AUG-2011**	**05-SEP-2011**	23-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 12/0.2-0.3, 10/0.2-0.2	11/0.15-0.25,	**16-AUG-2011**	**06-SEP-2011**	23-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 12-1/0.4-0.5		**16-AUG-2011**	**31-AUG-2011**	23-AUG-2011	×	**06-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved 8/0.85-0.95,	9-2/0.3-0.4	**17-AUG-2011**	**05-SEP-2011**	24-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 8/0.35-0.45,	9-2/0.1-0.2	**17-AUG-2011**	**06-SEP-2011**	24-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 8-1/0.45-0.55		**17-AUG-2011**	**31-AUG-2011**	24-AUG-2011	×	**06-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved 7/0.7-0.8,	7-1/0.4-0.5	**18-AUG-2011**	**05-SEP-2011**	25-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 7/0.3-0.4,	6-2/0.8-0.9	**18-AUG-2011**	**06-SEP-2011**	25-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 6-1/0.4-0.5		**18-AUG-2011**	**31-AUG-2011**	25-AUG-2011	×	**06-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved 5/0.400-0.500, 4/0.6-0.65	5/0.95-1.05,	**19-AUG-2011**	**05-SEP-2011**	26-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 4/0-0.1		**19-AUG-2011**	**06-SEP-2011**	26-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 4-1/0.1-0.2,	4-1/0.4-0.5	**19-AUG-2011**	**31-AUG-2011**	26-AUG-2011	×	**06-SEP-2011**	28-SEP-2011	✓
Soil Glass Jar - Unpreserved 3/0.3-0.4, 2/0.65-0.7	3/1.0-1.1,	**20-AUG-2011**	**05-SEP-2011**	27-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 2/0.1-0.2		**20-AUG-2011**	**06-SEP-2011**	27-AUG-2011	×	**06-SEP-2011**	04-OCT-2011	✓
Soil Glass Jar - Unpreserved 1/0.4-0.5,	1/1.1-1.2	**21-AUG-2011**	**05-SEP-2011**	28-AUG-2011	×	**06-SEP-2011**	03-OCT-2011	✓
Soil Glass Jar - Unpreserved 3-2/0.5-0.6		**21-AUG-2011**	**31-AUG-2011**	28-AUG-2011	×	**06-SEP-2011**	28-SEP-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride Discrete analyser - Continued								
Soil Glass Jar - Unpreserved								
0/0.2-0.3, 0-2/0.2-0.3,	0/0.7-0.8, 0-2/0.6-0.65	**22-AUG-2011**	**06-SEP-2011**	29-AUG-2011	×	**07-SEP-2011**	04-OCT-2011	✓
ED093S: Soluble Major Cations								
Soil Glass Jar - Unpreserved								
15 /0.3-0.45,	15/0.55-0.66	**15-AUG-2011**	**05-SEP-2011**	11-FEB-2012	✓	**05-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved								
13-1/0.3-0.4		**15-AUG-2011**	**06-SEP-2011**	11-FEB-2012	✓	**06-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved								
14/0.3-0.4		**15-AUG-2011**	**06-SEP-2011**	11-FEB-2012	✓	**07-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved								
12/0.2-0.3, 10/0.2-0.2	11/0.15-0.25,	**16-AUG-2011**	**06-SEP-2011**	12-FEB-2012	✓	**06-SEP-2011**	12-FEB-2012	✓
Soil Glass Jar - Unpreserved								
8/0.35-0.45,	9-2/0.1-0.2	**17-AUG-2011**	**06-SEP-2011**	13-FEB-2012	✓	**06-SEP-2011**	13-FEB-2012	✓
Soil Glass Jar - Unpreserved								
7/0.3-0.4,	6-2/0.8-0.9	**18-AUG-2011**	**06-SEP-2011**	14-FEB-2012	✓	**06-SEP-2011**	14-FEB-2012	✓
Soil Glass Jar - Unpreserved								
5/0.400-0.500		**19-AUG-2011**	**05-SEP-2011**	15-FEB-2012	✓	**05-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved								
4/0-0.1		**19-AUG-2011**	**06-SEP-2011**	15-FEB-2012	✓	**06-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved								
3/0.3-0.4		**20-AUG-2011**	**05-SEP-2011**	16-FEB-2012	✓	**05-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved								
2/0.1-0.2		**20-AUG-2011**	**06-SEP-2011**	16-FEB-2012	✓	**06-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved								
1/0.4-0.5		**21-AUG-2011**	**05-SEP-2011**	17-FEB-2012	✓	**05-SEP-2011**	17-FEB-2012	✓
Soil Glass Jar - Unpreserved								
0/0.2-0.3		**22-AUG-2011**	**06-SEP-2011**	18-FEB-2012	✓	**07-SEP-2011**	18-FEB-2012	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 14/0.3-0.4, 13-1/0.3-0.4	**15-AUG-2011**	**06-SEP-2011**	11-FEB-2012	✓	**06-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved 12/0.2-0.3, 11/0.15-0.25, 10/0.2-0.2	**16-AUG-2011**	**06-SEP-2011**	12-FEB-2012	✓	**06-SEP-2011**	12-FEB-2012	✓
Soil Glass Jar - Unpreserved 8/0.35-0.45, 9-2/0.1-0.2	**17-AUG-2011**	**06-SEP-2011**	13-FEB-2012	✓	**06-SEP-2011**	13-FEB-2012	✓
Soil Glass Jar - Unpreserved 7/0.3-0.4, 6-2/0.8-0.9	**18-AUG-2011**	**06-SEP-2011**	14-FEB-2012	✓	**06-SEP-2011**	14-FEB-2012	✓
Soil Glass Jar - Unpreserved 5/0.400-0.500	**19-AUG-2011**	**05-SEP-2011**	15-FEB-2012	✓	**06-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved 4/0-0.1	**19-AUG-2011**	**06-SEP-2011**	15-FEB-2012	✓	**06-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved 3/0.3-0.4, 2/0.1-0.2	**20-AUG-2011**	**06-SEP-2011**	16-FEB-2012	✓	**06-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved 1/0.4-0.5	**21-AUG-2011**	**05-SEP-2011**	17-FEB-2012	✓	**06-SEP-2011**	17-FEB-2012	✓
Soil Glass Jar - Unpreserved 0/0.2-0.3	**22-AUG-2011**	**06-SEP-2011**	18-FEB-2012	✓	**07-SEP-2011**	18-FEB-2012	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 14/0.3-0.4, 13-1/0.3-0.4	**15-AUG-2011**	**03-SEP-2011**	11-FEB-2012	✓	**05-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved 12/0.2-0.3, 11/0.15-0.25, 10/0.2-0.2	**16-AUG-2011**	**03-SEP-2011**	12-FEB-2012	✓	**05-SEP-2011**	12-FEB-2012	✓
Soil Glass Jar - Unpreserved 8/0.35-0.45, 9-2/0.1-0.2	**17-AUG-2011**	**03-SEP-2011**	13-FEB-2012	✓	**05-SEP-2011**	13-FEB-2012	✓
Soil Glass Jar - Unpreserved 7/0.3-0.4, 6-2/0.8-0.9	**18-AUG-2011**	**03-SEP-2011**	14-FEB-2012	✓	**05-SEP-2011**	14-FEB-2012	✓
Soil Glass Jar - Unpreserved 5/0.400-0.500, 4/0-0.1	**19-AUG-2011**	**03-SEP-2011**	15-FEB-2012	✓	**05-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved 3/0.3-0.4	**20-AUG-2011**	**03-SEP-2011**	16-FEB-2012	✓	**05-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved 2/0.1-0.2	**20-AUG-2011**	**05-SEP-2011**	16-FEB-2012	✓	**06-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved 1/0.4-0.5	**21-AUG-2011**	**05-SEP-2011**	17-FEB-2012	✓	**06-SEP-2011**	17-FEB-2012	✓
Soil Glass Jar - Unpreserved 0/0.2-0.3	**22-AUG-2011**	**05-SEP-2011**	18-FEB-2012	✓	**06-SEP-2011**	18-FEB-2012	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK067G: Total Phosphorus as P by Discrete Analyser							
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 14/0.3-0.4, 13-1/0.3-0.4	**15-AUG-2011**	**03-SEP-2011**	11-FEB-2012	✓	**05-SEP-2011**	11-FEB-2012	✓
Soil Glass Jar - Unpreserved 12/0.2-0.3, 11/0.15-0.25, 10/0.2-0.2	**16-AUG-2011**	**03-SEP-2011**	12-FEB-2012	✓	**05-SEP-2011**	12-FEB-2012	✓
Soil Glass Jar - Unpreserved 8/0.35-0.45, 9-2/0.1-0.2	**17-AUG-2011**	**03-SEP-2011**	13-FEB-2012	✓	**05-SEP-2011**	13-FEB-2012	✓
Soil Glass Jar - Unpreserved 7/0.3-0.4, 6-2/0.8-0.9	**18-AUG-2011**	**03-SEP-2011**	14-FEB-2012	✓	**05-SEP-2011**	14-FEB-2012	✓
Soil Glass Jar - Unpreserved 5/0.400-0.500, 4/0-0.1	**19-AUG-2011**	**03-SEP-2011**	15-FEB-2012	✓	**05-SEP-2011**	15-FEB-2012	✓
Soil Glass Jar - Unpreserved 3/0.3-0.4	**20-AUG-2011**	**03-SEP-2011**	16-FEB-2012	✓	**05-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved 2/0.1-0.2	**20-AUG-2011**	**05-SEP-2011**	16-FEB-2012	✓	**06-SEP-2011**	16-FEB-2012	✓
Soil Glass Jar - Unpreserved 1/0.4-0.5	**21-AUG-2011**	**05-SEP-2011**	17-FEB-2012	✓	**06-SEP-2011**	17-FEB-2012	✓
Soil Glass Jar - Unpreserved 0/0.2-0.3	**22-AUG-2011**	**05-SEP-2011**	18-FEB-2012	✓	**06-SEP-2011**	18-FEB-2012	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Acid Neutralising Capacity (ANC)	EA013	1	5	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Alkalinity in Soil	ED037	3	16	**18.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Cations - soluble by ICP-AES	ED093S	4	16	**25.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	6	40	**15.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	1	8	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	6	40	**15.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	2	17	**11.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	4	16	**25.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Moisture Content	EA055-103	5	35	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	4	16	**25.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	6	40	**15.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	1	2	**50.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TKN as N By Discrete Analyser	EK061G	3	23	**13.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosporus By Discrete Analyser	EK067G	3	23	**13.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Acid Neutralising Capacity (ANC)	EA013	1	5	**20.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Alkalinity in Soil	ED037	4	17	**23.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	12	41	**29.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	6	41	**14.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	1	17	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	4	17	**23.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	3	16	**18.8**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	6	41	**14.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	1	2	**50.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TKN as N By Discrete Analyser	EK061G	2	23	**8.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosporus By Discrete Analyser	EK067G	2	23	**8.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Alkalinity in Soil	ED037	4	17	**23.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Cations - soluble by ICP-AES	ED093S	4	17	**23.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	6	41	**14.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	6	41	**14.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	1	17	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	4	17	**23.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	3	16	**18.8**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Sulfur - Total as S (LECO)	ED042T	1	2	**50.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TKN as N By Discrete Analyser	EK061G	2	23	**8.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosporus By Discrete Analyser	EK067G	2	23	**8.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	15	**13.3**	**5.0**	✓	ALS QCS3 requirement
TKN as N By Discrete Analyser	EK061G	2	23	**8.7**	**5.0**	✓	ALS QCS3 requirement
Total Phosporus By Discrete Analyser	EK067G	2	23	**8.7**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 103)
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 104)
Acid Neutralising Capacity (ANC)	EA013	SOIL	USEPA 600/2-78-054, I. Miller (2000). A fizz test is done to semiquanititatively estimate the likely reactivity. The soil is then reacted with an known excess quanitity of an appropriate acid. Titration determines the acid remaining, and the ANC can be calculated from comparison with a blank titration.
Chromium Reducible Sulphur	EA026	SOIL	Sullivan et al (1998) The CRS method converts reduced inorganic sulfur to H2S by CrCl2 solution ; the evolved H2S is trapped in a zinc acetate solution as ZnS which is quantified by iodometric titration.
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2010 Draft) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Exchangeable Cations	ED007	SOIL	Rayment & Higginson (1992) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (1999) Schedule B(3) (Method 301)
Alkalinity in Soil	ED037	SOIL	APHA 21st ed., 2320 B Alkalinity is determined and reported on a 1:5 soil/water leach.
Major Anions - Soluble	ED040S	SOIL	In-house. Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Sulfur - Total as S (LECO)	ED042T	SOIL	In-house. Dried and pulverised sample is combusted in a LECO furnace at 1350C in the presence of strong oxidants / catalysts. The evolved S (as SO2) is measured by infra-red detector
Chloride Soluble By Discrete Analyser	ED045G	SOIL	The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition 4500-Cl- E.
Cations - soluble by ICP-AES	ED093S	SOIL	APHA 21st ed., 3120; USEPA SW 846 - 6010 (ICPAES) Water extracts of the soil are analyzed for major cations by ICPAES. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3)
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	SOIL	APHA 21st ed., 4500 NO3- F. Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by Cadmium Reduction, and direct colourimetry by Discrete Analyser.
TKN as N By Discrete Analyser	EK061G	SOIL	APHA 21st ed., 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by Discrete Analyser.
Total Nitrogen as N (TKN + NOx) By Discrete Analyser	EK062G	SOIL	APHA 21st ed., 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.
Total Phosporus By Discrete Analyser	EK067G	SOIL	APHA 21st ed., 4500 P-B&F This procedure involves sulfuric acid digestion and quantification using Discrete Analyser.

