DISTRICT STRUCTURE PLAN
DEVELOPMENT AREA 19
CITY OF COCKBURN
WESTERN AUSTRALIA

GEOTECHNICAL
AND
ACID SULPHATE SOIL ASSESSMENT

MAY 2007
Ref: 06036.01

FOR
KOLTASZ SMITH

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CONDITIONS RELATING TO THIS REPORT

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6. The recommendations of this report should be considered a starting point. Recommendations should be continuously reviewed during the earthworks stage as sub-surface information and results from monitoring become available. It is strongly recommended that the Company be retained to provide consultancy and/or inspections during the earthwork stages.

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1 Introduction

A District Structure Plan (DSP) is currently being prepared for the City of Cockburn's Development Area 19, Jandakot. As part of the DSP a geotechnical and acid sulphate soil assessment is required. Brown Geotechnical & Environmental was commissioned by Koltasz Smith (Project Engineers) on behalf of associated land owners to undertake the assessment. This report presents the results of the assessment.

The terms of reference for the assessment were outlined in Brown Geotechnical and Environmental's proposal dated 4 August 2006. Instructions to proceed with the investigation were received from the Koltasz Smith on 4 October 2006.

Details and plans for the development area, survey plans and contact details for individual Lot owners were supplied through Koltasz Smith.

2 Site Location

Development Area 19 lies at the northwest corner of the intersection of North Lake Road and the Kwinana Freeway. The land is approximately 16km south of the Perth central business district and approximately 10km southeast of Fremantle, within the City of Cockburn. The land adjoins the predominantly developed suburb of South Lake to the west along Semple Court, abuts the Kwinana Freeway to the east, and is bounded by Verna Court to the north and North Lake Road to the south.

3 Site Details and Background

The area has previously been used for a mixture of rural lifestyle, horse agistment and similar related activities. Some light industrial and commercial activities have also been present in the area. Immediately to the west there is history of market gardens.

The area is characterized by low density housing surrounded by grassed paddocks and occasional trees. An area of very dense trees is present towards the south eastern corner and past aerial photographs show groundwater in a small lake bed within this area. During the investigation this area was dry; however a depression with old reeds was evident, though inaccessible to the excavator.

The site area is generally level at approximately 24m AHD with high points to approximately 27m AHD in the central south and northeast.

4 Geology and Environmental Studies

The Environmental Geology sheet for the area **[2]** indicates the site to be underlain by Thin Bassendean Sands over the Guildford Formation (consisting of silts and clays) in the north and south, with Bassendean Sands running west to east through the centre. A pocket of Swamp deposits consisting of silty sand is present towards the south eastern corner.

The Perth Groundwater Atlas **[3]** shows the maximum historical groundwater level to be approximately 23m AHD.

The City of Cockburn, Arterial Drainage Scheme Review Nov 2005 **[4]** show design regional groundwater levels to range from 23.5m AHD in the east of the development area to 20m AHD in the west. The hydraulic gradient is therefore to the west.

The WAPC Bulletin No.64 May 2007 – *Acid Sulphate Soils, Central Perth Metro Area* **[5]** shows the potential for Acid Sulphate Soils (ASS) over the majority of the site to be medium to low. The exception to this is towards the south eastern corner where high risk soils are indicated and are likely to be associated with the swamp deposits show on the geological map.

5 Objectives

It was essential that the geotechnical and acid sulphate soil assessment methodology for the development area was consistent with the requirements for a Structure Plan as detailed in the Town Planning Scheme and WAPC Guidelines for the Preparation of Local Structural Plans in Urban Release Areas (June 1992).

The following issues will therefore be addressed in this report:

- Subsurface conditions.
- Present site classifications in accordance with AS 2870-1996 **[1]**.
- Earthwork required to obtain site classifications suitable for the development of the area.
- The suitability of soils within the area to be used as borrow material for residential or industrial land fill.
- Groundwater levels.
- Drainage and soil permeability issues.
- Public Open Spaces.
- Design CBR's for road pavement design.
- Potential acid sulphate soil issues.

6 Methodology and Scope of Works

To enable an assessment of the geotechnical issues highlighted in Section 5, it was proposed to carry out a limited test pitting exercise across the whole development area. Perth sand penetrometer testing would also be carried out to determine the relative density of sands and current groundwater levels would be recorded in test pits. Selected soil samples would be collected for field descriptions and laboratory testing.

It was also proposed to use the test pitting exercise to assess the extent of the high risk ASS in the south eastern corner of the site. An increased density of test pits would be required in this area. ASS field testing would be carried out on samples from test pits in this area at selected depths.

The fieldwork would be followed by laboratory testing to determine relevant geotechnical properties of the soils and potential ASS risk.

7 Fieldwork and Laboratory Testing

7.1 Investigation Fieldwork

The fieldwork was undertaken during the period from 15 March 2007 to 23 March 2007. Thirty-four test pits were excavated across the site using a 5 tonne excavator. The test pits were extended to a maximum depth of 2.7m. Occasionally test pits were terminated early due to the test pit walls collapsing or where refusal in very dense material was encountered. Perth sand penetrometer (PSP) tests were carried out to determine relative density of the soils at thirty locations. Soil samples were obtained from the test pits for field descriptions, ASS field testing, geotechnical and ASS laboratory testing. Groundwater levels were recorded where encountered.

The original grid system envisaged proved impossible to implement due to site access problems with the high number Lots owners involved. Test pits were located on accessible Lots and an acceptable coverage of the development area was attained. Access into the dense area of trees in the southern corner of the site proved impossible due to the dense vegetation and owner access issues.

Test pit and PSP locations are shown in Figure 1, with test pit logs enclosed in Appendix A and PSP plots in Appendix B.

7.2 ASS Field Testing

Thirty-six soil samples were selected for preliminary ASS testing. Field tests were carried out on all the samples and included the initial pH of the soil (pH_F) and pH after oxidation by hydrogen peroxide (pH_{FOX}), in accordance with the DoE's 'Identification and Investigation of Acid Sulphate Soils and Groundwater' **[6]** and 'Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils in Queensland' **[7]**. ASS field test results are presented in Appendix D.

7.3 Laboratory Testing

Soil samples were delivered to Western Geotechnics Group laboratories for particle size distributions determinations, percent fines determinations and organic contents. Soil samples were also delivered to ALS Environmental for ASS laboratory testing. The geotechnical laboratory test certificates are presented in Appendix C and ASS laboratory test certificates in Appendix D.

8 Results

8.1 Subsurface Conditions

Subsurface conditions encountered in the test pits and inferred from laboratory testing and penetrometer test results are described as follows:

8.1.1 Fill

Fill was encountered in TP1, 2, 17, 22, 23, 25, 29, 30 and 31. The majority of the fill material encountered consisted of reworked or imported sand often containing gravel of limestone associated with old road base. The depth of fill extended to approximately 0.5m. In TP29 fill

was encountered to 1m depth and consisted of household rubbish and building materials in a sandy matrix.

8.1.2 Topsoil

Topsoil was encountered in seventeen of the test pits and generally consisted of dark grey, fine and medium grained sand with rootlets and occasional roots. The thickness of the topsoil varied from 0.2m to 0.5m.

8.1.3 Sand

Medium grained, grey sand with a trace of silt was encountered below the topsoil or fill in all test pits. The sand extended beyond the base of all test pits. The sand from TP25 and 28 contained traces of organic material, with laboratory results indicating low values of up to 0.85%.

The relative density of the sand was generally medium dense, becoming dense below approximately 1.5m depth. In TP19, 20, 24, 27 and 32 the sand was dense throughout. In TP23, 26 and 33 sands were loose to 1m depth.

The test pits walls were generally stable, only occasionally collapsing in looser sands above approximately 1.5m depth as the excavations deepened.

8.1.4 Coffee Rock

Very dense (weakly cemented), brown sand, colloquially named coffee rock, was encountered in TP14 and TP15 below 1.6m and 2.0m depth respectively. The 5 tonne excavator refused in the material at approximately 2.2m depth.

8.1.5 Groundwater

Groundwater was encountered in a number of the test pits. Groundwater depths and reduced levels are shown in Table 1. Ground levels have been taken from survey plans provided.

Table 1 - Groundwater Depth

Location	Groundwater Depth (m BGL)	Ground Level (m AHD)	Groundwater Level (m AHD)
TP17	2.4	25.0	22.6
TP20	2.2	23.6	21.4
TP27	2.4	24.8	22.4
TP28	2.5	24.0	21.5
TP29	2.1	23.8	21.7
TP30	2.3	24.0	21.7
TP31	2.1	24.5	22.4
TP32	2.3	24.8	22.5
TP33	2.0	23.8	21.8
TP34	2.1	22.8	20.7

The maximum groundwater level encountered was 22.6m AHD (2.4m bgl) in the north east corner of the site (TP17). The minimum depth to groundwater encountered was 2.0m (21.8m AHD) in the west of the site (TP33).

8.2 Test Results

8.2.1 Geotechnical Laboratory Test Results

Laboratory test results are summarised in Table 2.

Table 2 – Geotechnical Laboratory Test Results

Test Pit No.	Depth (m)	Organic Content (%)	Particle Size Distribution					USC
			Fines (%)	Sand (%)			Gravel (%)	
				fine	medium	coarse		
TP5	0.5 – 1.5	-	2	6	75	17	0	SP
TP7	1.3 – 2.5	-	2	10	75	13	0	SP
TP11	0.5 – 1.5	-	1	-	-	-	-	SP
TP13	0.5 – 1.5	-	1	-	-	-	-	SP
TP15	0.5 – 1.5	-	2	16	76	6	0	SP
TP17	0.9 – 2.0	-	0	9	78	13	0	SP
TP20	0.5 – 1.5	-	2	12	80	6	0	SP
TP22	1.5 – 2.5	-	1	5	78	16	0	SP
TP28	0.5 – 1.5	0.8	3	11	75	11	0	SP

Sands tested were poorly graded with low fines content. Organic contents were low.

8.2.2 Acid Sulphate Soil Test Results

ASS field test results are summarised in Table 3.

Table 3 – Acid Sulphate Soil Field Test Results

Test Pit No	Depth (m)	pH_F (field)	pH_{FOX} (post oxidation)	Reaction Strength
TP1	0.5	6.9	5.1	Moderate
TP1	1.5	7.2	5.5	Slight
TP1	2.5	6.9	5.0	Slight*
TP2	0.5	6.8	4.9	Slight
TP2	1.5	7.2	5.2	Slight
TP2	2.5	7.1	5.0	Slight
TP3	0.5	6.7	4.2	Slight
TP3	1.5	6.6	4.5	Slight*
TP3	2.5	7.1	5.2	Slight
TP4	0.5	7.0	3.8	Slight
TP4	1.5	5.8	3.8	Slight*
TP4	2.5	6.2	4.8	Slight
TP5	0.5	6.3	4.7	Slight
TP5	1.5	6.2	4.7	Slight
TP5	2.5	6.5	4.9	Slight
TP9	0.5	6.8	4.9	Slight
TP9	1.5	6.9	4.7	Slight
TP9	2.5	6.8	4.9	Slight
TP26	0.5	6.2	4.6	Slight
TP26	1.5	6.2	4.5	Slight*
TP26	2.5	6.3	4.6	Slight
TP27	0.5	6.0	4.8	Slight
TP27	1.5	6.3	4.8	Slight*
TP27	2.5	6.0	5.9	Slight
TP28	0.5	6.1	5.0	Slight
TP28	1.5	6.2	4.8	Slight
TP28	2.5	6.3	4.9	Slight
TP29	0.5	7.9	4.9	Slight
TP29	1.5	7.7	5.2	Slight
TP29	2.5	7.3	4.6	Strong*
TP30	0.5	7.3	4.3	Moderate*
TP30	1.5	6.8	4.7	Slight
TP30	2.5	6.8	4.6	Slight
TP31	0.5	7.0	4.5	Moderate*
TP31	1.5	7.0	5.0	Slight
TP31	2.5	7.0	5.1	Slight*
TP32	0.5	6.1	2.9	Moderate*
TP32	1.5	6.3	4.1	Slight*
TP32	2.5	5.9	4.2	Slight

* Selected for laboratory testing.

The field results show the actual pH_F of the soil to be non-acidic i.e. generally pH_F >6. The pH_{FOX} results however indicated that some soils in the vicinity of the high risk area may become acidic if oxidised, with pH_{FOX} of 2.9 in TP32 and 3.8 in TP4. These samples and samples showing volatile reactions were sent for confirmatory laboratory analysis to confirm sulphitic content.

ASS laboratory test results are summarised in Table 4.

Table 4 – Acid Sulphate Soil Laboratory Test Results

	Sample		TP1	TP3	TP4	TP4	TP26	TP27	TP29	TP30	TP31	TP31	TP32	TP32
	Depth		0.25	1.5	1.5	2.5	1.5	1.5	2.5	0.5	0.5	2.5	0.5	1.5
Analyte grouping / Analyte	**Units**	**LOR**												
EA033-A: Actual Acidity														
pH KCl (23A)	pH Unit	0.1	6.5	6.2	5.4	6.6	6.4	6.2	6.6	6.7	6.9	6.2	4.9	5.8
Titratable Actual Acidity (23F)	mole H+ / t	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity	% pyrite S	.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
Potential Acidity														
Chromium Reducible Sulfur (22B)	% S	0.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
acidity - Chromium Reducible Sulfur	mole H+ / t	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
EA033-E: Acid Base Accounting														
ANC Fineness Factor	---	0.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	% S	0.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
Net Acidity (acidity units)	mole H+ / t	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

All results are below critical threshold limits (see Appendix E).

9 Analysis and Discussion

9.1 Subsurface Conditions

Evidence from the limited test pitting exercise has shown the whole of Development Area 19 to be underlain by medium grained, grey sand to a depth of at least 2m. This formation is consistent with the Bassendean Sands shown on the geological map for the area **[2]**.

The laboratory test results show the sand to have a low fines content (approximately 2%) and a zero gravel content. In-situ penetrometer testing has shown the density of the sand to be generally medium dense, becoming dense below approximately 1.5m depth. Some tests indicated loose sand to approximately 1m depth; however these areas appear to be sporadic across the site. The sand was usually overlain by a thin layer of sandy topsoil.

The geology map for the area indicates the Guildford Formation, consisting of silt and clay deposits, to be present in the northern and southern areas of the site. No evidence of these deposits was uncovered during the investigation.

Pockets of fill were identified during the test pitting exercise and appear to occur randomly across the site. It should be noted that the majority of test pits were located in areas easily accessible to the excavator, such as paddocks or in areas where disruption to occupiers or land owners would be minimised. The test pit positions would therefore not necessarily be located in areas where fill would be expected.

The fill encountered should be suitable for foundation support, however screening to remove deleterious material may be required in some areas. The detailed geotechnical investigations for future individual developments will be able to identify suspect fill areas.

9.2 Site Classification

Future Site Classifications for the area, in accordance with AS 2870 – 1996 **[1]**, are likely to be Site Class 'A'. This assumes the underlying sand identified during this investigation is consistent across the whole site. Detailed geotechnical investigations for future individual developments within the area will be required to confirm site classifications.

9.3 Earthwork Requirements

The majority of the earthworks envisaged as part of any future development will be associated with removal of topsoil, trees, old buildings and associated fill materials. Proof compacting of surface sand will be required, and any filling with imported sands to bring future site developments up to formation levels (see Section 9.6) will require compaction to relevant residential or industrial standards.

9.4 Borrow Materials

The grain size, low fines content and free draining nature of in-situ sands underlying the development area make them suitable for use as imported fill material for residential and industrial building developments.

9.5 Groundwater

The maximum groundwater level encountered during the investigation was 22.6m AHD in the north eastern corner of the site. This was at a depth of 2.4m below existing ground level. The minimum depth to groundwater encountered was 2.0m (21.8m AHD) towards the western boundary of the site.

The City of Cockburn, Arterial Drainage Scheme Review Nov 2005 **[4]** show design regional groundwater levels to vary from 23.5m AHD in the east of the development area to 20m AHD in the west. The hydraulic gradient therefore being to the west.

It appears from the above study, that the design regional groundwater levels will be closest to the existing ground level in the south eastern corner of the site at approximately 23.5m AHD (1.5m below existing ground level).

9.6 Soil Permeability and Drainage

The grain size, low fines content and free draining nature of in-situ sands underlying the development area make them suitable for the use of soakwells in future developments. It is estimated, based on particle size distribution analysis from laboratory test results, that a permeability value approximating to $1x10^{-4}$m/sec would be appropriate for soakwell design. However, as with all geotechnical assumptions within this report, a full geotechnical investigation will be required for each future development to confirm these values.

It is not envisaged that existing ground levels would require raising for site drainage using soakwells. The approximate depth to the design regional groundwater levels is 1.5m.

9.7 Public Open Spaces

The Structure Plan for development areas requires the provision of Public Open Spaces (POS). POS areas often contain lakes both ornamental and for drainage related issues. The free draining nature of the in-situ soils may require the provision of an impermeable lining for the lakes to prevent drying out in times of low groundwater levels.

9.8 CBR for Road Pavement Design

The in-situ sand appears to be consistent across the site. With surface sands compacted to a minimum of 98% SMDD at optimum moisture content, a design CBR of approximately 12% should be appropriate for future road pavement designs **[8]**. Further geotechnical investigations will be required to confirm this value.

9.9 Acid Sulphate Soils

The WAPC Bulletin No.64 May 2007 – *Acid Sulphate Soils, Central Perth Metro Area* **[5]** indicates the potential for acid sulphate generating soils within the development area to be mostly moderate to low. The exception is a pocket of potentially high risk soil towards the south eastern corner.

Moderate to low risk ASS zones require a full ASS investigation if soils are to be disturbed below a depth of 3m or below the groundwater level. High risk ASS zones require detailed ASS investigations if soils are to be disturbed below the existing ground level.