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method	ED007PR	SOIL	Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
TKN/TP Digestion	EK061/EK067	SOIL	APHA 21st ed., 4500 Norg- D; APHA 21st ed., 4500 P - H. Macro Kjeldahl digestion.
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
ED037: Alkalinity	EB1117162-049	1/1.1-1.2	**Total Alkalinity as CaCO3**	----	Not Determined		**Analyte not determined in allocated original sample.**
ED037: Alkalinity	EB1117162-049	1/1.1-1.2	**Total Alkalinity as CaCO3**	----	Not Determined		**RPD exceeds LOR based limits**
ED093S: Soluble Major Cations	EB1117162-049	1/1.1-1.2	**Calcium**	7440-70-2	Not Determined		**Analyte not determined in allocated original sample.**
ED093S: Soluble Major Cations	EB1117162-049	1/1.1-1.2	**Magnesium**	7439-95-4	Not Determined		**Analyte not determined in allocated original sample.**
ED093S: Soluble Major Cations	EB1117162-049	1/1.1-1.2	**Sodium**	7440-23-5	Not Determined		**RPD exceeds LOR based limits**
ED093S: Soluble Major Cations	EB1117162-049	1/1.1-1.2	**Sodium**	7440-23-5	Not Determined		**Analyte not determined in allocated original sample.**
ED093S: Soluble Major Cations	EB1117162-049	1/1.1-1.2	**Potassium**	7440-09-7	Not Determined		**Analyte not determined in allocated original sample.**
Matrix Spike (MS) Recoveries							
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser	EB1117162-048	1/0.4-0.5	**Total Kjeldahl Nitrogen as N**	----	133 %	70-130%	**Recovery greater than upper data quality objective**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	**Days overdue**	Date analysed	Due for analysis	**Days overdue**
EA002 : pH (Soils)						
Soil Glass Jar - Unpreserved 15 /0.3-0.45, 15/0.55-0.66, 14/0.3-0.4	05-SEP-2011	22-AUG-2011	**14**	----	----	----

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002 : pH (Soils) - Analysis Holding Time Compliance							
Soil Glass Jar - Unpreserved							
13-1/0.7-0.8		05-SEP-2011	22-AUG-2011	**14**	06-SEP-2011	05-SEP-2011	**1**
Soil Glass Jar - Unpreserved							
13-1/0.3-0.4		06-SEP-2011	22-AUG-2011	**15**	----	----	----
Soil Glass Jar - Unpreserved							
14/0.3-0.4		06-SEP-2011	22-AUG-2011	**15**	07-SEP-2011	06-SEP-2011	**1**
Soil Glass Jar - Unpreserved							
12/0.3-0.4,	11/0.3-0.4,	05-SEP-2011	23-AUG-2011	**13**	06-SEP-2011	05-SEP-2011	**1**
11/1.0-1.1,	10/0.6-0.7						
Soil Glass Jar - Unpreserved							
12/0.2-0.3,	11/0.15-0.25,	06-SEP-2011	23-AUG-2011	**14**	----	----	----
10/0.2-0.2							
Soil Glass Jar - Unpreserved							
12-1/0.4-0.5		31-AUG-2011	23-AUG-2011	**8**	05-SEP-2011	31-AUG-2011	**5**
Soil Glass Jar - Unpreserved							
8/0.85-0.95,	9-2/0.3-0.4	05-SEP-2011	24-AUG-2011	**12**	06-SEP-2011	05-SEP-2011	**1**
Soil Glass Jar - Unpreserved							
8/0.35-0.45,	9-2/0.1-0.2	06-SEP-2011	24-AUG-2011	**13**	----	----	----
Soil Glass Jar - Unpreserved							
8-1/0.45-0.55		31-AUG-2011	24-AUG-2011	**7**	05-SEP-2011	31-AUG-2011	**5**
Soil Glass Jar - Unpreserved							
7/0.7-0.8,	7-1/0.4-0.5	05-SEP-2011	25-AUG-2011	**11**	06-SEP-2011	05-SEP-2011	**1**
Soil Glass Jar - Unpreserved							
7/0.3-0.4,	6-2/0.8-0.9	06-SEP-2011	25-AUG-2011	**12**	----	----	----
Soil Glass Jar - Unpreserved							
6-1/0.4-0.5		31-AUG-2011	25-AUG-2011	**6**	05-SEP-2011	31-AUG-2011	**5**
Soil Glass Jar - Unpreserved							
5/0.400-0.500,	5/0.95-1.05	05-SEP-2011	26-AUG-2011	**10**	----	----	----
Soil Glass Jar - Unpreserved							
4/0.6-0.65		05-SEP-2011	26-AUG-2011	**10**	06-SEP-2011	05-SEP-2011	**1**
Soil Glass Jar - Unpreserved							
4/0-0.1		06-SEP-2011	26-AUG-2011	**11**	----	----	----
Soil Glass Jar - Unpreserved							
4-1/0.1-0.2,	4-1/0.4-0.5	31-AUG-2011	26-AUG-2011	**5**	05-SEP-2011	31-AUG-2011	**5**
Soil Glass Jar - Unpreserved							
3/0.3-0.4,	3/1.0-1.1	05-SEP-2011	27-AUG-2011	**9**	----	----	----
Soil Glass Jar - Unpreserved							
2/0.65-0.7		05-SEP-2011	27-AUG-2011	**9**	06-SEP-2011	05-SEP-2011	**1**
Soil Glass Jar - Unpreserved							
2/0.1-0.2		06-SEP-2011	27-AUG-2011	**10**	----	----	----