Test pitting was carried out in the vicinity of the south western corner of the development area in order to determine the extent of the high risk soils. Samples taken were field tested for actual pH (pH_F) and pH after oxidation with hydrogen peroxide (pH_{FOX}) which gives an indication of potential acidity should the soils be excavated and exposed to air. Further confirmatory testing was carried out in the laboratory. Samples could not be obtained from the very centre of the high risk hotspot, a small dried up lake area within dense vegetation.

Laboratory results revealed that some sands within the high risk ASS area contained existing acidity, however no potential acidity was identified. Sands containing existing acidity may require remediation during earthworks. This would consist of blending the sands with lime to neutralise the acidity. The extent of any remediation would be confirmed during detailed ASS investigation as part of future developments.

Based on the preliminary acid sulphate assessments, it can be concluded that the sand surrounding the dense vegetated areas denoted as high risk may contain some existing acidity but no potential acidity (refer Figure 3). It should be assumed that high risk soils exist in the centre of the area where the old lake existed.

Detailed ASS investigations will be required for all future developments in the area denoted as high risk by the WAPC Bulletin No.64. It is likely however that these investigations will show little or no potential acidity within the soils, except in the vicinity of the old lake.

If potential ASS soils are identified as part of these detailed investigations, ASS Management Plans will be required to treat acid generating soils. Dewatering Management Plans will also be required if excavations are to extend below groundwater level.

BROWN GEOTECHNICAL & ENVIRONMENTAL

Ken Brown

REFERENCES

[1] Standards Australia AS 2870 (1996). Residential Slabs and Footings – Construction.

[2] Geological Survey of Western Australia. 1:50,000 Environmental Geology Series, Perth.

[3] Department of Water: www.environment.wa.gov.au

[4] The City of Cockburn - Cockburn Central and Solomon Road Development Areas, Arterial Drainage Scheme Review Nov 2005.

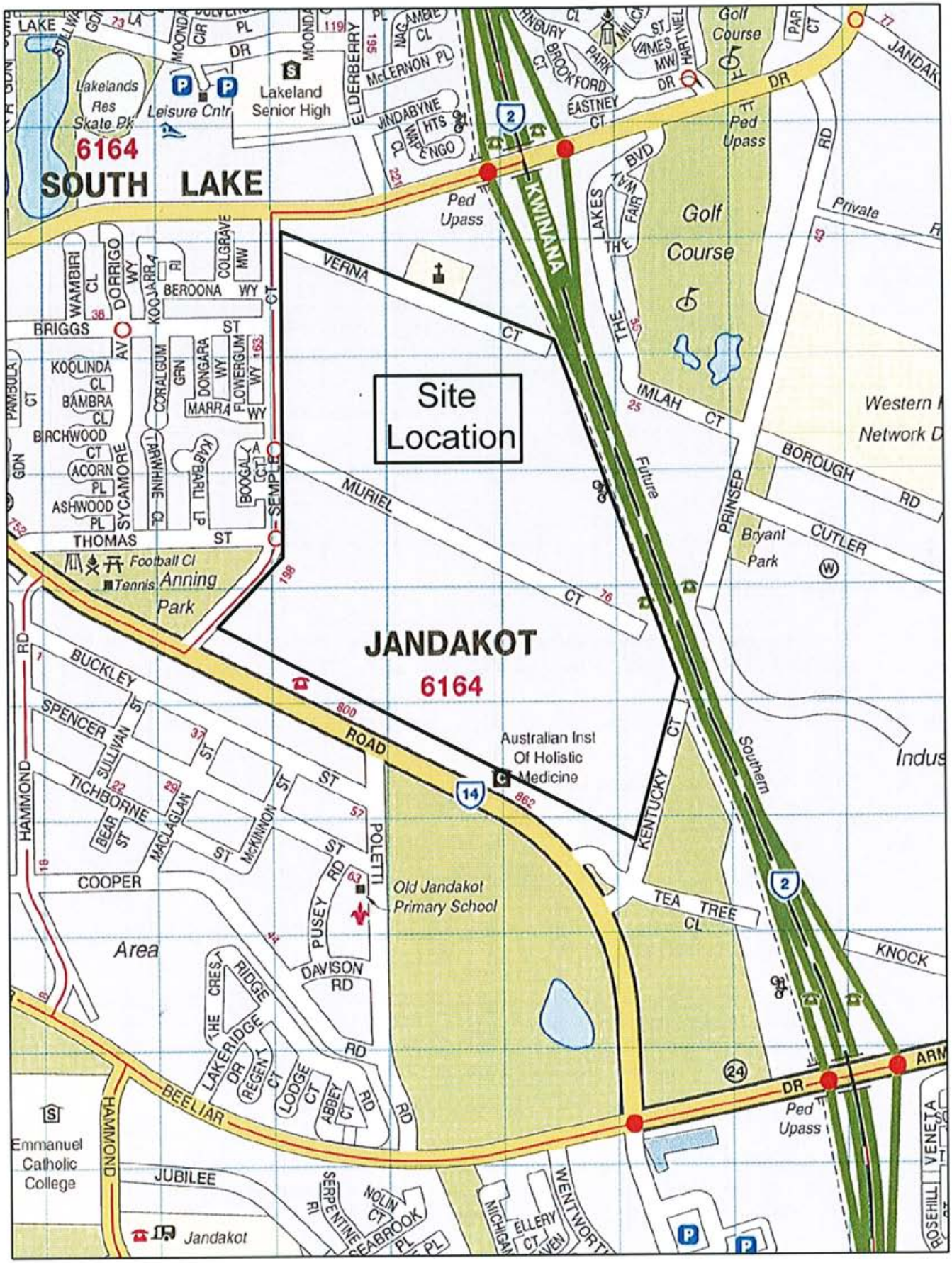
[5] DoE and WAPC (Up-dated May 2007). Planning Bulletin No.64. Central Metropolitan Region Scheme Acid Sulphate Soils.

[6] DoE (2004). Identification and Investigation of Acid Sulphate Soils (August).

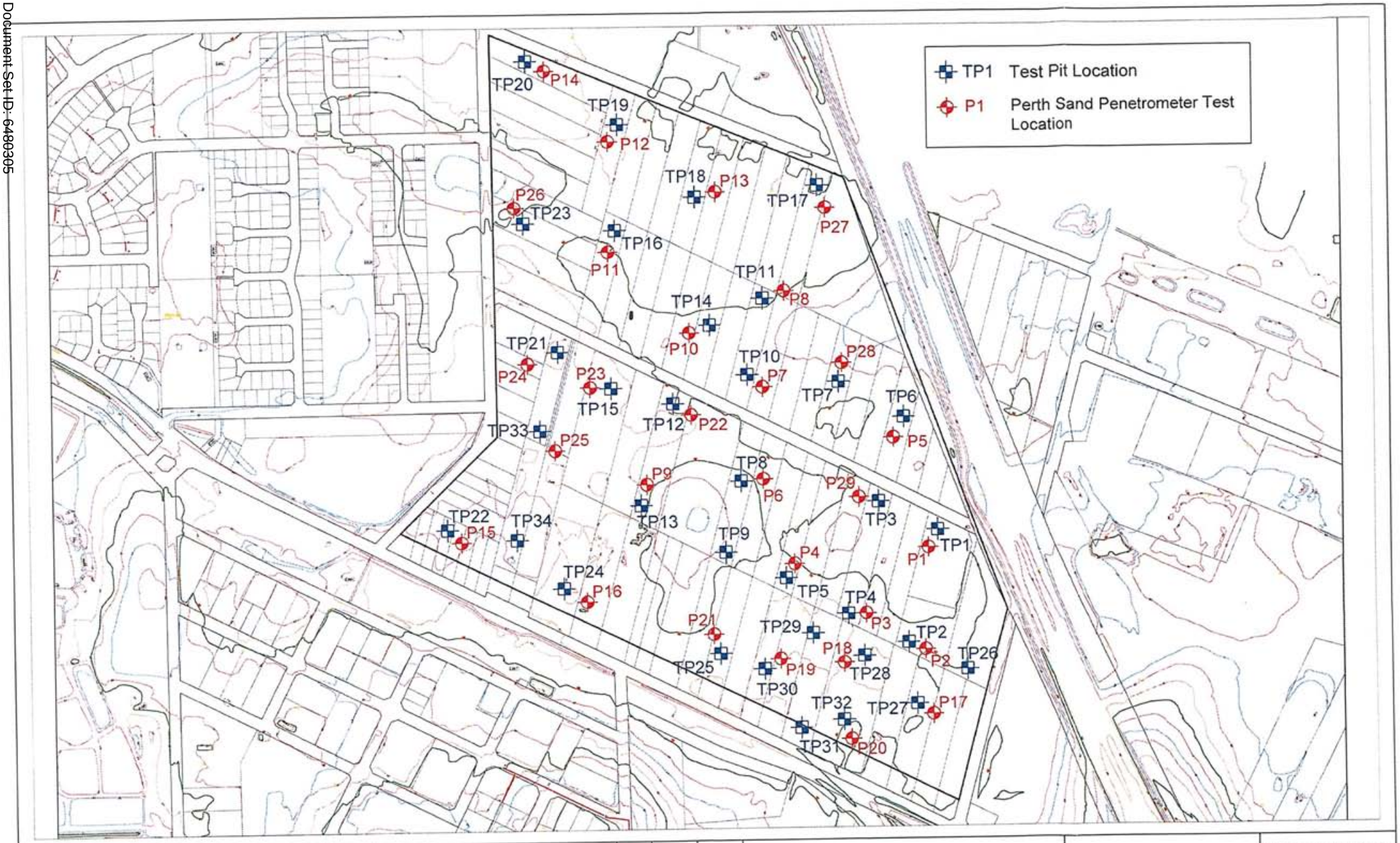
[7] CR Ahern et al (1998). Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils in Queensland 1998 (October).

[8] Main Roads Western Australia (April 2004); Engineering Road Note No 9. Procedure for Thickness Design of Flexible Pavements.

FIGURES



Brown Geotechnical & Environmental	Date	Description	Drawn	Checked	Approved	LOCATION PLAN	CLIENT	Drawing No. 06036.01
Suite 4, 47 Monash Avenue Como WA6152 Tel: (08) 9368 2615 Email: bge@acidss.com.au	01.05.07	Location Plan	TW	KIB				Scale: NTS
						DEVELOPMENT AREA 19 JANDAKOT	KOLTASZ SMITH	Sheet Size: A4
								Job No. 06036.01
								FIGURE 1



Date	Description	Drawn	Checked	Approved
10.05.07	Test Location Plan	TW	KB	

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TEST LOCATION PLAN

DEVELOPMENT AREA 19 (MURIEL COURT)
JANDAKOT

CLIENT

KOLTASZ SMITH

Drawing No. 07036.02
Scale: NTS
Sheet Size: A4
Job No: J07036.01
FIGURE 2

APPENDIX A

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP1

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 25.6 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.854064E 32.119052S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		25.5			FILL	FILL: Light brown, coarse sandy gravel and limestone road base		
							pH_F=6.9% pH_{FOX}=5.1%	
					SP	SAND: Medium dense, medium, dark grey, trace silt, moist, roots to 1.2m		
			0.5					
		25.0						
			1.0					
	Not Encounterd	24.5					pH_F=7.2% pH_{FOX}=5.5%	
			1.5			dense below 1.5m		
		24.0						
			2.0				pH_F=6.9% pH_{FOX}=5.0%	
		23.5						
			2.5			Borehole TP1 terminated at 2.5m		
		23.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP2

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 24.8 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.853531E 32.120831S MGA
TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5	0.0		FILL	FILL: Sandy gravel, coarse, light brown, road base, trace limestone		
					SP	SAND: Medium dense, medium, light grey, trace silt, moist	pH_F=6.8% pH_{FOX}=4.9%	
	Not Encounterd	24.0	0.5					
			1.0			dense below 1.2m		
		23.5				collapse below 1.3m	pH_F=7.2% pH_{FOX}=5.2%	
			1.5					
		23.0	2.0					
		22.5					pH_F=7.1% pH_{FOX}=5.0%	
			2.5			Borehole TP2 terminated at 2.5m		
		22.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP3

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 25.3 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.853048E 32.118670S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		25.0	0.0			TOPSOIL: Medium dense, medium, dark grey, with many rootlets to 1.1m		
	Not Encounterd		0.5			SAND: Medium dense, medium, grey, moist	pH_F=6.7% pH_{FOX}=4.2%	
		24.5	1.0				pH_F=6.6% pH_{FOX}=4.5%	
		24.0	1.5			dense below 1.5m		
		23.5	2.0				pH_F=7.1% pH_{FOX}=5.2%	
		23.0	2.5			Borehole TP3 terminated at 2.5m		
		22.5	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP4

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 24 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.852489E 32.120323S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encounterd	24	0			TOPSOIL: Medium dense, fine to medium, black, trace rootlets		
		23.5	0.5		SP	SAND: Medium dense, medium, dark grey, trace silt, moist, roots to 1.7m	pH_F=7.0% pH_{FOX}=3.8%	
		23.0	1.0			dense below 0.9m	pH_F=5.8% pH_{FOX}=3.8%	
		22.5	1.5					
		22.0	2.0				pH_F=6.2% pH_{FOX}=4.8%	
		21.5	2.5			Borehole TP4 terminated at 2.5m		
		21.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP5

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 24.7 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.851294E 32.119890S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5	0			TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
					SP	SAND: Medium dense, medium, light grey, moist	pH_F=6.3% pH_{FOX}=4.7%	
			0.5					
		24.0					Fines=2% Sand=98% Gravel=0%	
						dense below 0.9m		
	Not Encounterd		1.0					
		23.5					pH_F=6.2% pH_{FOX}=4.7%	
			1.5					
		23.0						
			2.0					
		22.5					pH_F=6.5% pH_{FOX}=4.9%	
			2.5			Borehole TP5 terminated at 2.5m		
		22.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP6

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25.4 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 116.853454E 32.117476S MGA
TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		25.0	0.0			TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
					SP	SAND: Medium dense, medium, grey, trace silt, moist		
			0.5					
		24.5						
			1.0			dense below 1.2m		
	Not Encounterd	24.0						
			1.5					
		23.5						
			2.0					
		23.0						
			2.5			Borehole TP6 terminated at 2.5m		
		22.5						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP7

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 25.5 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.852336E 32.116866S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, fine to medium, dark grey, rootlets, dry		
						SAND: Medium dense, medium, light grey, trace silt, moist		
	Not Encounterd	25.0	0.5					
		24.5	1.0			dense below 1.2m		
		24.0	1.5				Fines=2% Sand=98% Gravel=0%	
		23.5	2.0					
		23.0	2.5					
						Borehole TP7 terminated at 2.5m		
		22.5	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

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TEST PIT NUMBER TP8

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 25 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.850684E 32.118188S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, grey, trace rootlets, dry		
	Not Encounterd	24.5	0.5		SP	SAND: Medium dense, medium, light grey, trace silt, moist		
		24.0	1.0					
		23.5	1.5			Collapse below 1.8m		
		23.0	2.0			dense below 2.4m		
		22.5	2.5			Borehole TP8 terminated at 2.5m		
		22.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP9

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 25.7 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.850252E 32.119153S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encounterd	25.5	0.0		SP	SAND: Medium dense, medium, grey, trace silt, dry		
						light grey below 0.2m	pH_F=6.8% pH_{FOX}=4.9%	
		25.0	0.5			moist below 0.7m		
		24.5	1.0			dense below 1.2m	pH_F=6.9% pH_{FOX}=4.7%	
		24.0	1.5					
		23.5	2.0				pH_F=6.8% pH_{FOX}=4.7%	
			2.5			Borehole TP9 terminated at 2.5m		
		23.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP10

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 25.6 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.851142E 32.116866S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		25.5				TOPSOIL: Medium dense, medium, grey, trace rootlets, dry		
					SP	SAND: Medium dense, medium, light grey, trace silt, moist		
			0.5					
		25.0						
	Not Encounterd		1.0					
		24.5						
			1.5					
		24.0						
			2.0					
		23.5				dense below 2.1m		
						Borehole TP10 terminated at 2.3m		
			2.5					
		23.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

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Brown Geotechnical & Environmental

TEST PIT NUMBER TP11

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25.1 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.851447E 32.115748S MGA
TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		25.0				TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
			0.5			SAND: Medium dense, medium, light grey, trace silt, moist		
		24.5						
			1.0				Fines=1%	
	Not Encounterd	24.0				dense below 1.2m		
			1.5					
		23.5						
			2.0					
		23.0						
			2.5			Borehole TP11 terminated at 2.5m		
		22.5						
			3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

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TEST PIT NUMBER TP12

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 24.8 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.849439E 32.117146S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5	0.0			TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
					SP	SAND: Medium dense, medium, grey, trace silt, moist		
			0.5					
		24.0						
			1.0					
	Not Encounterd	23.5						
			1.5			wet below 1.5m collpase below 1.5m brown below 1.6m		
		23.0				dense below 1.8m		
			2.0					
		22.5						
			2.5			Borehole TP12 terminated at 2.5m		
		22.0						
			3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

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TEST PIT NUMBER TP13

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 24.5 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.848906E 32.118569S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encounterd	24.0	0.5		SP	SAND: Medium dense, medium, grey, trace silt, roots to 0.5m, dry		
						dense and moist below 0.6m		
		23.5	1.0				Fines=1%	
		23.0	1.5					
		22.5	2.0					
		22.0	2.5			Borehole TP13 terminated at 2.5m		
		21.5	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP14

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 25 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.850024E 32.116053S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, fine, grey, trace rootlets, dry		
					SP	SAND: Medium dense, medium, light grey, trace silt, moist		
		24.5	0.5					
	Not Encounterd	24.0	1.0			dense below 1.2m		
		23.5	1.5					
						COFFEE ROCK: Very dense, medium, brown sand, moist (weakly cemented)		
		23.0	2.0					
						Refusal Borehole TP14 terminated at 2.3m		
		22.5	2.5					
		22.0	3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