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002 : pH (Soils) - Analysis Holding Time Compliance							
Soil Glass Jar - Unpreserved							
1/0.4-0.5,	1/1.1-1.2	05-SEP-2011	28-AUG-2011	**8**	----	----	----
Soil Glass Jar - Unpreserved							
3-2/0.5-0.6		31-AUG-2011	28-AUG-2011	**3**	05-SEP-2011	31-AUG-2011	**5**
Soil Glass Jar - Unpreserved							
0/0.2-0.3,	0/0.7-0.8,	06-SEP-2011	29-AUG-2011	**8**	07-SEP-2011	06-SEP-2011	**1**
0-2/0.2-0.3,	0-2/0.6-0.65						
EA010: Conductivity							
Soil Glass Jar - Unpreserved							
15 /0.3-0.45,	15/0.55-0.66,	05-SEP-2011	22-AUG-2011	**14**	----	----	----
14/0.3-0.4							
Soil Glass Jar - Unpreserved							
13-1/0.7-0.8		05-SEP-2011	22-AUG-2011	**14**	----	----	----
Soil Glass Jar - Unpreserved							
13-1/0.3-0.4		06-SEP-2011	22-AUG-2011	**15**	----	----	----
Soil Glass Jar - Unpreserved							
14/0.3-0.4		06-SEP-2011	22-AUG-2011	**15**	----	----	----
Soil Glass Jar - Unpreserved							
12/0.3-0.4,	11/0.3-0.4,	05-SEP-2011	23-AUG-2011	**13**	----	----	----
11/1.0-1.1,	10/0.6-0.7						
Soil Glass Jar - Unpreserved							
12/0.2-0.3,	11/0.15-0.25,	06-SEP-2011	23-AUG-2011	**14**	----	----	----
10/0.2-0.2							
Soil Glass Jar - Unpreserved							
12-1/0.4-0.5		31-AUG-2011	23-AUG-2011	**8**	----	----	----
Soil Glass Jar - Unpreserved							
8/0.85-0.95,	9-2/0.3-0.4	05-SEP-2011	24-AUG-2011	**12**	----	----	----
Soil Glass Jar - Unpreserved							
8/0.35-0.45,	9-2/0.1-0.2	06-SEP-2011	24-AUG-2011	**13**	----	----	----
Soil Glass Jar - Unpreserved							
8-1/0.45-0.55		31-AUG-2011	24-AUG-2011	**7**	----	----	----
Soil Glass Jar - Unpreserved							
7/0.7-0.8,	7-1/0.4-0.5	05-SEP-2011	25-AUG-2011	**11**	----	----	----
Soil Glass Jar - Unpreserved							
7/0.3-0.4,	6-2/0.8-0.9	06-SEP-2011	25-AUG-2011	**12**	----	----	----
Soil Glass Jar - Unpreserved							
6-1/0.4-0.5		31-AUG-2011	25-AUG-2011	**6**	----	----	----
Soil Glass Jar - Unpreserved							
5/0.400-0.500,	5/0.95-1.05	05-SEP-2011	26-AUG-2011	**10**	----	----	----
Soil Glass Jar - Unpreserved							
4/0.6-0.65		05-SEP-2011	26-AUG-2011	**10**	----	----	----

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA010: Conductivity - Analysis Holding Time Compliance							
Soil Glass Jar - Unpreserved							
4/0-0.1		06-SEP-2011	26-AUG-2011	**11**	----	----	----
Soil Glass Jar - Unpreserved							
4-1/0.1-0.2,	4-1/0.4-0.5	31-AUG-2011	26-AUG-2011	**5**	----	----	----
Soil Glass Jar - Unpreserved							
3/0.3-0.4,	3/1.0-1.1	05-SEP-2011	27-AUG-2011	**9**	----	----	----
Soil Glass Jar - Unpreserved							
2/0.65-0.7		05-SEP-2011	27-AUG-2011	**9**	----	----	----
Soil Glass Jar - Unpreserved							
2/0.1-0.2		06-SEP-2011	27-AUG-2011	**10**	----	----	----
Soil Glass Jar - Unpreserved							
1/0.4-0.5,	1/1.1-1.2	05-SEP-2011	28-AUG-2011	**8**	----	----	----
Soil Glass Jar - Unpreserved							
3-2/0.5-0.6		31-AUG-2011	28-AUG-2011	**3**	----	----	----
Soil Glass Jar - Unpreserved							
0/0.2-0.3,	0/0.7-0.8,	06-SEP-2011	29-AUG-2011	**8**	----	----	----
0-2/0.2-0.3,	0-2/0.6-0.65						
ED040S : Soluble Sulfate by ICPAES							
Soil Glass Jar - Unpreserved							
15 /0.3-0.45,	15/0.55-0.66	05-SEP-2011	22-AUG-2011	**14**	----	----	----
Soil Glass Jar - Unpreserved							
13-1/0.3-0.4		06-SEP-2011	22-AUG-2011	**15**	----	----	----
Soil Glass Jar - Unpreserved							
14/0.3-0.4		06-SEP-2011	22-AUG-2011	**15**	----	----	----
Soil Glass Jar - Unpreserved							
12/0.2-0.3,	11/0.15-0.25,	06-SEP-2011	23-AUG-2011	**14**	----	----	----
10/0.2-0.2							
Soil Glass Jar - Unpreserved							
8/0.35-0.45,	9-2/0.1-0.2	06-SEP-2011	24-AUG-2011	**13**	----	----	----
Soil Glass Jar - Unpreserved							
7/0.3-0.4,	6-2/0.8-0.9	06-SEP-2011	25-AUG-2011	**12**	----	----	----
Soil Glass Jar - Unpreserved							
5/0.400-0.500		05-SEP-2011	26-AUG-2011	**10**	----	----	----
Soil Glass Jar - Unpreserved							
4/0-0.1		06-SEP-2011	26-AUG-2011	**11**	----	----	----
Soil Glass Jar - Unpreserved							
3/0.3-0.4		05-SEP-2011	27-AUG-2011	**9**	----	----	----
Soil Glass Jar - Unpreserved							
2/0.1-0.2		06-SEP-2011	27-AUG-2011	**10**	----	----	----
Soil Glass Jar - Unpreserved							
1/0.4-0.5		05-SEP-2011	28-AUG-2011	**8**	----	----	----

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
ED040S : Soluble Sulfate by ICPAES - Analysis Holding Time Compliance							
Soil Glass Jar - Unpreserved							
0/0.2-0.3		06-SEP-2011	29-AUG-2011	**8**	----	----	----
ED045G: Chloride Discrete analyser							
Soil Glass Jar - Unpreserved							
15 /0.3-0.45, 14/0.3-0.4,	15/0.55-0.66, 13-1/0.7-0.8	05-SEP-2011	22-AUG-2011	**14**	----	----	----
Soil Glass Jar - Unpreserved							
13-1/0.3-0.4		06-SEP-2011	22-AUG-2011	**15**	----	----	----
Soil Glass Jar - Unpreserved							
14/0.3-0.4		06-SEP-2011	22-AUG-2011	**15**	----	----	----
Soil Glass Jar - Unpreserved							
12/0.3-0.4, 11/1.0-1.1,	11/0.3-0.4, 10/0.6-0.7	05-SEP-2011	23-AUG-2011	**13**	----	----	----
Soil Glass Jar - Unpreserved							
12/0.2-0.3, 10/0.2-0.2	11/0.15-0.25,	06-SEP-2011	23-AUG-2011	**14**	----	----	----
Soil Glass Jar - Unpreserved							
12-1/0.4-0.5		31-AUG-2011	23-AUG-2011	**8**	----	----	----
Soil Glass Jar - Unpreserved							
8/0.85-0.95,	9-2/0.3-0.4	05-SEP-2011	24-AUG-2011	**12**	----	----	----
Soil Glass Jar - Unpreserved							
8/0.35-0.45,	9-2/0.1-0.2	06-SEP-2011	24-AUG-2011	**13**	----	----	----
Soil Glass Jar - Unpreserved							
8-1/0.45-0.55		31-AUG-2011	24-AUG-2011	**7**	----	----	----
Soil Glass Jar - Unpreserved							
7/0.7-0.8,	7-1/0.4-0.5	05-SEP-2011	25-AUG-2011	**11**	----	----	----
Soil Glass Jar - Unpreserved							
7/0.3-0.4,	6-2/0.8-0.9	06-SEP-2011	25-AUG-2011	**12**	----	----	----
Soil Glass Jar - Unpreserved							
6-1/0.4-0.5		31-AUG-2011	25-AUG-2011	**6**	----	----	----
Soil Glass Jar - Unpreserved							
5/0.400-0.500, 4/0.6-0.65	5/0.95-1.05,	05-SEP-2011	26-AUG-2011	**10**	----	----	----
Soil Glass Jar - Unpreserved							
4/0-0.1		06-SEP-2011	26-AUG-2011	**11**	----	----	----
Soil Glass Jar - Unpreserved							
4-1/0.1-0.2,	4-1/0.4-0.5	31-AUG-2011	26-AUG-2011	**5**	----	----	----
Soil Glass Jar - Unpreserved							
3/0.3-0.4, 2/0.65-0.7	3/1.0-1.1,	05-SEP-2011	27-AUG-2011	**9**	----	----	----
Soil Glass Jar - Unpreserved							
2/0.1-0.2		06-SEP-2011	27-AUG-2011	**10**	----	----	----