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TEST PIT NUMBER TP15

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 24 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.848346E 32.116714S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
	Not Encounterd	23.5	0.5		SP	SAND: Medium dense, medium, grey, trace silt, moist	Fines=2% Sand=98% Gravel=0%	
		23.0	1.0			dense below 1.2m		
		22.5	1.5					
		22.0	2.0			COFFEE ROCK: Very dense, medium, brown sand, moist (weakly cemented)		
						Refusal Borehole TP15 terminated at 2.2m		
		21.5	2.5					
		21.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

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TEST PIT NUMBER TP16

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07
R.L. SURFACE 24.7 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.848372E 32.114503S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encounterd	24.5	0.5		SP	SAND: Medium dense, medium, light grey, rootlets to 0.8m, dry		
		24.0				dense below 0.6m		
		23.5	1.0					
		23.0	1.5					
		22.5	2.0					
			2.5			Borehole TP16 terminated at 2.5m		
		22.0	3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP17

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07
R.L. SURFACE 25 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.852108E 32.113766S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						FILL: Medium dense, fine to medium, light brown, sand, dry		
		24.5	0.5		SP	SAND: Medium dense, medium, dark grey, trace silt, moist		
						trace roots at 0.9m		
		24.0	1.0			dense below 1.2m		
		23.5	1.5				Fines=0% Sand=100% Gravel=0%	
		23.0	2.0					
	▼ 2.4m	22.5	2.5			Borehole TP17 terminated at 2.4m		
		22.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP18

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07
R.L. SURFACE 24.3 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.849871E 32.113740S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encounterd	24.0	0.5			SAND: Medium dense, medium, grey, trace silt, dry		
		23.5	1.0			dense below 0.9m		
		23.0	1.5			moist below 1.2m		
		22.5	2.0					
		22.0	2.5			Borehole TP18 terminated at 2.5m		
		21.5	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

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TEST PIT NUMBER TP19

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07
R.L. SURFACE 24 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.484999E 32.112800S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encountered	23.5	0.5		SP	SAND: Dense, fine to medium, grey, trace silt, dry, with rootlets		
						medium grained below 0.5m		
						moist below 0.8m		
		23.0	1.0					
						light grey, moist below 1.2m		
		22.5	1.5					
		22.0	2.0					
		21.5	2.5					
		21.0	3.0			Borehole TP19 terminated at 2.7m		

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA.GDT 23/1/08

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TEST PIT NUMBER TP20

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 23.6 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.846517E 32.111606S MGA
TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		23.5	0			SAND: Dense, medium, grey, trace silt, rootlets to 0.5m, moist		
		23.0	0.5					
		22.5	1.0				Fines=2% Sand=98% Gravel=0%	
		22.0	1.5					
	▼ 2.2m	21.5	2.0					
		21.0	2.5					
			3.0			Borehole TP20 terminated at 2.7m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

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TEST PIT NUMBER TP21

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07
R.L. SURFACE 24 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.847305E 32.116205S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, grey, dry with rootlets		
					SP	SAND: Medium dense, medium, grey, trace silt, moist		
		23.5	0.5					
	Not Encounterd	23.0	1.0					
						Collapse above 1.4m		
		22.5	1.5			dense below 1.5m		
		22.0	2.0					
						Borehole TP21 terminated at 2.2m		
		21.5	2.5					
		21.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP22

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07
R.L. SURFACE 22 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.845246E 32.119026S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		21.5	0.5			FILL: Medium dense, fine to medium, grey, sand, trace limestone		
	Not Encounterd	21.0	1.0			TOPSOIL: Medium dense, medium, dark grey, rootlets, moist Collapse above 1.3m		
		20.5	1.5		SP	SAND: Dense, medium, grey, trace silt, moist	Fines=1% Sand=99% Gravel=0%	
		20.0	2.0					
		19.5	2.5			Borehole TP22 terminated at 2.5m		
		19.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

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Brown Geotechnical & Environmental

TEST PIT NUMBER TP23

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07
R.L. SURFACE 24.7 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.846695E 32.114223S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5				FILL: Medium dense, fine to medium, red sand, rootlets to 0.2m, dry		
						FILL: Medium dense, fine to medium, light brown, trace limestone, dry		
					SP	SAND: Loose, medium, grey, trace silt, dry		
			0.5					
		24.0						
						medium dense and moist below 0.9m		
			1.0					
	Not Encounterd	23.5						
			1.5					
		23.0				dense below 1.8m		
			2.0					
		22.5						
			2.5			Borehole TP23 terminated at 2.5m		
		22.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP24

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07
R.L. SURFACE 24 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.847254E 32.120170S MGA
TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encounterd	23.5	0.5		SP	SAND: Dense, medium, grey, dry, roots to 1m		
		23.0	1.0			moist below 1.0m		
		22.5	1.5					
		22.0	2.0					
		21.5	2.5					
		21.0	3.0			Borehole TP24 terminated at 2.7m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP25

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07
R.L. SURFACE 24.4 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.850024E 32.121263S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.0	0			FILL: Medium dense, medium, brown, sand, rootlets		
	Not Encounterd		0.5		SP	SAND: Medium dense, medium, dark grey, moist		
		23.5	1.0			peaty between 1.1m and 1.3m		
		23.0	1.5			dense below 1.5m		
		22.5	2.0					
		22.0	2.5			Borehole TP25 terminated at 2.2m		
		21.5	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE
Brown Geotechnical & Environmental

TEST PIT NUMBER TP26

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07
R.L. SURFACE 25.2 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.854573E 32.121212S MGA
TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
	Not Encounterd	25.0	0.0		SP	SAND: Loose, coarse, dark grey, moist, roots to 1m		
							pH_F=6.2% pH_{FOX}=4.6%	
		24.5	0.5					
			1.0			medium dense and medium grained below 1.0m		
		24.0					pH_F=6.2% pH_{FOX}=4.5%	
			1.5					
		23.5				dense below 1.8m		
			2.0				pH_F=6.3% pH_{FOX}=4.6%	
		23.0	2.5			Collapse Borehole TP26 terminated at 2.5m		
		22.5	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE
Brown Geotechnical & Environmental

TEST PIT NUMBER TP27

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07
R.L. SURFACE 24.8 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.853709E 32.121949S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5	0.5		SP	SAND: Dense, fine to medium, grey, moist, trace rootlets	pH_F=6.0% pH_{FOX}=4.8%	
		24.0	1.0					
		23.5	1.5			brown below 1.6m	pH_F=6.2% pH_{FOX}=4.5%	
	▼ 2.4m	23.0	2.0					
		22.5	2.5				pH_F=6.3% pH_{FOX}=4.6%	
		22.0	3.0			Borehole TP27 terminated at 2.5m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP28

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07
R.L. SURFACE 24 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.852641E 32.121085S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	SAND: Medium dense, medium, grey, locally brown, trace silt, trace organics, moist		
							pH_F=6.1% pH_{FOX}=5.0%	
		23.5	0.5					
							Organic Content=0.84%	
		23.0	1.0			dense below 1.0m		
							pH_F=6.2% pH_{FOX}=4.8%	
		22.5	1.5			brown and wet below 1.6m		
		22.0	2.0					
							pH_F=6.3% pH_{FOX}=4.9%	
	▼ 2.5m	21.5	2.5			Borehole TP28 terminated at 2.5m		
		21.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP29

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07
R.L. SURFACE 23.8 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.851879E 32.120780S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		23.5	0.0			FILL: Fine to medium, grey, rocks, rubbish, pipe, in a sandy matrix	pH_F=7.9% pH_{FOX}=4.9%	
		23.0	0.5		SP	SAND: Medium dense, medium, grey, trace silt, moist yellow below 0.7m		
		22.5	1.0				pH_F=7.7% pH_{FOX}=5.2%	
		22.0	1.5					
	▼ 2.1m	21.5	2.0				pH_F=7.3% pH_{FOX}=4.6%	
		21.0	2.5			Borehole TP29 terminated at 2.5m		
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP30

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07
R.L. SURFACE 24 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.850811E 32.121440S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					FILL	FILL: Medium dense, medium, yellow and grey sand, trace rootlets	pH_F=7.3% pH_{FOX}=4.3%	
		23.5	0.5			TOPSOIL: Fine to medium, dark grey, sand, with rootlets		
		23.0	1.0		SP	SAND: Dense, medium, grey, trace silt, moist	pH_F=6.8% pH_{FOX}=4.7%	
		22.5	1.5					
		22.0	2.0				pH_F=6.8% pH_{FOX}=4.6%	
	▼ 2.3m	21.5	2.5					
						Borehole TP30 terminated at 2.5m		
		21.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP31

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 24.5 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.851472E 32.122355S MGA
TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						FILL: Fine to medium, yellow, sand, trace rootlets		
							pH_F=7.0% pH_{FOX}=4.5%	
		24.0	0.5			TOPSOIL: Fine to medium, dark grey, sand, trace rootlets		
					SP	SAND: Medium dense, medium, grey, moist		
		23.5	1.0					
						brown and wet below 1.35m	pH_F=7.0% pH_{FOX}=5.0%	
		23.0	1.5					
	▼ 2.1m	22.5	2.0					
							pH_F=7.0% pH_{FOX}=5.1%	
		22.0	2.5					
						Borehole TP31 terminated at 2.5m		
		21.5	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP32

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07
R.L. SURFACE 24.8 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.852235E 32.122203S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5	0.5			TOPSOIL: Fine to medium, dark grey sand, trace rootlets	pH_F=6.1% pH_{FOX}=2.9%	
		24.0	1.0		SP	SAND: Dense, medium, light grey, trace silt, moist		
		23.5	1.5			collapse above 1.2m brown and wet below 1.3m	pH_F=6.3% pH_{FOX}=4.1%	
	2.3m	23.0	2.0					
		22.5	2.5				pH_F=5.9% pH_{FOX}=4.2%	
		22.0	3.0			Borehole TP32 terminated at 2.5m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE
Brown Geotechnical & Environmental

TEST PIT NUMBER TP33

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07
R.L. SURFACE 23.8 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting
SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator
TEST PIT LOCATION 115.846949E 32.117527S MGA
TEST PIT SIZE 0.5m x 1m
LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		23.5	0.0		SP	SAND: Loose, coarse, dark grey, moist		
			0.5				pH_F=7.9% pH_{FOX}=4.9%	
		23.0						
			1.0			medium dense and medium grained below 1.0m		
		22.5					pH_F=7.7% pH_{FOX}=5.2%	
			1.5					
		22.0						
	▼ 2.0m		2.0			Collapse above 2.2m		
		21.5					pH_F=7.3% pH_{FOX}=4.6%	
			2.5			Borehole TP33 terminated at 2.5m		
		21.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

BGE

Brown Geotechnical & Environmental

TEST PIT NUMBER TP34

CLIENT City of Cockburn
PROJECT NAME District Structurial Plan - Development Area 19
PROJECT NUMBER J06036.01
PROJECT LOCATION Jandakot

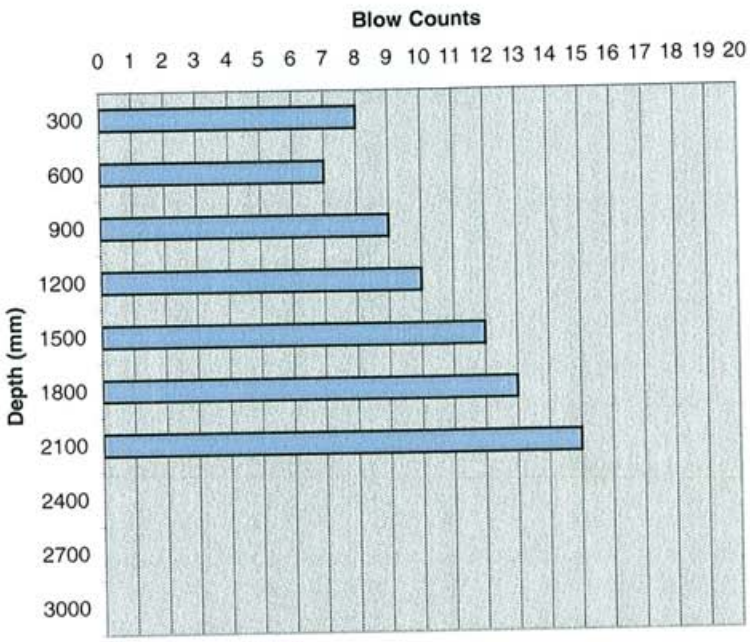
DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 22.8 DATUM m AHD
EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---
EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.846440E 32.118975S MGA
TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		22.5	0			TOPSOIL: Medium dense, medium, dark grey, dry		
			0.5		SP	SAND: Medium dense, medium, grey, trace silt, moist	pH_F=7.9% pH_{FOX}=4.9%	
		22.0						
			1.0					
		21.5					pH_F=7.7% pH_{FOX}=5.2%	
			1.5					
		21.0						
			2.0					
	▼ 2.1m							
		20.5					pH_F=7.3% pH_{FOX}=4.6%	
			2.5			Borehole TP34 terminated at 2.5m		
		20.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

Depth (mm)	Blow Counts
300	8
600	7
900	9
1200	10
1500	12
1800	13
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 13

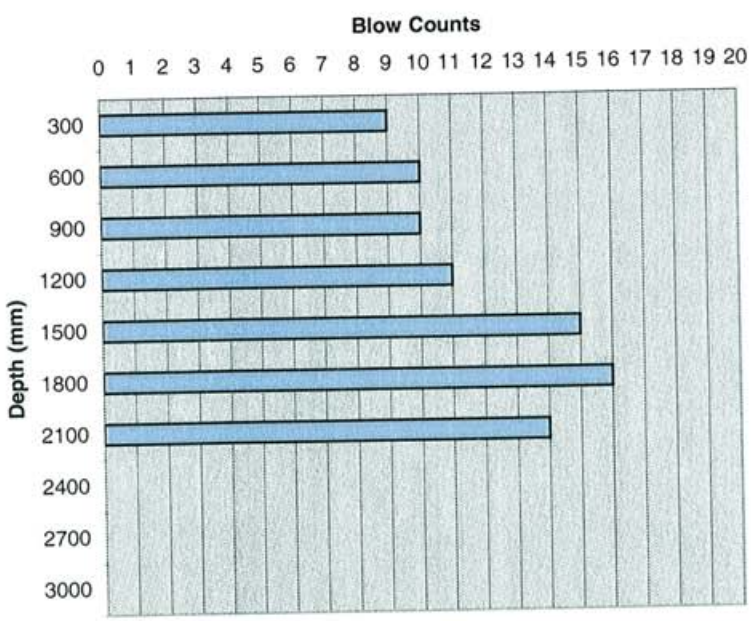


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	9
600	10
900	10
1200	11
1500	15
1800	16
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 14



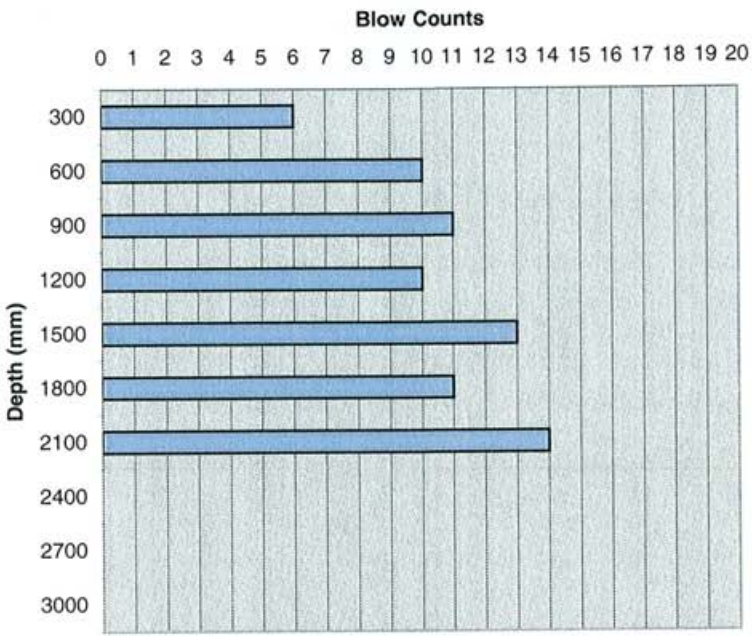
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	6
600	10
900	11
1200	10
1500	13
1800	11
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 15

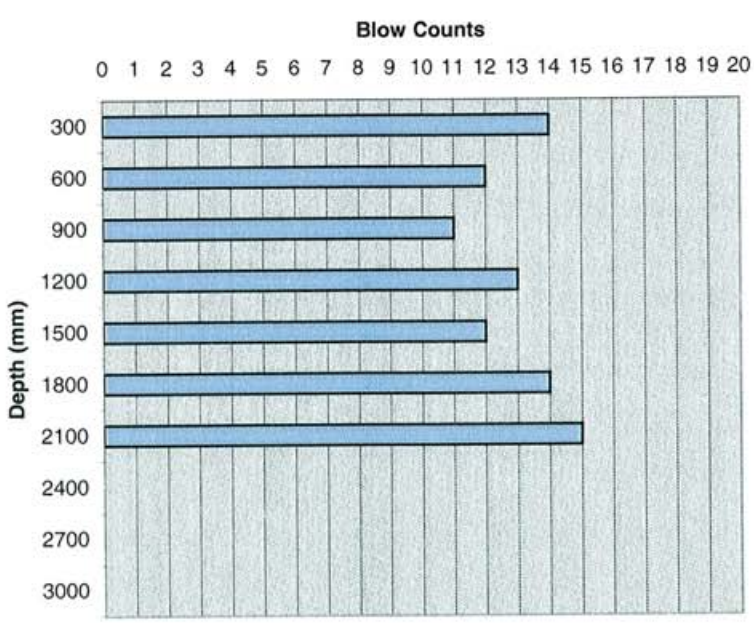


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	14
600	12
900	11
1200	13
1500	12
1800	14
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 16



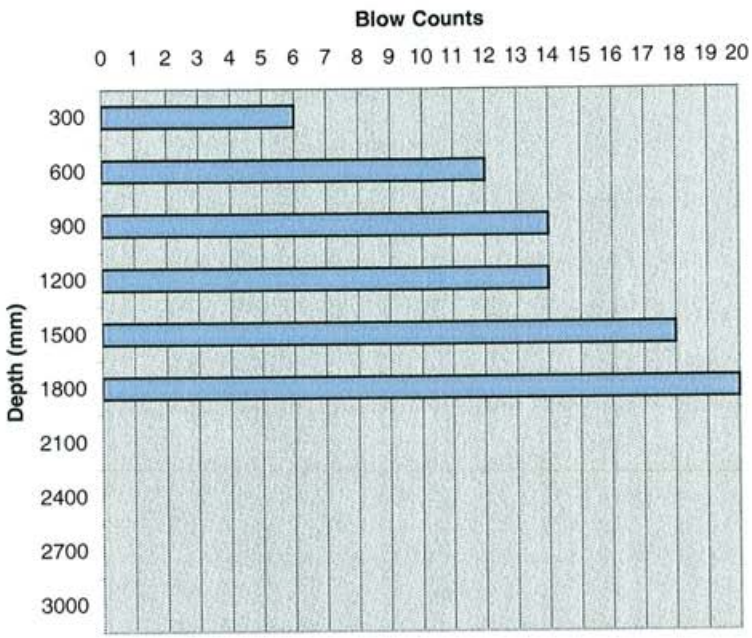
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	6
600	12
900	14
1200	14
1500	18
1800	20
2100	
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 17

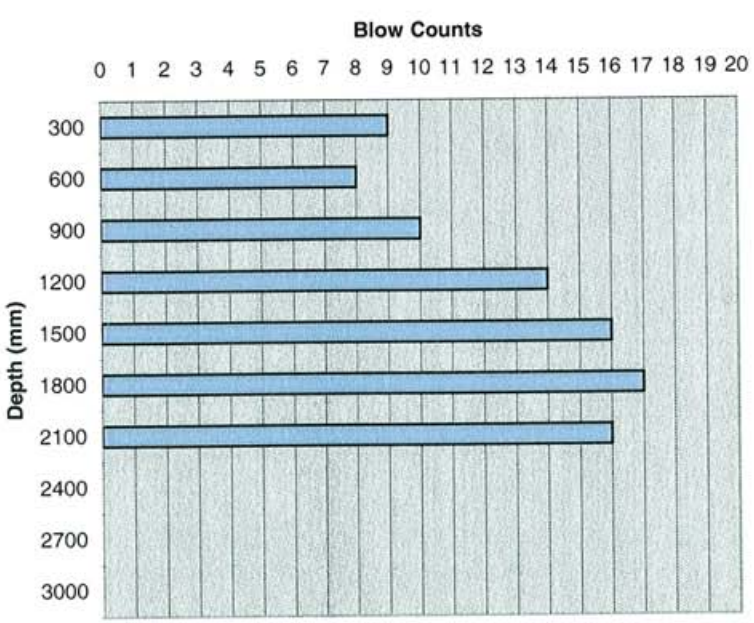


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	9
600	8
900	10
1200	14
1500	16
1800	17
2100	16
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 18



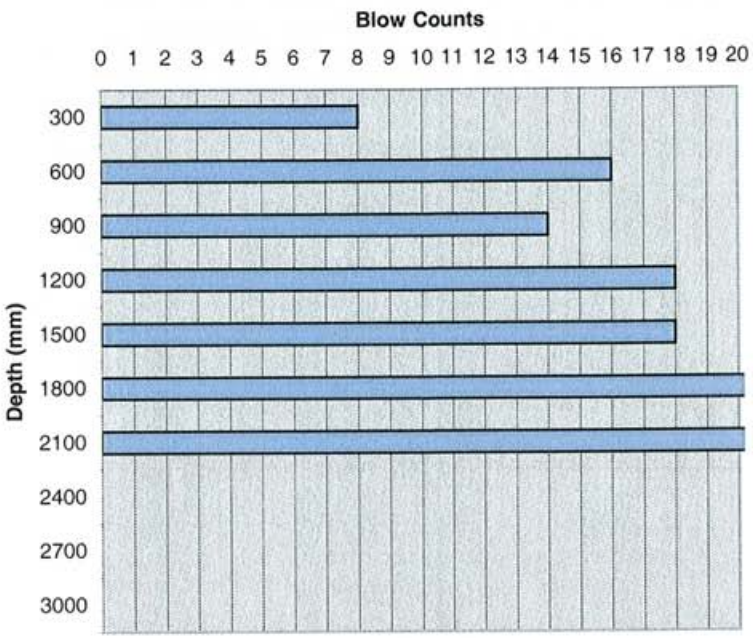
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	8
600	16
900	14
1200	18
1500	18
1800	22
2100	24
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 19

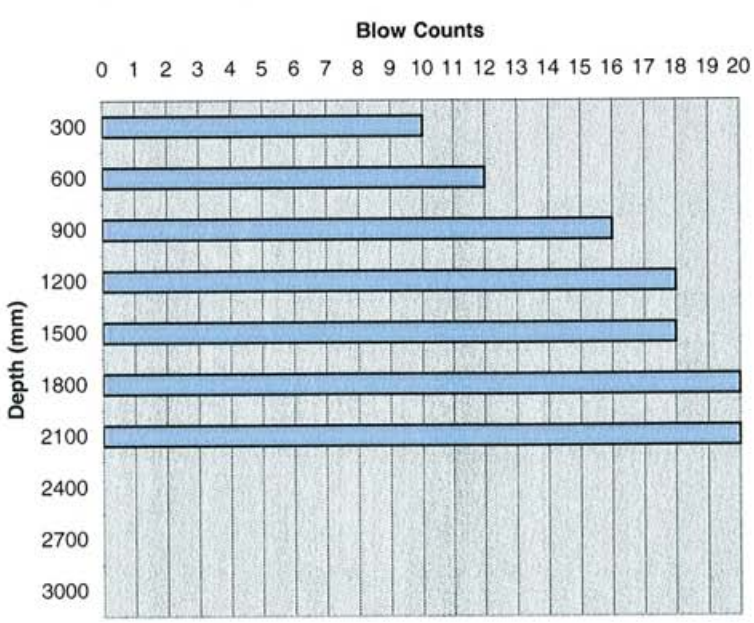


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	10
600	12
900	16
1200	18
1500	18
1800	20
2100	20
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 20



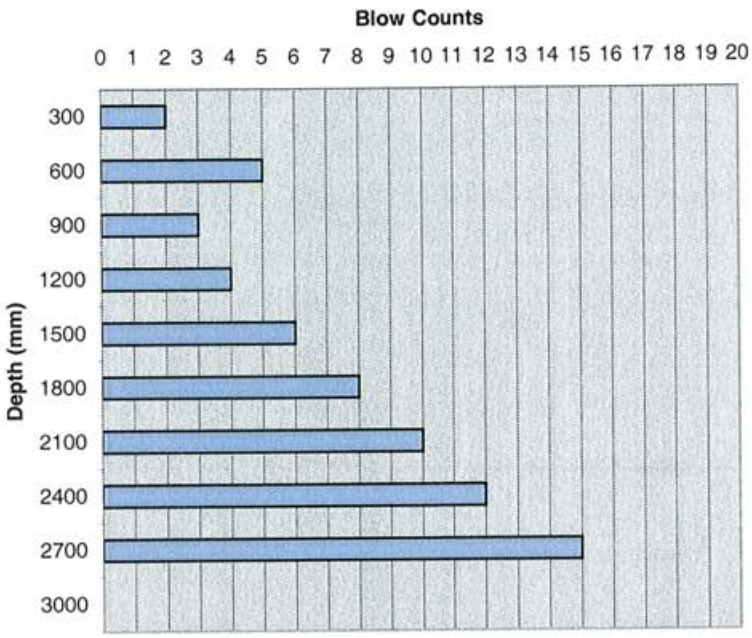
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	2
600	5
900	3
1200	4
1500	6
1800	8
2100	10
2400	12
2700	15
3000	

Perth Sand Penetrometer Results - Test 21

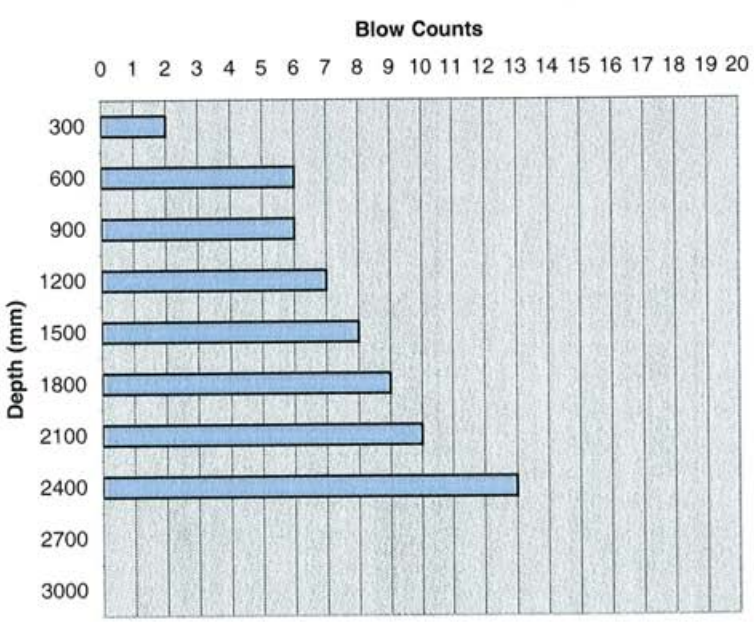


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	2
600	6
900	6
1200	7
1500	8
1800	9
2100	10
2400	13
2700	
3000	

Perth Sand Penetrometer Results - Test 22



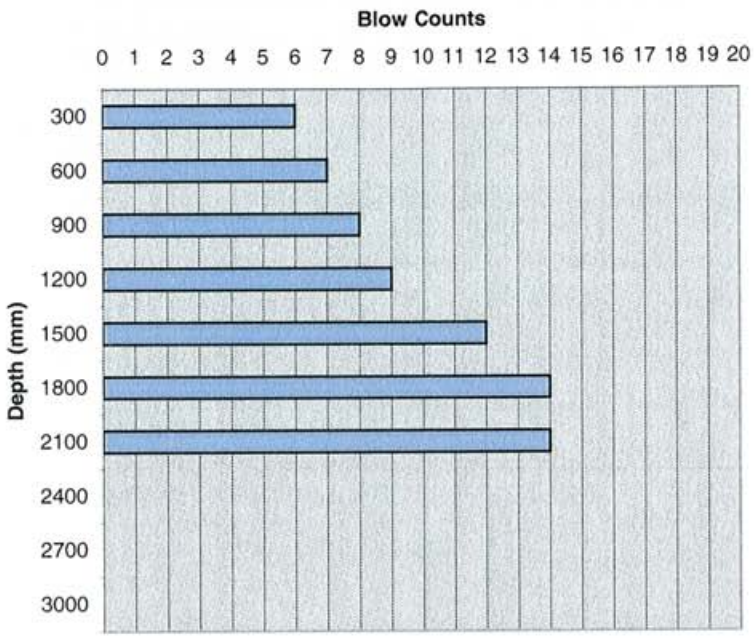
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	6
600	7
900	8
1200	9
1500	12
1800	14
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 23

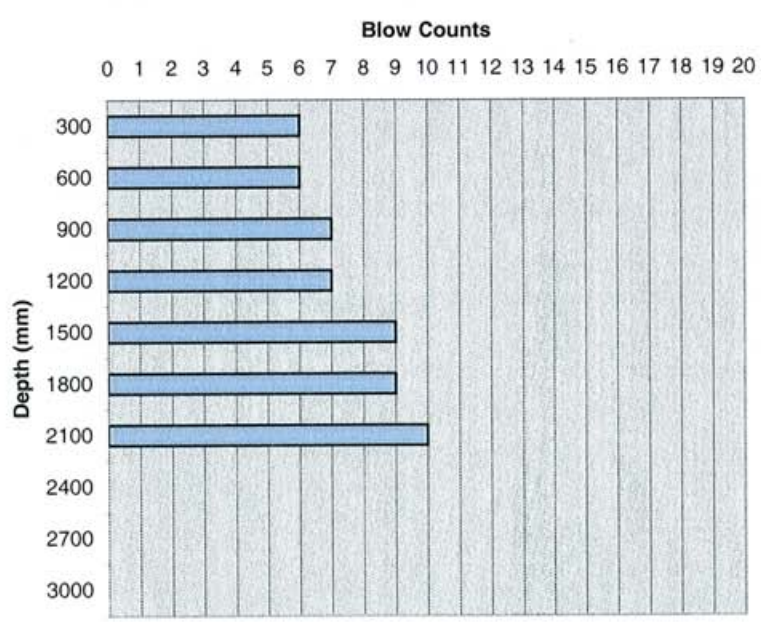


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	6
600	6
900	7
1200	7
1500	9
1800	9
2100	10
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 24



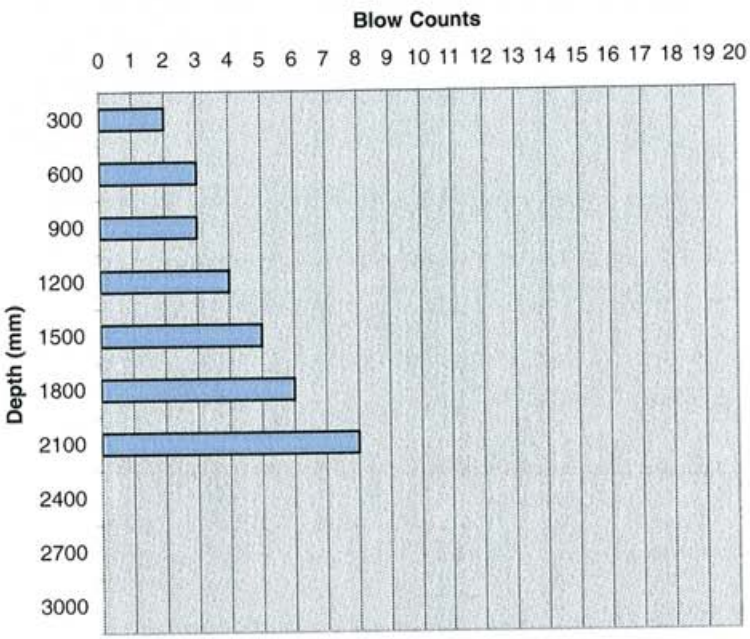
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	2
600	3
900	3
1200	4
1500	5
1800	6
2100	8
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 25

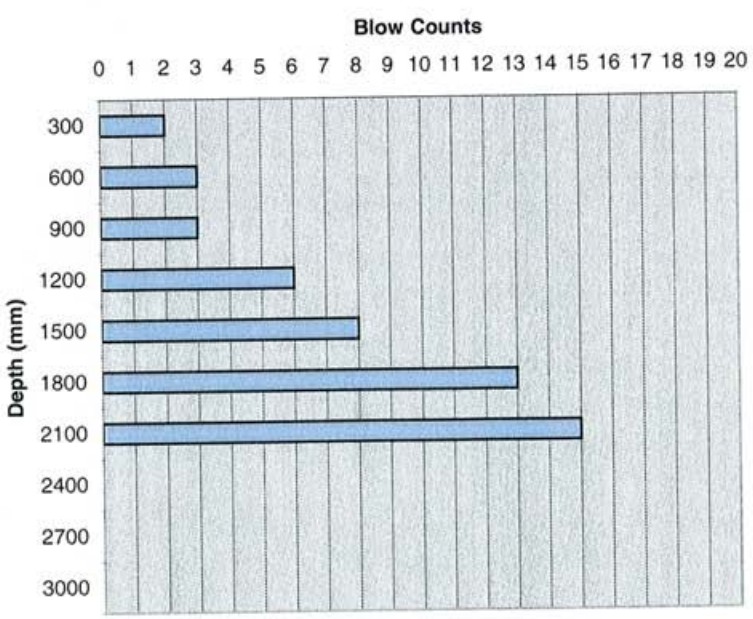


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	2
600	3
900	3
1200	6
1500	8
1800	13
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 26



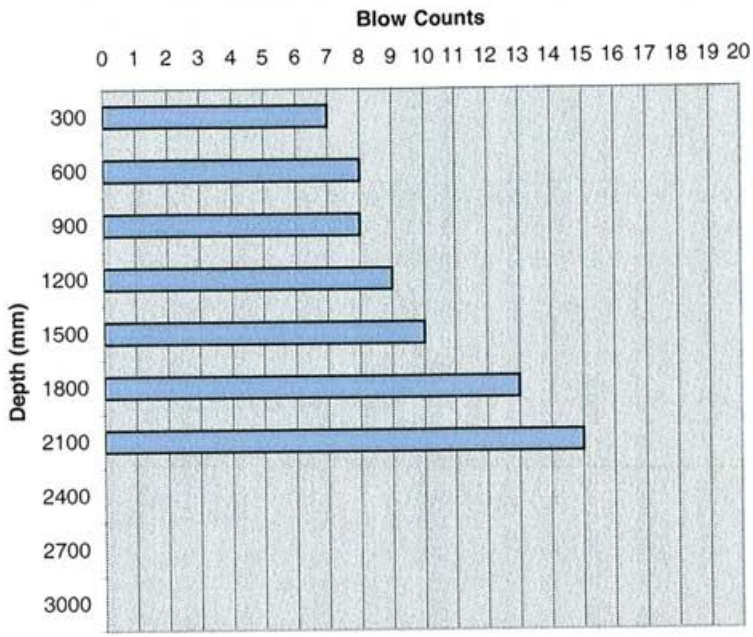
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	7
600	8
900	8
1200	9
1500	10
1800	13
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 27