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
ED045G: Chloride Discrete analyser - Analysis Holding Time Compliance						
Soil Glass Jar - Unpreserved						
1/0.4-0.5, 1/1.1-1.2	05-SEP-2011	28-AUG-2011	**8**	----	----	----
Soil Glass Jar - Unpreserved						
3-2/0.5-0.6	31-AUG-2011	28-AUG-2011	**3**	----	----	----
Soil Glass Jar - Unpreserved						
0/0.2-0.3, 0/0.7-0.8, 0-2/0.2-0.3, 0-2/0.6-0.65	06-SEP-2011	29-AUG-2011	**8**	----	----	----

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order : **EB1117162**

Client	: **SINCLAIR KNIGHT MERZ**	Laboratory	: Environmental Division Brisbane
Contact	: MS KRISTELLE GENTIL	Contact	: Dean Sullivan
Address	: 32 CORDELIA STREET SOUTH BRISBANE QLD, AUSTRALIA 4101	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: kgentil@globalskm.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 07 3026 8323	Telephone	: +61 7 3243 7144
Facsimile	: +61 0730 267 306	Facsimile	: +61 7 3243 7218
Project	: EN02962 ABP	Page	: 1 of 5
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2010SINKNI0337 (EN/003/10)
Site	: ----		
Sampler	: Kristelle Gentil	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 24-AUG-2011	Issue Date	: 29-AUG-2011 11:55
Client Requested Due Date	: 07-SEP-2011	Scheduled Reporting Date	: **07-SEP-2011**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 13°C 13°C 14°C - Ice present
No. of coolers/boxes	: 3 MEDIUM	No. of samples received	: 56
Security Seal	: Intact.	No. of samples analysed	: 41

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Please be advised that analysis have been adjusted as per an updated COC.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	(On Hold) SOIL No analysis requested	SOIL - EA002 pH (1:5)	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA013 Acid Neutralising Capacity (ANC)	SOIL - EA026 Chromium Reducible Sulphur	SOIL - EA055-103 Moisture Content	SOIL - ED007 CEC / Exchangeable Cations (ED007)	SOIL - ED037 Alkalinity in Soil
EB1117162-001	15-AUG-2011 15:00	15 /0.3-0.45		✓	✓				✓	✓
EB1117162-002	15-AUG-2011 15:00	15/0.55-0.66		✓	✓				✓	✓
EB1117162-003	15-AUG-2011 15:00	14/0.3-0.4		✓	✓	✓	✓		✓	✓
EB1117162-004	15-AUG-2011 15:00	14/0.3-0.4		✓	✓	✓	✓			
EB1117162-005	15-AUG-2011 15:00	13/0.25-0.3	✓							
EB1117162-006	15-AUG-2011 15:00	13/0.6-0.7	✓							
EB1117162-007	15-AUG-2011 15:00	13-1/0.3-0.4		✓	✓				✓	✓
EB1117162-008	15-AUG-2011 15:00	13-1/0.5-0.55	✓							
EB1117162-009	15-AUG-2011 15:00	13-1/0.7-0.8		✓	✓			✓		
EB1117162-010	16-AUG-2011 15:00	12/0.1-0.2	✓							
EB1117162-011	16-AUG-2011 15:00	12/0.2-0.3		✓	✓				✓	✓
EB1117162-012	16-AUG-2011 15:00	12/0.3-0.4		✓	✓			✓		
EB1117162-013	16-AUG-2011 15:00	12-1/0.4-0.5		✓	✓			✓		
EB1117162-014	16-AUG-2011 15:00	11/0.15-0.25		✓	✓				✓	✓
EB1117162-015	16-AUG-2011 15:00	11/0.3-0.4		✓	✓			✓		
EB1117162-016	16-AUG-2011 15:00	11/1.0-1.1		✓	✓			✓		
EB1117162-017	16-AUG-2011 15:00	10/0.2-0.2		✓	✓				✓	✓
EB1117162-018	16-AUG-2011 15:00	10/0.3-0.4	✓							
EB1117162-019	16-AUG-2011 15:00	10/0.6-0.7		✓	✓			✓		
EB1117162-020	17-AUG-2011 15:00	8/0.35-0.45		✓	✓				✓	✓
EB1117162-021	17-AUG-2011 15:00	8/0.5-0.6	✓							
EB1117162-022	17-AUG-2011 15:00	8/0.85-0.95		✓	✓			✓		
EB1117162-023	17-AUG-2011 15:00	8-1/0.45-0.55		✓	✓			✓		
EB1117162-024	17-AUG-2011 15:00	9/0-0.1	✓							
EB1117162-025	17-AUG-2011 15:00	9/0.2-0.3	✓							
EB1117162-026	17-AUG-2011 15:00	9/0.4-0.5	✓							
EB1117162-027	17-AUG-2011 15:00	9-2/0.1-0.2		✓	✓				✓	✓
EB1117162-028	17-AUG-2011 15:00	9-2/0.3-0.4		✓	✓			✓		
EB1117162-029	18-AUG-2011 15:00	7/0.3-0.4		✓	✓				✓	✓
EB1117162-030	18-AUG-2011 15:00	7/0.55-0.65	✓							
EB1117162-031	18-AUG-2011 15:00	7/0.7-0.8		✓	✓			✓		
EB1117162-032	18-AUG-2011 15:00	7/0.8-0.9	✓							
EB1117162-033	18-AUG-2011 15:00	6-1/0.4-0.5		✓	✓			✓		
EB1117162-034	18-AUG-2011 15:00	6/0.3-0.4	✓							