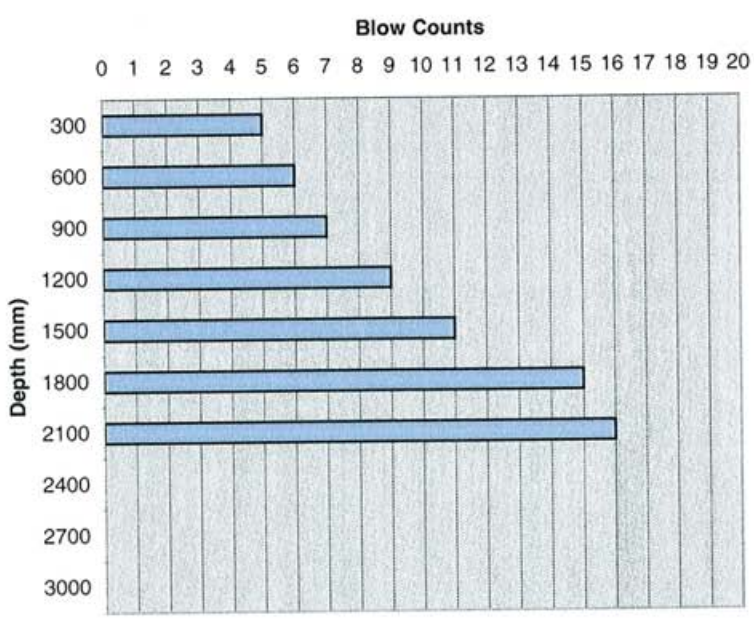


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	5
600	6
900	7
1200	9
1500	11
1800	15
2100	16
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 28



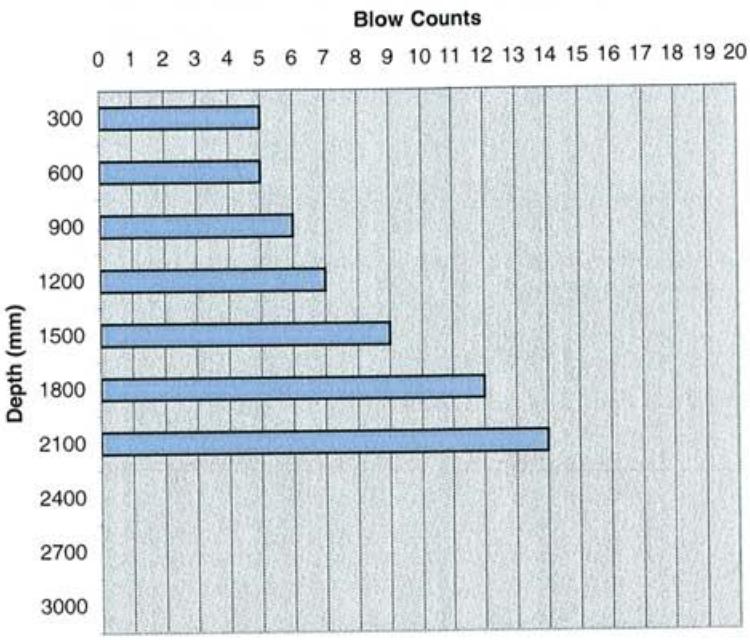
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	5
600	5
900	6
1200	7
1500	9
1800	12
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 29

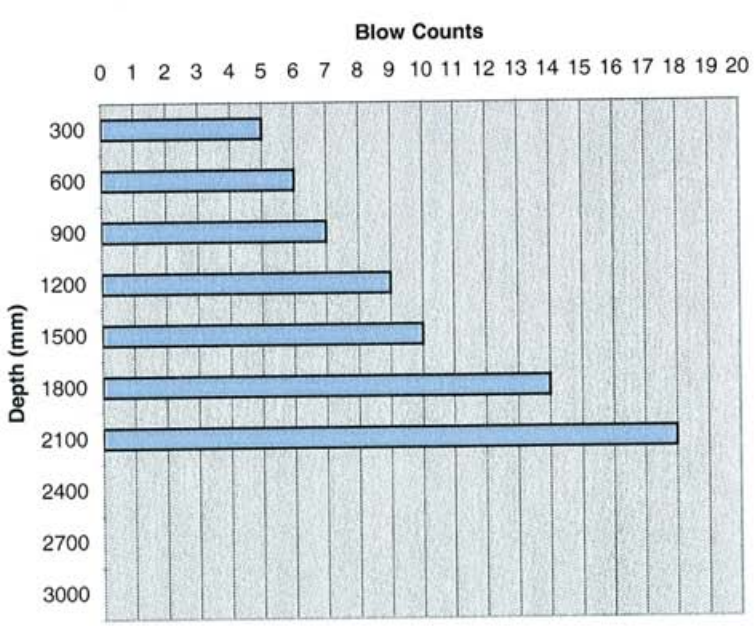


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	5
600	6
900	7
1200	9
1500	10
1800	14
2100	18
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 30



Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

APPENDIX C

Western Geotechnics Group
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

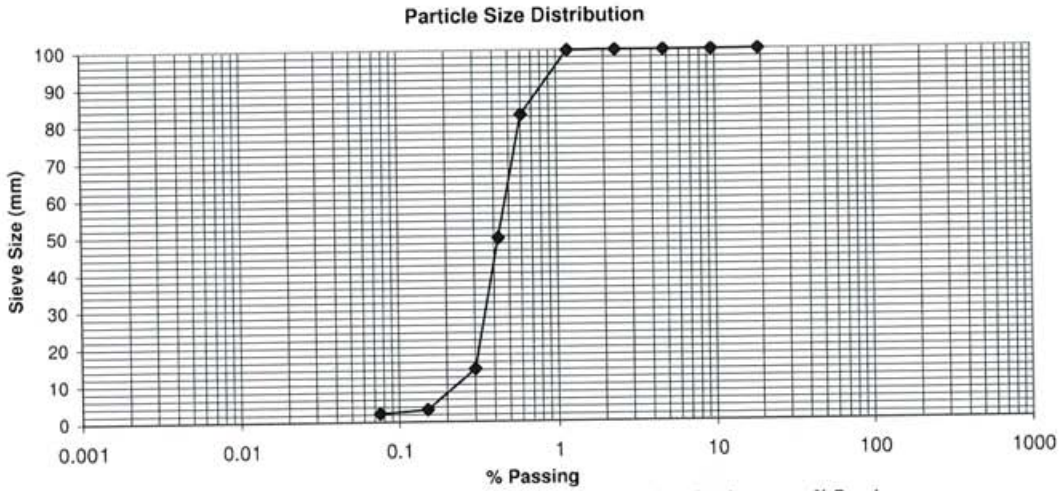
perth@westerngeo.com.au
ABN 91105324436
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	28/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-710
Sample ID.:	TP5	Depth:	0.5 - 1.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	83
		0.425	49
19.0	100	0.300	14
9.5	100	0.150	3
4.75	100	0.075	2

Notes:
Sample supplied by client

Certificate No.:07-WG-710 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

SN 2411

Western Geotechnics Group
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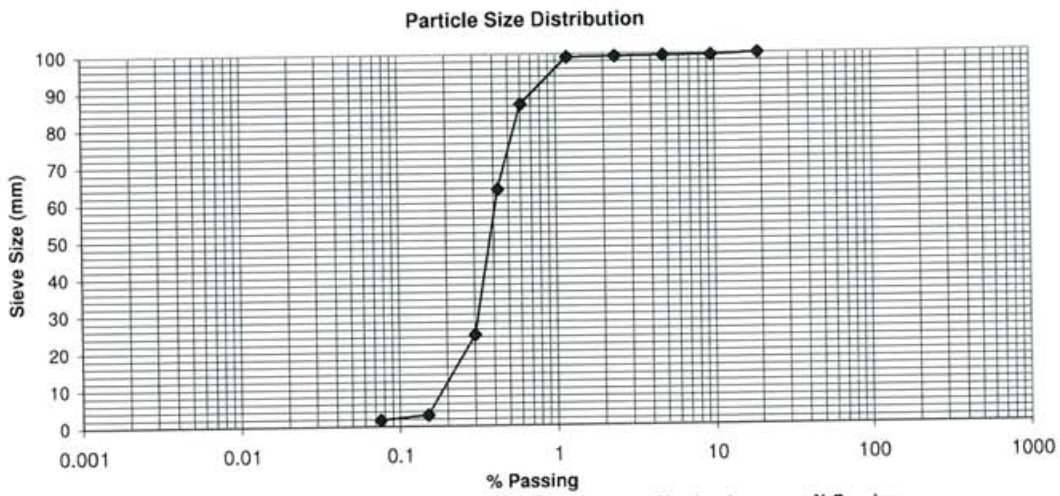
TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	29/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-718
Sample ID.:	TP7	Depth:	1.3 - 2.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	99
		1.18	99
		0.600	87
		0.425	64
19.0	100	0.300	24
9.5	100	0.150	3
4.75	99	0.075	2

Notes:
Sample supplied by client

Certificate No.:07-WG-718 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

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TEST CERTIFICATE

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fx: (08) 9458 3700

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No:	J06036/1
Project:	Muriel Court (Area 19)	Order No:	
Location:	Jandakot	Tested Date:	12/04/2007
Sample No:	07-WG-711	WG Job Number:	07-01-175
Sample ID:	TP11 0.5 - 1.5m	Lab:	Welshpool

PSD: PERCENT FINES <0.075MM

AS1289.3.6.1 (% Fines)

Part	Method	
Material Finer than 75µm (%)		1

Notes:

Note: Sample supplied by client

Approved Signatory: (M.Matthews) Date: 12/04/2007

Accreditation No.: 2418

This document is issued in accordance with NATA's accreditation requirements

Western Geotechnics Group
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TEST CERTIFICATE

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Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No:	J06036/1
Project:	Muriel Court (Area 19)	Order No:	
Location:	Jandakot	Tested Date:	12/04/2007
Sample No:	07-WG-712	WG Job Number:	07-01-175
Sample ID:	TP13 0.5 - 1.5m	Lab:	Welshpool

PSD: PERCENT FINES <0.075MM

AS1289.3.6.1 (% Fines)

Part	Method	
Material Finer than 75µm (%)		1

Notes:

Note: Sample supplied by client

Approved Signatory: (M.Matthews) Date: 12/04/2007

ilac-MRA NATA

This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Western Geotechnics Group
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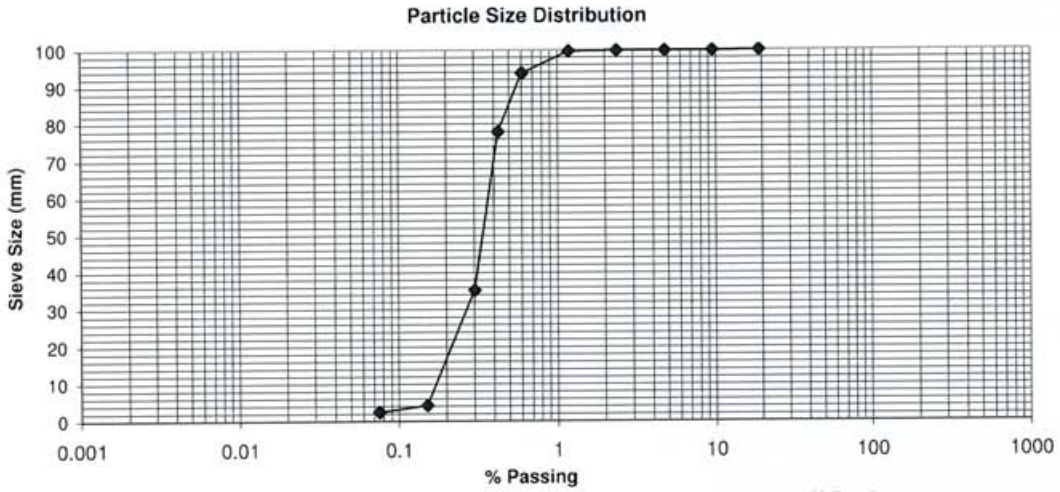
TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	29/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-713
Sample ID.:	TP15	Depth:	0.5 - 1.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	94
		0.425	78
19.0	100	0.300	35
9.5	100	0.150	4
4.75	100	0.075	2

Notes:
Sample supplied by client

Certificate No.:07-WG-713 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

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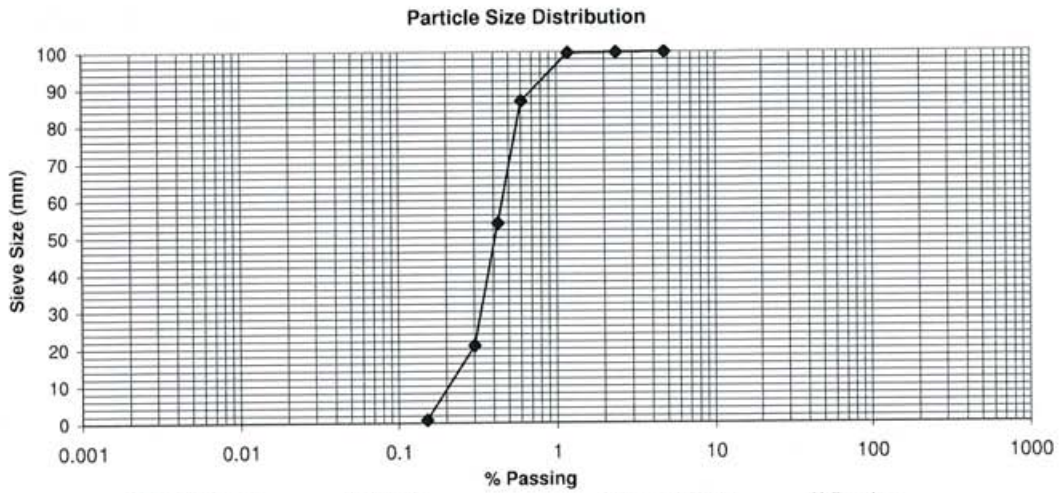
TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	29/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-714
Sample ID.:	TP17	Depth:	0.9 - 2.0

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	87
		0.425	54
		0.300	21
		0.150	1
4.75	100	0.075	0

Notes:
Sample supplied by client

Certificate No.:07-WG-714 / S301

Approved Signatory: (Mark Matthews) **Date:** 12/04/2007

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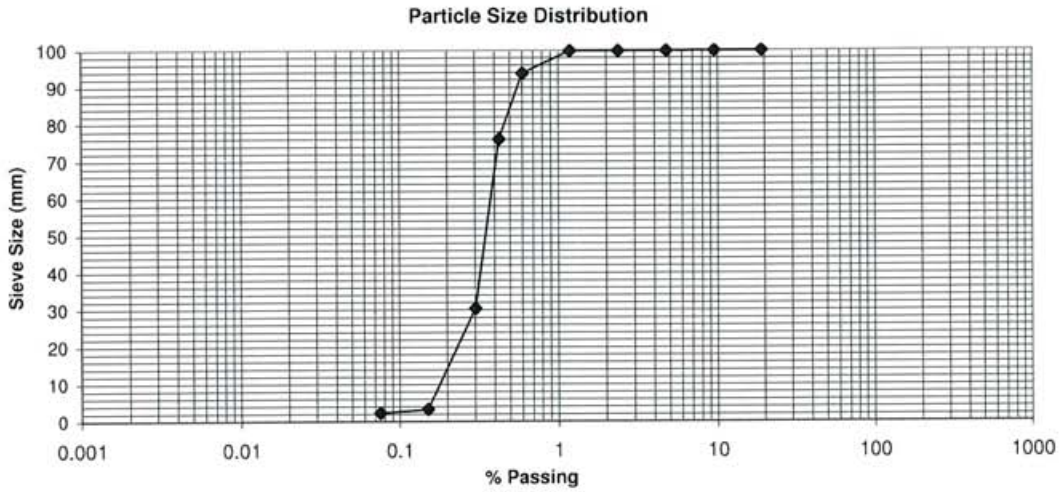
TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	29/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-715
Sample ID.:	TP20	Depth:	0.5 - 1.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	94
		0.425	76
19.0	100	0.300	30
9.5	100	0.150	3
4.75	100	0.075	2

Notes:
Sample supplied by client

Certificate No.:07-WG-715 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

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36 Railway Parade
Welshpool WA 6106

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ABN 91105324436
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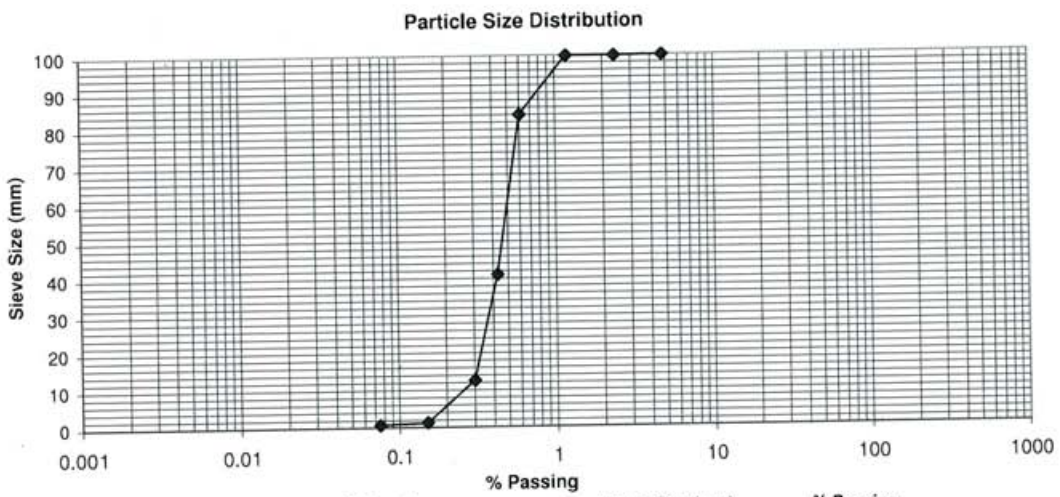
fx: (08) 9458 3700

TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	30/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-716
Sample ID.:	TP22	Depth:	1.5 - 2.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	84
		0.425	41
		0.300	13
		0.150	1
4.75	100	0.075	1

Notes:
Sample supplied by client

Certificate No.:07-WG-716 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

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Welshpool WA 6106

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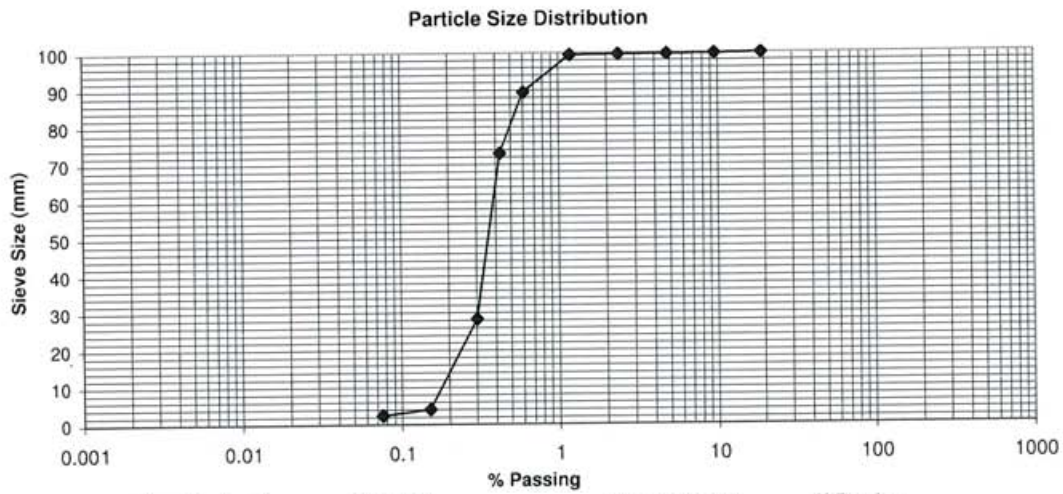
ABN 91105324436
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	28/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-717
Sample ID.:	TP28	Depth:	0.5 - 1.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	99
		0.600	89
		0.425	73
19.0	100	0.300	28
9.5	100	0.150	4
4.75	100	0.075	3

Notes:
Sample supplied by client

Certificate No.:07-WG-717 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

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SN 2411

TEST CERTIFICATE

CLIENT: Brown Geotechnical & Enviromental Pty Ltd
PROJECT: Muriel Court (Area 19)
LOCATION: Jandakot

JOB NO.: 07-01-175
CLIENT JOB NO.: J06036/1
DATE TESTED: 30/03/2007

Lab Ref No.: 07-WG-717
Sample Id:
Sample No.: TP28 – 0.5 - 1.5m
Description:

ORGANIC MATTER CONTENT - FURNACE METHOD

- according to ASTM D 2974, Part 9, Method C

Organic Content (%):	0.84

Note:

Certificate No.: WG717

Approved Signatory :_ (M.Matthews)

Date : 12/04/2007

QMS.Forms.Soils.WG086.01.C

36 Railway Parade Welshpool WA 6106 Phone (08) 9458 1700 Fax (08) 9458 3700

APPENDIX D

Acid Sulphate Soil Field Test Results

Test Pit No	Depth (m)	pH_F (field)	pH_{FOX} (post oxidation)	Reaction Strength
TP1	0.5	6.9	5.1	Moderate
TP1	1.5	7.2	5.5	Slight
TP1	2.5	6.9	5.0	Slight*
TP2	0.5	6.8	4.9	Slight
TP2	1.5	7.2	5.2	Slight
TP2	2.5	7.1	5.0	Slight
TP3	0.5	6.7	4.2	Slight
TP3	1.5	6.6	4.5	Slight*
TP3	2.5	7.1	5.2	Slight
TP4	0.5	7.0	3.8	Slight
TP4	1.5	5.8	3.8	Slight*
TP4	2.5	6.2	4.8	Slight
TP5	0.5	6.3	4.7	Slight
TP5	1.5	6.2	4.7	Slight
TP5	2.5	6.5	4.9	Slight
TP9	0.5	6.8	4.9	Slight
TP9	1.5	6.9	4.7	Slight
TP9	2.5	6.8	4.9	Slight
TP26	0.5	6.2	4.6	Slight
TP26	1.5	6.2	4.5	Slight*
TP26	2.5	6.3	4.6	Slight
TP27	0.5	6.0	4.8	Slight
TP27	1.5	6.3	4.8	Slight*
TP27	2.5	6.0	5.9	Slight
TP28	0.5	6.1	5.0	Slight
TP28	1.5	6.2	4.8	Slight
TP28	2.5	6.3	4.9	Slight
TP29	0.5	7.9	4.9	Slight
TP29	1.5	7.7	5.2	Slight
TP29	2.5	7.3	4.6	Strong*
TP30	0.5	7.3	4.3	Moderate*
TP30	1.5	6.8	4.7	Slight
TP30	2.5	6.8	4.6	Slight
TP31	0.5	7.0	4.5	Moderate*
TP31	1.5	7.0	5.0	Slight
TP31	2.5	7.0	5.1	Slight*
TP32	0.5	6.1	2.9	Moderate*
TP32	1.5	6.3	4.1	Slight*
TP32	2.5	5.9	4.2	Slight

* Selected for laboratory testing.

ALS Environmental

11/F, Chung Shun Knitting Centre
1-3 Wing Yip St, Kwai Chung
Tel : (852) 2610 1044
Fax : (852) 2610 2021
Email: alshk@hknet.com

SAMPLE SUBMISSION FORM

Please Note : The following information is required to expedite sample analysis. Please complete all the necessary details and return this form with your samples.

CLIENT DETAILS:
Company Name: Brown Geotechnical & Environmental

Client Contact Name: Ken Brown Date: 05/04/07

Postal Address: POBox 4000, Victotia Park WA6979

Email: bge@acidss.com.au

Phone: 9368 2615 Fax: 9367 7409

CLIENT ORDER No : J06036.01/2 ALS QUOTATION NUMBER : PEN/063/06

PROJECT NAME: Area 19, Muriel Court, Jandakot

SECONDARY CONTACT
Name :
Address:
Phone :

Environmental Division
Perth
Work Order
EP0701409

Telephone : 61-8-9209 7655

(office use only)
Batch No: EP0701409
Date Received: 5/4/07
Total No Samples: #13

Luke Jones
5/4/07 16:30

SAMPLE ANALYTIC

Lab ID (office use only)	Sample ID.	Matrix	Sampling Date/Time	Analysis Required
1	TP1 – 2.5m EP07012007003	Soil	15/03/07	ASS Chromium Suite
2	TP3 – 1.5m EP07012007008	Soil	15/03/07	ASS Chromium Suite
3	TP4 – 1.5m EP07012007011	Soil	15/03/07	ASS Chromium Suite
4	TP4 – 2.5m EP07012007012	Soil	15/03/07	ASS Chromium Suite
5	TP26 – 1.5m EP07012007020	Soil	15/03/07	ASS Chromium Suite
6	TP27 – 1.5m EP07012007023	Soil	15/03/07	ASS Chromium Suite
7	TP29 – 2.5m EP07012007027	Soil	15/03/07	ASS Chromium Suite
8	TP30 – 0.5m EP07012007028	Soil	15/03/07	ASS Chromium Suite
9	TP31 – 0.5m EP07012007031	Soil	15/03/07	ASS Chromium Suite

(CONTINUED OVERLEAF)

SAMPLE ANALYTICAL REQUIREMENTS (continued) :

(office use only)
Batch No:

Lab ID (office use only)	Sample ID.	Matrix	Sampling Date/Time	Analysis Required
10	TP31 – 2.5m EP07012007033	Soil	15/03/07	ASS Chromium Suite
11	TP32 – 0.5m EP07012007034	Soil	15/03/07	ASS Chromium Suite
12	TP32 – 1.5m EP07012007035	Soil	15/03/07	ASS Chromium Suite
13	QA1	Soil	15/03/07	ASS Chromium Suite
	Soil samples retained by ALS			

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	: BROWN GEOTECHNICAL AND ENVIRONMENTAL	Laboratory	: Environmental Division Perth	Page	: 1 of 6
Contact	: MR KEN BROWN	Contact	: Michael Sharp	Work Order	: EP0701409
Address	: SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	Address	: 10 Hod Way Malaga WA Australia 6090		
E-mail	: kenbrown@acidss.com.au	E-mail	: Michael.Sharp@alsenviro.com		
Telephone	: 93682615	Telephone	: 61-8-9209 7655		
Facsimile	: - Not provided -	Facsimile	: 61-8-9209 7600		
Project	: J06036.01 2 Ex EP0701207	Quote number	: PEN-063-06	Date received	: 5 Apr 2007
Order number	: - Not provided -			Date issued	: 17 Apr 2007
C-O-C number	: - Not provided -			No. of samples	- Received : 13
Site	: Area 19, Muriel Court, Janakot				Analysed : 13

ALSE - Excellence in Analytical Testing

NATA Accredited Laboratory 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Stacey Hawkins	Instrument Chemist	Perth Inorganics - NATA 825 (15847 - Perth)

ALS Environmental

Comments

This report for the ALSE reference EP0701409 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical Results for Samples Submitted**
- **Surrogate Recovery Data**

The analytical procedures used by ALS Environmental 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 herein. Reference methods from which ALSE methods are based are provided in parenthesis.

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

Specific comments for Work Order **EP0701409**

Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Retained Acidity not required because pH KCl greater than or equal to 4.5

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: TP1 2.5	TP3 1.5	TP4 1.5	TP4 2.5	TP26 1.5
Sample Matrix Type / Description:				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Date / Time:				15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00
Laboratory Sample ID:				EP0701409-001	EP0701409-002	EP0701409-003	EP0701409-004	EP0701409-005
EA033-A: Actual Acidity								
pH KCl (23A)		0.1	pH Unit	6.5	6.2	5.4	6.6	6.4
Titratable Actual Acidity (23F)		2	mole H+ / t	<2	2	10	<2	2
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)		10	mole H+ / t	<10	<10	<10	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A1)		0.01	% CaCO3	----	----	----	<0.01	----
acidity - Acid Neutralising Capacity (a-19A1)		10	mole H+ / t	----	----	----	<10	----
sulfidic - Acid Neutralising Capacity (s-19A1)		0.01	% pyrite S	----	----	----	<0.01	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	11	<10	<10
Liming Rate		1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	11	<10	<10
Liming Rate excluding ANC		1	kg CaCO3/t	<1	<1	<1	<1	<1

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: TP27 1.5	TP29 2.5	TP30 0.5	TP31 0.5	TP31 2.5
Sample Matrix Type / Description:				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Date / Time:				15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00
Laboratory Sample ID:				EP0701409-006	EP0701409-007	EP0701409-008	EP0701409-009	EP0701409-010
EA033-A: Actual Acidity								
pH KCl (23A)		0.1	pH Unit	6.2	6.6	6.7	6.9	6.2
Titratable Actual Acidity (23F)		2	mole H+ / t	2	<2	<2	<2	2
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)		10	mole H+ / t	<10	<10	<10	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A1)		0.01	% CaCO3	----	0.06	0.24	0.30	----
acidity - Acid Neutralising Capacity (a-19A1)		10	mole H+ / t	----	11	48	61	----
sulfidic - Acid Neutralising Capacity (s-19A1)		0.01	% pyrite S	----	0.02	0.08	0.10	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate		1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate excluding ANC		1	kg CaCO3/t	<1	<1	<1	<1	<1

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: TP32 0.5	TP32 1.5	QA1		
Sample Matrix Type / Description:				SOIL	SOIL	SOIL		
Sample Date / Time:				15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00		
Laboratory Sample ID:				EP0701409-011	EP0701409-012	EP0701409-013		
EA033-A: Actual Acidity								
pH KCl (23A)		0.1	pH Unit	4.9	5.8	5.9		
Titratable Actual Acidity (23F)		2	mole H+ / t	5	2	2		
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S	<0.02	<0.02	<0.02		
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)		0.02	% S	<0.02	<0.02	<0.02		
acidity - Chromium Reducible Sulfur (a-22B)		10	mole H+ / t	<10	<10	<10		
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5		1.5	1.5	1.5		
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02		
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10		
Liming Rate		1	kg CaCO3/t	<1	<1	<1		
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02		
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	<10		
Liming Rate excluding ANC		1	kg CaCO3/t	<1	<1	<1		

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Surrogate Control Limits

- No surrogates present on this report.

ALS Environmental

QUALITY CONTROL REPORT

Client	:	**BROWN GEOTECHNICAL AND ENVIRO**	**Laboratory**	: Environmental Division Perth	**Page**	:	1 of 5
Contact	:	MR KEN BROWN	**Contact**	: Michael Sharp			
Address	:	SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	**Address**	: 10 Hod Way Malaga WA Australia 6090	**Work order**	:	EP0701409
					Amendment No.	:	
Project	:	J06036.01 2 Ex EP0701207	**Quote number**	: PEN-063-06	**Date received**	:	5 Apr 2007
Order number	:	- Not provided -			**Date issued**	:	17 Apr 2007
C-O-C number	:	- Not provided -					
Site	:	Area 19, Muriel Court, Janakot					
E-mail	:	kenbrown@acidss.com.au	**E-mail**	: Michael.Sharp@alsenviro.com	**No. of samples**		
Telephone	:	93682615	**Telephone**	: 61-8-9209 7655	**Received**	:	13
Facsimile	:	- Not provided -	**Facsimile**	: 61-8-9209 7600	**Analysed**	:	13

This final report for the ALSE work order reference EP0701409 supersedes any previous reports with this reference.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

Work order specific comments

Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Retained Acidity not required because pH KCl greater than or equal to 4.5

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NATA
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NATA Accredited Laboratory - 825

This document is issued in accordance with NATA's accreditation requirements.

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Stacey Hawkins	Perth Inorganics - NATA 825 (15847 - Perth)

Quality Control Report - Laboratory Duplicates (DUP)

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.
- Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** = *Limit of Reporting,* ***RPD*** = *Relative Percent Difference.*
* Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) 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%

Laboratory Duplicates (DUP) Report

Matrix Type: SOIL

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EA033-A: Actual Acidity						
EA033-A: Actual Acidity - (QC Lot: 389856)				pH Unit	pH Unit	%
EP0701409-001	TP1 - 2.5	pH KCl (23A)	0.1 pH Unit	6.5	6.5	0.0
		Titratable Actual Acidity (23F)	2 mole H+ / t	<2	<2	0.0
		sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	0.0
EP0701409-011	TP32 - 0.5	pH KCl (23A)	0.1 pH Unit	4.9	5.5	11.1
		Titratable Actual Acidity (23F)	2 mole H+ / t	5	4	28.4
		sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	0.0
EA033-B: Potential Acidity						
EA033-B: Potential Acidity - (QC Lot: 389856)				% S	% S	%
EP0701409-001	TP1 - 2.5	Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	0.0
		Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	0.0
EP0701409-011	TP32 - 0.5	Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	0.0
		Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	0.0
EA033-E: Acid Base Accounting						
EA033-E: Acid Base Accounting - (QC Lot: 389856)						%
EP0701409-001	TP1 - 2.5	ANC Fineness Factor		1.5	1.5	0.0
		Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate	1 kg CaCO3/t	<1	<1	0.0
		Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	0.0
EP0701409-011	TP32 - 0.5	ANC Fineness Factor		1.5	1.5	0.0
		Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate	1 kg CaCO3/t	<1	<1	0.0

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EA033-E: Acid Base Accounting - continued						
EA033-E: Acid Base Accounting - (QC Lot: 389856) - continued				% S	% S	%
EP0701409-011	TP32 - 0.5	Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	0.0

Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)

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 type is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. Abbreviations: LOR = Limit of reporting.

Matrix Type: SOIL

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

Analyte name	LOR	Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
				LCS	Low	High
EA033-A: Actual Acidity						
EA033-A: Actual Acidity - (QC Lot: 389856)		pH Unit	pH Unit	%	%	%
pH KCl (23A)	0.1 pH Unit	<0.1	----	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	----	----	----	----
Titratable Actual Acidity (23F)	2 mole H+ / t	<2	----	----	----	----
EA033-B: Potential Acidity						
EA033-B: Potential Acidity - (QC Lot: 389856)		mole H+ / t	mole H+ / t	%	%	%
Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	----	----	----	----
Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	----	----	----	----
EA033-E: Acid Base Accounting						
EA033-E: Acid Base Accounting - (QC Lot: 389856)				%	%	%
ANC Fineness Factor		<0.5	----	----	----	----
Liming Rate	1 kg CaCO3/t	<1	----	----	----	----
Net Acidity (acidity units)	10 mole H+ / t	<10	----	----	----	----
Net Acidity (sulfur units)	0.02 % S	<0.02	----	----	----	----

Quality Control Report - Matrix Spikes (MS)

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 type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** *= Limit of Reporting,* ***RPD*** *= Relative Percent Difference.*

* Indicates failed QC

Matrix Spike (MS) Report

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration		MS	Low	High
- (QC Lot:)						%	%	%

- **No Matrix Spike (MS) carried out on this Work Order.**

ALS Environmental

INTERPRETIVE QUALITY CONTROL REPORT

Client	:	**BROWN GEOTECHNICAL AND ENVIRONMENTAL**	**Laboratory**	:	Environmental Division Perth	**Page**	: **1 of 5**
Contact	:	MR KEN BROWN	**Contact**	:	Michael Sharp		
Address	:	SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	**Address**	:	10 Hod Way Malaga WA Australia 6090	**Work order**	: **EP0701409**
						Amendment No.	:
Project	:	J06036.01 2 Ex EP0701207	**Quote number**	:	PEN-063-06	**Date received**	: 5 Apr 2007
Order number	:	- Not provided -				**Date issued**	: 17 Apr 2007
C-O-C number	:	- Not provided -					
Site	:	Area 19, Muriel Court, Janakot					
E-mail	:	kenbrown@acidss.com.au	**E-mail**	:	Michael.Sharp@alsenviro.com	**No. of samples**	
Telephone	:	93682615	**Telephone**	:	61-8-9209 7655	**Received**	: 13
Facsimile	:	- Not provided -	**Facsimile**	:	61-8-9209 7600	**Analysed**	: 13

This Interpretive Quality Control Report was issued on 17 Apr 2007 for the ALS work order reference EP0701409 and supersedes any previous reports with this reference.
This report contains the following information:

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

Interpretive Quality Control Report - Analysis Holding Time

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 preclude subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the sample aliquot was taken. Elapsed time to analysis represents time from sampling where no extraction / digestion is involved or time from extraction / digestion where this is present. For composite samples, sampling date/time is taken as that of the oldest sample contributing to that composite. Sample date/time for laboratory produced leaches are taken from the completion date/time of the leaching process. Outliers for holding time are based on USEPA SW846, APHA, AS and NEPM (1999). Failed outliers, refer to the 'Summary of Outliers'.