			(On Hold) SOIL No analysis requested	SOIL - EA002 pH (1:5)	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA013 Acid Neutralising Capacity (ANC)	SOIL - EA026 Chromium Reducible Sulphur	SOIL - EA055-103 Moisture Content	SOIL - ED007 CEC / Exchangeable Cations (ED007)	SOIL - ED037 Alkalinity in Soil
EB1117162-035	18-AUG-2011 15:00	6-2/0.8-0.9		✓	✓				✓	✓
EB1117162-036	19-AUG-2011 15:00	5/0.400-0.500		✓	✓				✓	✓
EB1117162-037	19-AUG-2011 15:00	5/0.95-1.05		✓	✓					
EB1117162-038	19-AUG-2011 15:00	4-1/0.1-0.2		✓	✓			✓		
EB1117162-039	19-AUG-2011 15:00	4-1/0.4-0.5		✓	✓			✓		
EB1117162-040	19-AUG-2011 15:00	4/0-0.1		✓	✓				✓	✓
EB1117162-041	19-AUG-2011 15:00	4/0.3-0.4	✓							
EB1117162-042	19-AUG-2011 15:00	4/0.6-0.65		✓	✓			✓		
EB1117162-043	20-AUG-2011 15:00	3/0.3-0.4		✓	✓				✓	✓
EB1117162-044	20-AUG-2011 15:00	3/1.0-1.1		✓	✓					
EB1117162-045	20-AUG-2011 15:00	2/0.1-0.2		✓	✓				✓	✓
EB1117162-046	20-AUG-2011 15:00	2/0.4-0.45	✓							
EB1117162-047	20-AUG-2011 15:00	2/0.65-0.7		✓	✓			✓		
EB1117162-048	21-AUG-2011 15:00	1/0.4-0.5		✓	✓				✓	✓
EB1117162-049	21-AUG-2011 15:00	1/1.1-1.2		✓	✓					
EB1117162-050	21-AUG-2011 15:00	3-2/0.5-0.6		✓	✓			✓		
EB1117162-051	22-AUG-2011 15:00	0/0.2-0.3		✓	✓				✓	✓
EB1117162-052	22-AUG-2011 15:00	0/0.4-0.5	✓							
EB1117162-053	22-AUG-2011 15:00	0/0.7-0.8		✓	✓			✓		
EB1117162-054	22-AUG-2011 15:00	0-2/0.2-0.3		✓	✓			✓		
EB1117162-055	22-AUG-2011 15:00	0-2/0.6-0.65		✓	✓			✓		
EB1117162-056	18-AUG-2011 15:00	7-1/0.4-0.5		✓	✓			✓		

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - ED042T Sulfur - Total as S (LECO)	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - NT-11S Total N + Total P	SOIL - NT-1S Major Cations (Ca, Mg, Na, K)	SOIL - NT-2S Major Anions (Cl, SO4)
EB1117162-001	15-AUG-2011 15:00	15 /0.3-0.45			✓	✓	✓
EB1117162-002	15-AUG-2011 15:00	15/0.55-0.66				✓	✓
EB1117162-003	15-AUG-2011 15:00	14/0.3-0.4	✓		✓	✓	✓
EB1117162-004	15-AUG-2011 15:00	14/0.3-0.4	✓	✓			
EB1117162-007	15-AUG-2011 15:00	13-1/0.3-0.4			✓	✓	✓
EB1117162-009	15-AUG-2011 15:00	13-1/0.7-0.8		✓			
EB1117162-011	16-AUG-2011 15:00	12/0.2-0.3			✓	✓	✓
EB1117162-012	16-AUG-2011 15:00	12/0.3-0.4		✓			

			SOIL - ED042T Sulfur - Total as S (LECO)	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - NT-11S Total N + Total P	SOIL - NT-1S Major Cations (Ca, Mg, Na, K)	SOIL - NT-2S Major Anions (Cl, SO4)
EB1117162-013	16-AUG-2011 15:00	12-1/0.4-0.5		✓			
EB1117162-014	16-AUG-2011 15:00	11/0.15-0.25			✓	✓	✓
EB1117162-015	16-AUG-2011 15:00	11/0.3-0.4		✓			
EB1117162-016	16-AUG-2011 15:00	11/1.0-1.1		✓			
EB1117162-017	16-AUG-2011 15:00	10/0.2-0.2			✓	✓	✓
EB1117162-019	16-AUG-2011 15:00	10/0.6-0.7		✓			
EB1117162-020	17-AUG-2011 15:00	8/0.35-0.45			✓	✓	✓
EB1117162-022	17-AUG-2011 15:00	8/0.85-0.95		✓			
EB1117162-023	17-AUG-2011 15:00	8-1/0.45-0.55		✓			
EB1117162-027	17-AUG-2011 15:00	9-2/0.1-0.2			✓	✓	✓
EB1117162-028	17-AUG-2011 15:00	9-2/0.3-0.4		✓			
EB1117162-029	18-AUG-2011 15:00	7/0.3-0.4			✓	✓	✓
EB1117162-031	18-AUG-2011 15:00	7/0.7-0.8		✓			
EB1117162-033	18-AUG-2011 15:00	6-1/0.4-0.5		✓			
EB1117162-035	18-AUG-2011 15:00	6-2/0.8-0.9			✓	✓	✓
EB1117162-036	19-AUG-2011 15:00	5/0.400-0.500			✓	✓	✓
EB1117162-037	19-AUG-2011 15:00	5/0.95-1.05					✓
EB1117162-038	19-AUG-2011 15:00	4-1/0.1-0.2		✓			
EB1117162-039	19-AUG-2011 15:00	4-1/0.4-0.5		✓			
EB1117162-040	19-AUG-2011 15:00	4/0-0.1			✓	✓	✓
EB1117162-042	19-AUG-2011 15:00	4/0.6-0.65		✓			
EB1117162-043	20-AUG-2011 15:00	3/0.3-0.4			✓	✓	✓
EB1117162-044	20-AUG-2011 15:00	3/1.0-1.1					✓
EB1117162-045	20-AUG-2011 15:00	2/0.1-0.2			✓	✓	✓
EB1117162-047	20-AUG-2011 15:00	2/0.65-0.7		✓			
EB1117162-048	21-AUG-2011 15:00	1/0.4-0.5			✓	✓	✓
EB1117162-049	21-AUG-2011 15:00	1/1.1-1.2					✓
EB1117162-050	21-AUG-2011 15:00	3-2/0.5-0.6		✓			
EB1117162-051	22-AUG-2011 15:00	0/0.2-0.3			✓	✓	✓
EB1117162-053	22-AUG-2011 15:00	0/0.7-0.8		✓			
EB1117162-054	22-AUG-2011 15:00	0-2/0.2-0.3		✓			
EB1117162-055	22-AUG-2011 15:00	0-2/0.6-0.65		✓			
EB1117162-056	18-AUG-2011 15:00	7-1/0.4-0.5		✓			

Requested Deliverables

MR DAMIAN WILLIAMS

- *AU Certificate of Analysis - NATA (COA)	Email	dwilliams@globalskm.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	dwilliams@globalskm.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	dwilliams@globalskm.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	dwilliams@globalskm.com
- A4 - AU Tax Invoice (INV)	Email	dwilliams@globalskm.com
- Chain of Custody (CoC) (COC)	Email	dwilliams@globalskm.com
- EDI Format - ENMRG (ENMRG)	Email	dwilliams@globalskm.com
- EDI Format - ESDAT (ESDAT)	Email	dwilliams@globalskm.com
- EDI Format - XTab (XTAB)	Email	dwilliams@globalskm.com

MS KRISTELLE GENTIL

- *AU Certificate of Analysis - NATA (COA)	Email	kgentil@globalskm.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	kgentil@globalskm.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	kgentil@globalskm.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	kgentil@globalskm.com
- A4 - AU Tax Invoice (INV)	Email	kgentil@globalskm.com
- Chain of Custody (CoC) (COC)	Email	kgentil@globalskm.com
- EDI Format - ENMRG (ENMRG)	Email	kgentil@globalskm.com
- EDI Format - ESDAT (ESDAT)	Email	kgentil@globalskm.com
- EDI Format - XTab (XTAB)	Email	kgentil@globalskm.com

Appendix G Pipeline Sections with Slope over 5%

AB Sections Slope 5%	
19.64	19.82
23.1	23.3
39.82	39.96
54.58	55
61.74	61.94
62.66	62.96
63.68	63.7
65.56	65.72
65.86	66.1
66.28	66.58
70.18	70.9
73.5	73.8
74.24	74.46
75.4	75.5
75.68	75.72
75.82	76.5
77.6	78.02
83.2	83.34
84.06	85.14
125.3	125.32
274.4	274.68
276.54	276.66
278.58	278.88
279.12	279.58
279.88	280.06
280.14	280.44
287.92	288.02
288.4	288.88
291.28	291.4
291.76	292.34
292.74	293.08
293.22	293.84
294	294.18
294.36	294.52
294.9	294.98
295.46	296.32
296.82	297.54
298.04	298.34
299.54	300.02
300.54	300.8
303.46	313.36
313.66	314.66
316.3	317.64
319.9	325.74
335.22	337.86
340.92	341.44
341.7	345.56
346	347.46
355.74	358.82

AB Sections Slope 5%	
359.2	360.22
361.06	361.32
362.7	366.16
368.48	368.84
369.32	370.34
372.02	375.52
376.08	377.28
380.8	382.34
385.38	385.76
385.96	387
388.08	390.34
408.44	409.28
409.48	409.56
412.08	412.42
412.6	415.68
447.6	449.58
450.4	450.72
451.36	452.82
453.16	456.04
457.66	458.38
458.46	462.26
463.1	463.42
467.18	467.92
469.4	470.14
470.48	470.92

EL Sections Slope 5%	
1.38	1.48
13.72	21.54
22.98	23.28
42.36	44.78