Matrix Type: SOIL

Analysis Holding Time and Preservation

Method / Container / Client Sample ID(s)	Date Sampled	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Pass?	Date analysed	Due for analysis	Pass?
EA033: Chromium Suite for Acid Sulphate Soils							
80° dried soil							
TP1 - 2.5, TP3 - 1.5, TP4 - 1.5, TP4 - 2.5, TP26 - 1.5, TP27 - 1.5, TP29 - 2.5, TP30 - 0.5, TP31 - 0.5, TP31 - 2.5, TP32 - 0.5, TP32 - 1.5, QA1	**15 Mar 2007**	**13 Apr 2007**	14 Mar 2008	Pass	**16 Apr 2007**	12 Jul 2007	Pass

Interpretive Quality Control Report - Frequency of Quality Control Samples

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which this work order was processed. Actual rate should be greater than or equal to the expected rate.

Frequency of Quality Control Samples

Matrix Type: SOIL

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
EA033: Chromium Suite for Acid Sulphate Soils	2	13	**15.4**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Laboratory Control Samples (LCS)					
EA033: Chromium Suite for Acid Sulphate Soils	1	13	**7.7**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Method Blanks (MB)					
EA033: Chromium Suite for Acid Sulphate Soils	1	13	**7.7**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement

Interpretive Quality Control Report - Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged on the 'Quality Control Report'. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot.

Non-surrogates

- **For all matrices, no RPD recovery outliers occur for the duplicate analysis.**
- **For all matrices, no method blank result outliers occur.**
- **For all matrices, no laboratory spike recoveries breaches occur.**
- **For all matrices, no matrix spike recoveries breaches occur.**

Surrogates

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

Outliers : Analysis Holding Time

The following report highlights outliers within this 'Interpretive Quality Control Report - Analysis Holding Time'.

- **No holding time outliers occur.**

Outliers : Frequency of Quality Control Samples

The following report highlights outliers within this 'Interpretive Quality Control Report - Frequency of Quality Control Samples'.

- **No frequency outliers occur.**

Method Reference Summary

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure 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 herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Matrix Type: SOIL

Preparation Methods

EN020PR : Drying at 85 degrees, bagging and labelling (ASS) - In house

Analytical Methods

EA033 : Chromium Suite for Acid Sulphate Soils - Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

APPENDIX E

APPENDIX E

Soil Assessment Criteria

Western Australia's Draft Acid Sulphate Soil Guidelines (2006) have established action criteria for the assessment of the environmental risk of acid sulphate soils. The action criteria are based on the sum of existing plus, potential acidity, calculated as equivalent sulphur (e.g. s-TAA + S_{CR} in %S units) or equivalent acidity (e.g. TAA + TPA in mol H^+/tonne). The highest laboratory result was used to assess against the action criteria.

As clay content tends to influence the soils natural pH buffering capacity, the action criteria are grouped by three broad texture categories – coarse, medium and fine. The criteria are used to define when acid sulphate soils disturbed at a site will need to be treated and managed. The Table below summarises the action criteria.

Texture based acid sulphate soils action criteria

Type of Material		Action Criteria if <1,000 tonnes of material is disturbed		Action Criteria if >1,000 tonnes of material is disturbed	
Texture Range	**Approx. Clay Content**	**Equivalent Sulphur (%)**	**Equivalent Acidity (mol H^+/tonne)**	**Equivalent Sulphur**	**Equivalent Acidity (mol H^+/tonne)**
Coarse – sands to loamy sands	≤ 5%	0.03	18.7	0.03	18.7
Medium – sandy loams to light clays	5 – 40%	0.06	37.4	0.03	18.7
Fine – medium to heavy clays and silty clays	≥ 40%	0.1	64.8	0.03	18.7

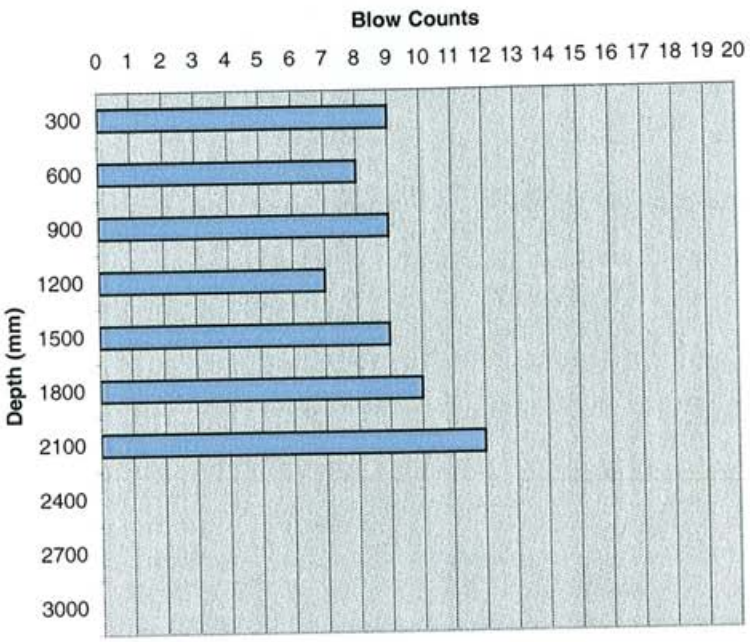
In addition to the action criteria, the guidelines define indicator pH values for field pH (pH_F) and field peroxide pH (pH_{FOX}) to assist with identifying likely acid generating soils. The pH indicator values are defined as:

- $pH_F \leq 4$ (when pH >4 but<5 may indicate some existing acidity); and
- pH_{FOX} <3 or a much lower pH_{FOX} than pH_F (greater than 1 pH unit change).

APPENDIX B

Depth (mm)	Blow Counts
300	9
600	8
900	9
1200	7
1500	9
1800	10
2100	12
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 1

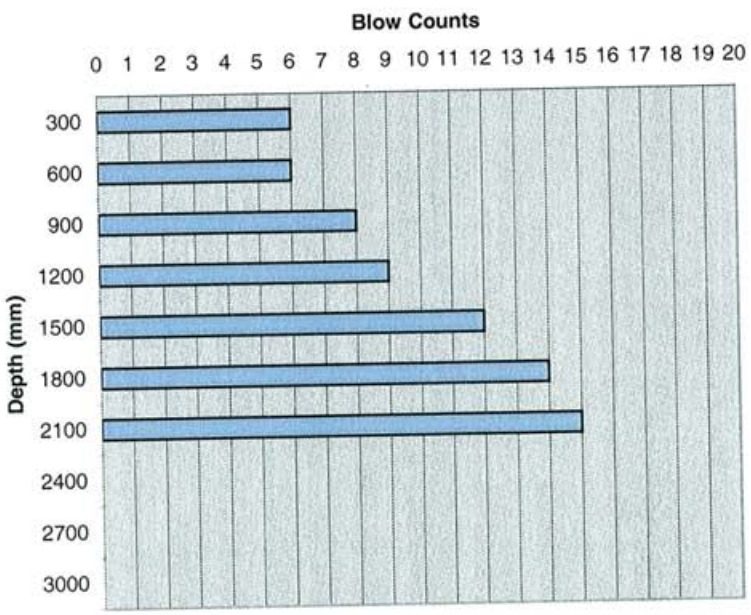


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	6
600	6
900	8
1200	9
1500	12
1800	14
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 2



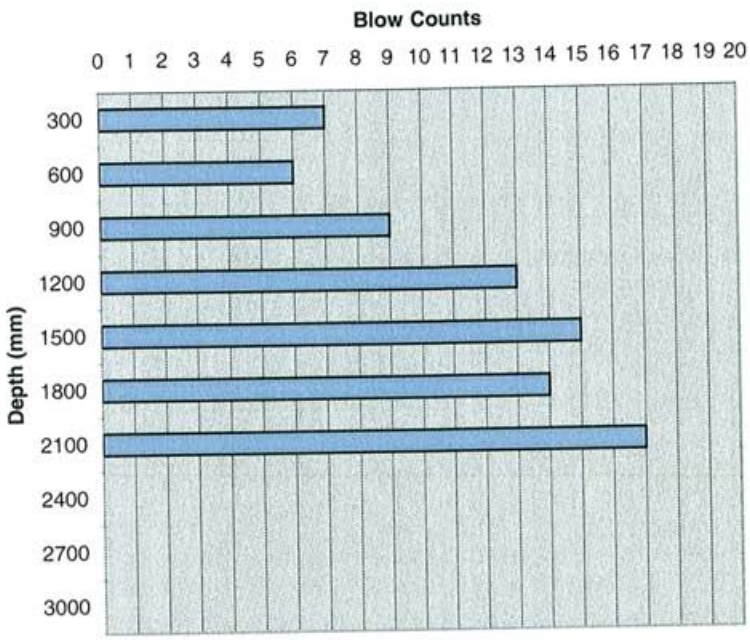
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	7
600	6
900	9
1200	13
1500	15
1800	14
2100	17
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 3

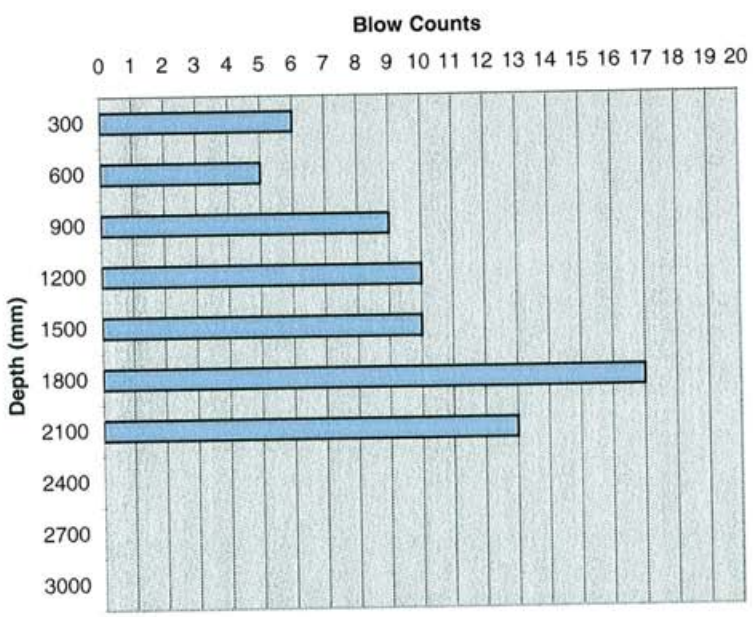


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	6
600	5
900	9
1200	10
1500	10
1800	17
2100	13
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 4



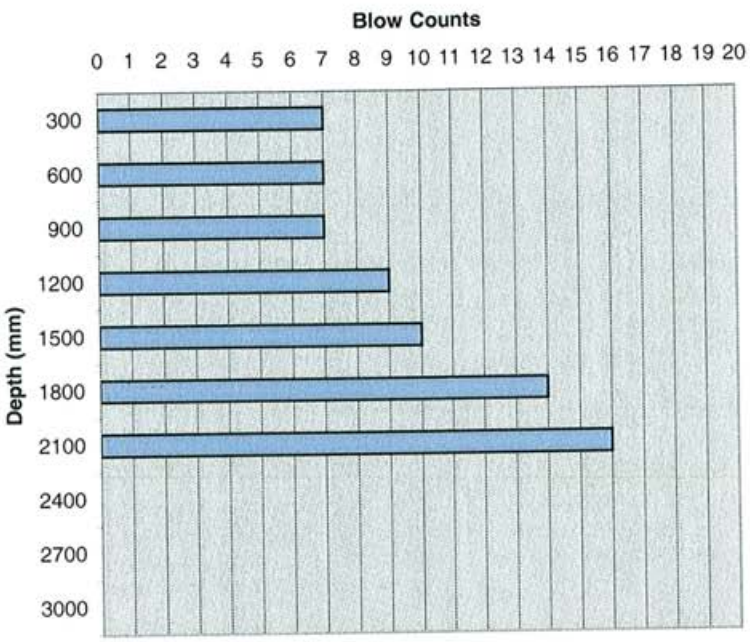
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	7
600	7
900	7
1200	9
1500	10
1800	14
2100	16
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 5

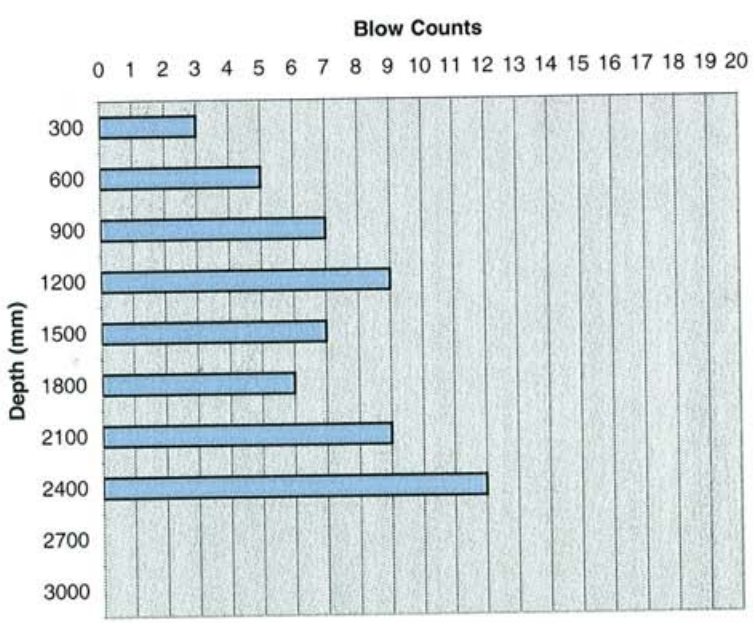


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	3
600	5
900	7
1200	9
1500	7
1800	6
2100	9
2400	12
2700	
3000	

Perth Sand Penetrometer Results - Test 6



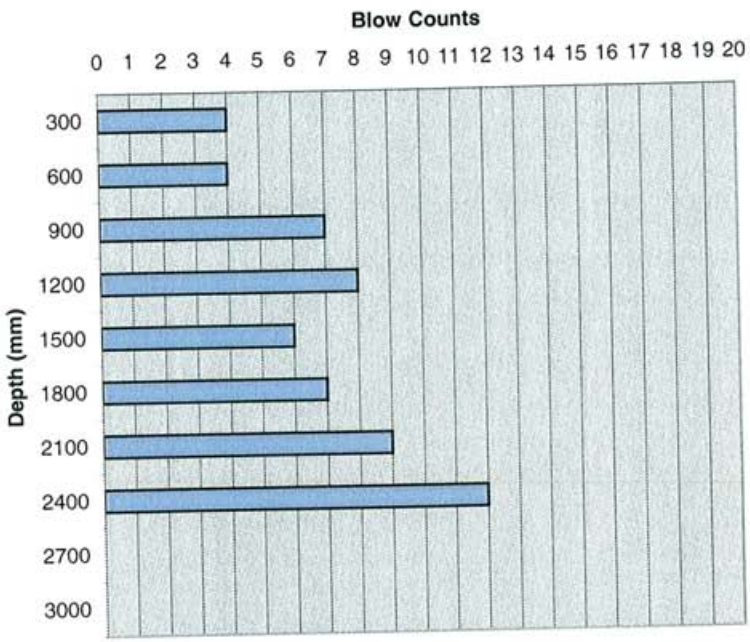
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	4
600	4
900	7
1200	8
1500	6
1800	7
2100	9
2400	12
2700	
3000	

Perth Sand Penetrometer Results - Test 7

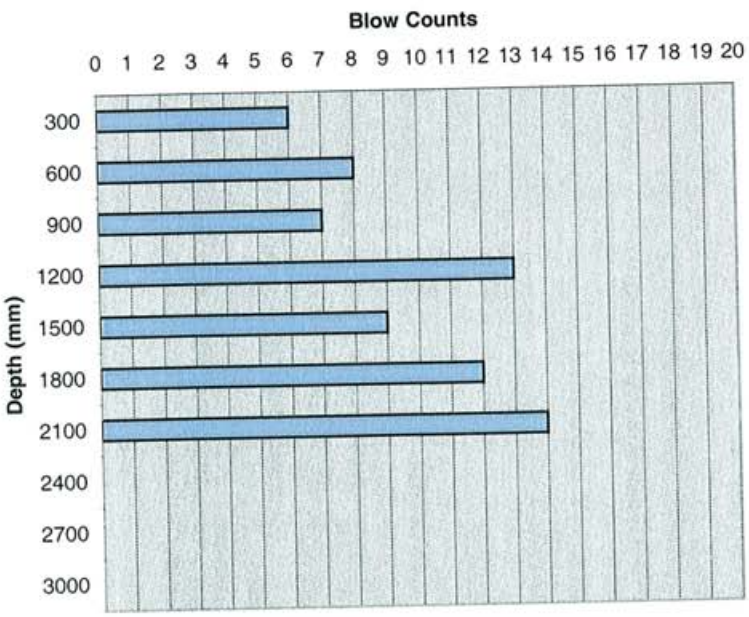


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	6
600	8
900	7
1200	13
1500	9
1800	12
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 8



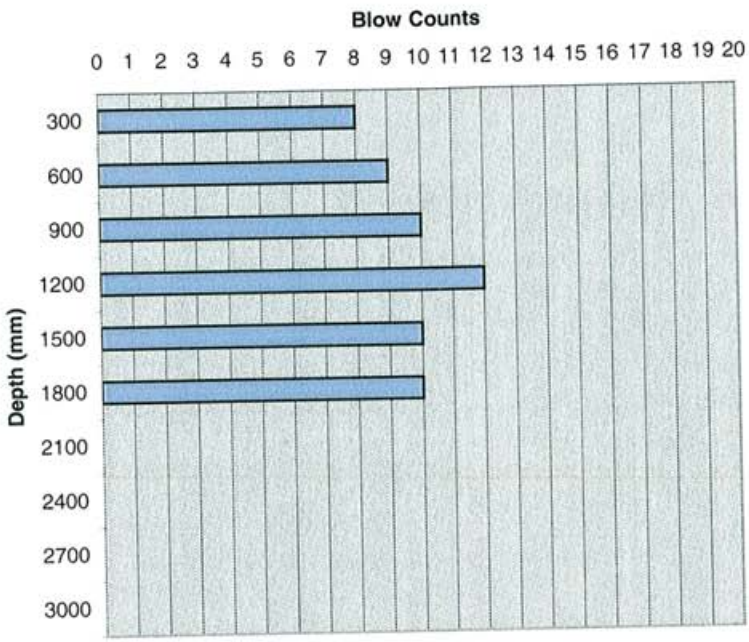
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	8
600	9
900	10
1200	12
1500	10
1800	10
2100	
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 9

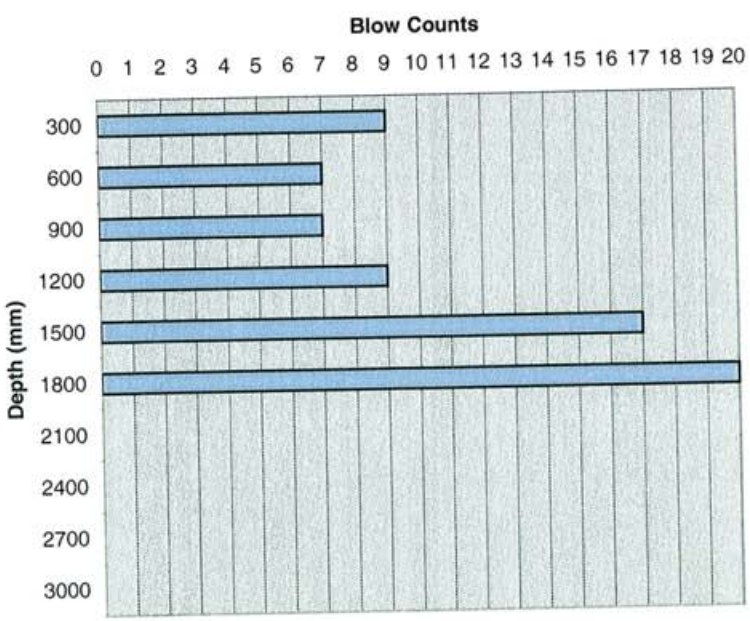


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	9
600	7
900	7
1200	9
1500	17
1800	20
2100	
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 10



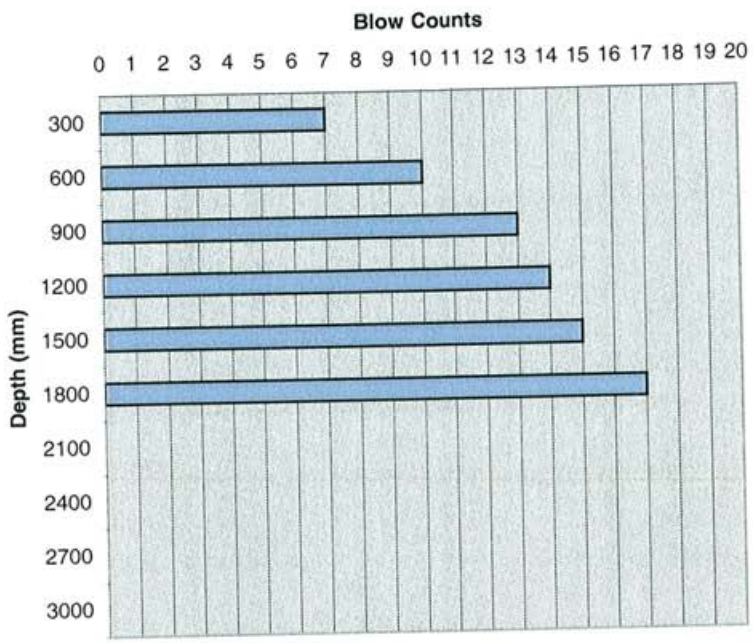
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	7
600	10
900	13
1200	14
1500	15
1800	17
2100	
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 11

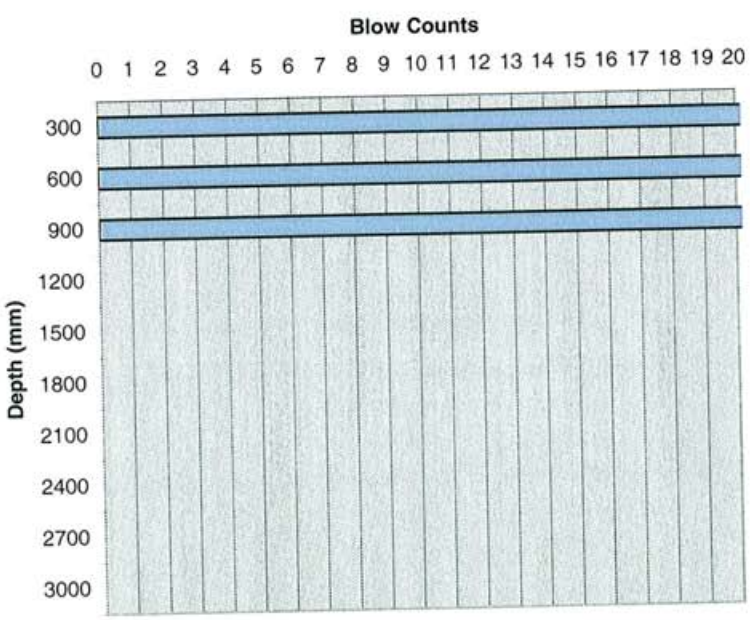


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	22
600	24
900	24
1200	
1500	
1800	
2100	
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 12



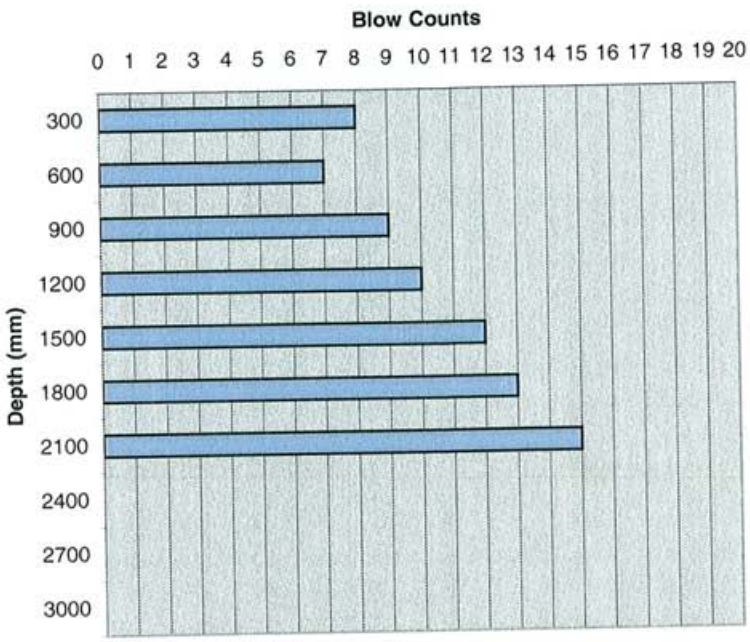
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	8
600	7
900	9
1200	10
1500	12
1800	13
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 13

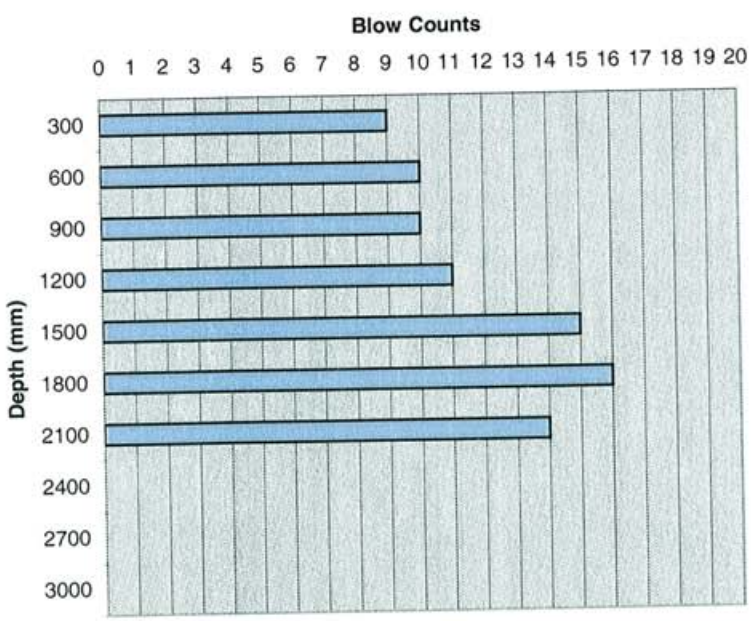


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	9
600	10
900	10
1200	11
1500	15
1800	16
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 14



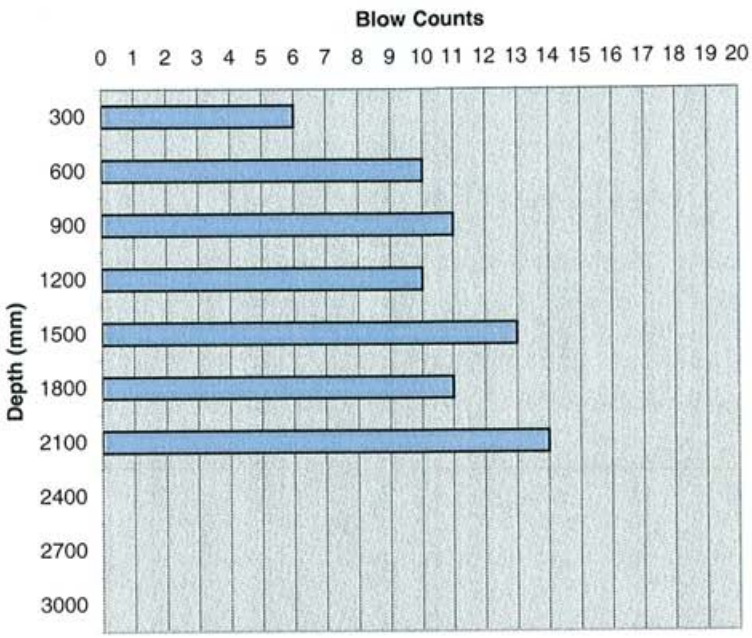
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	6
600	10
900	11
1200	10
1500	13
1800	11
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 15

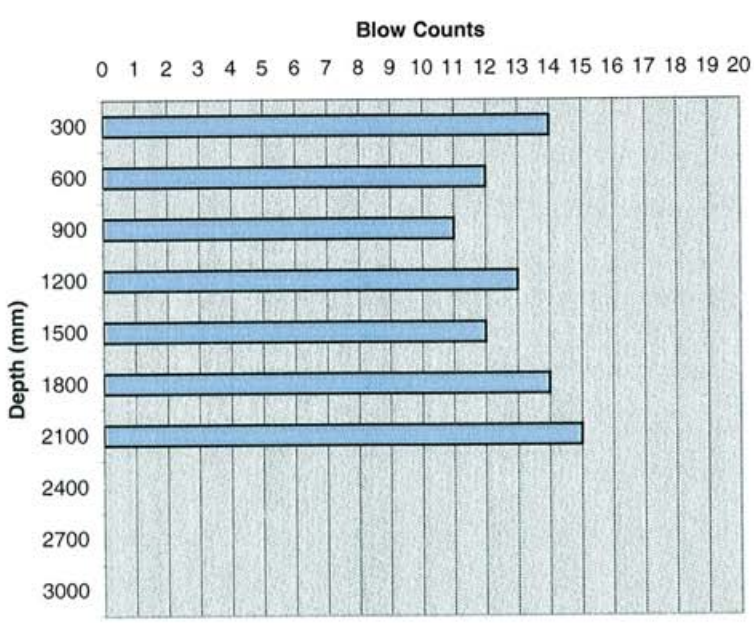


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	14
600	12
900	11
1200	13
1500	12
1800	14
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 16



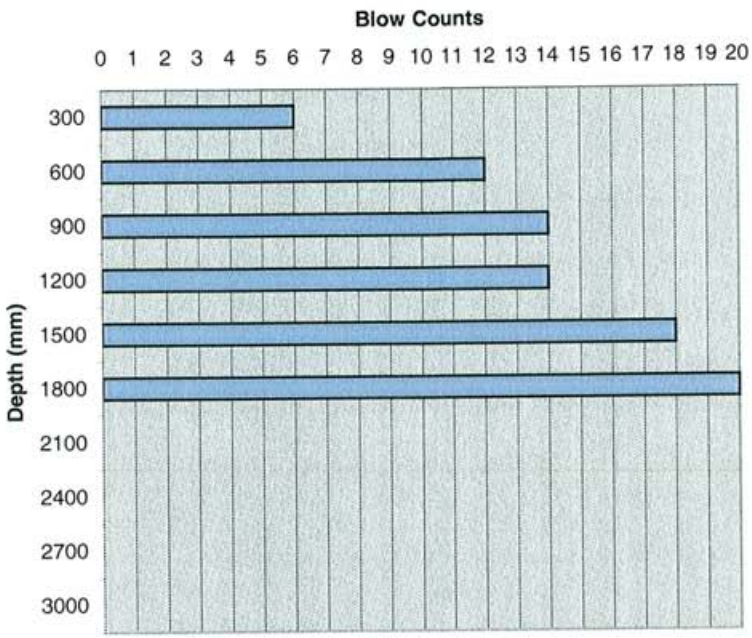
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	6
600	12
900	14
1200	14
1500	18
1800	20
2100	
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 17

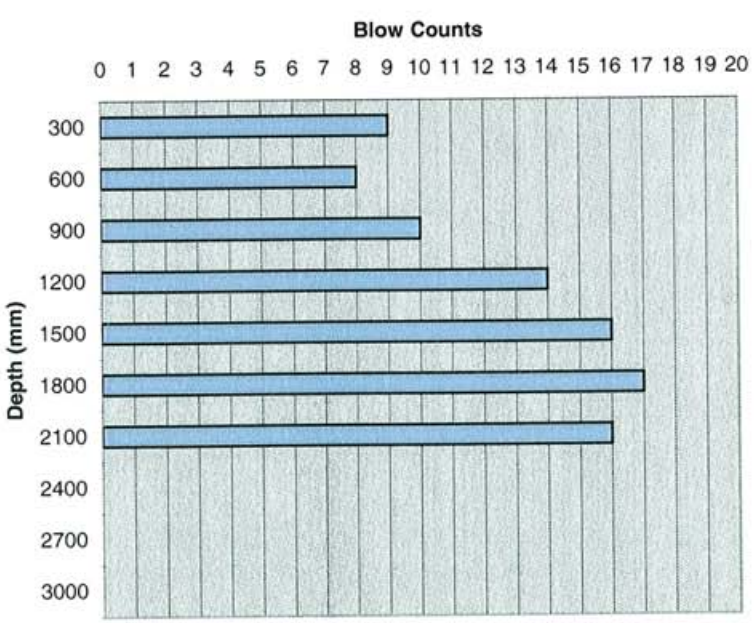


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	9
600	8
900	10
1200	14
1500	16
1800	17
2100	16
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 18



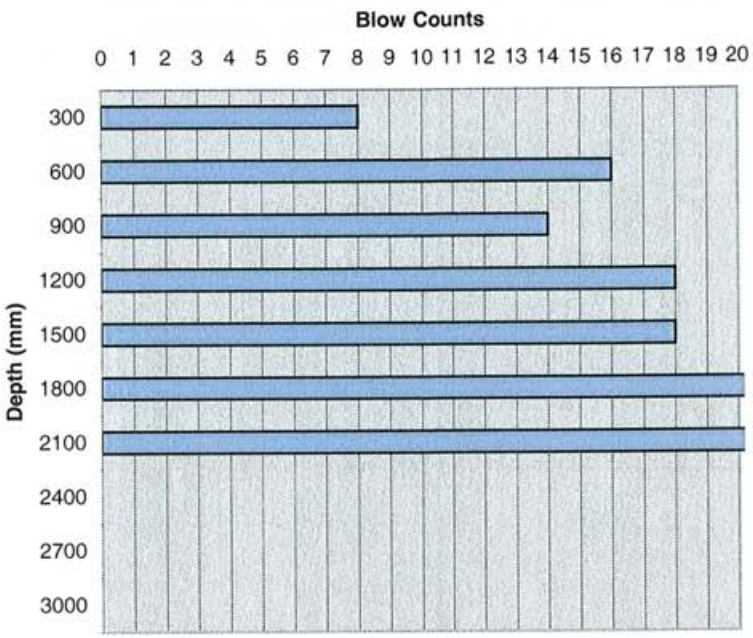
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	8
600	16
900	14
1200	18
1500	18
1800	22
2100	24
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 19

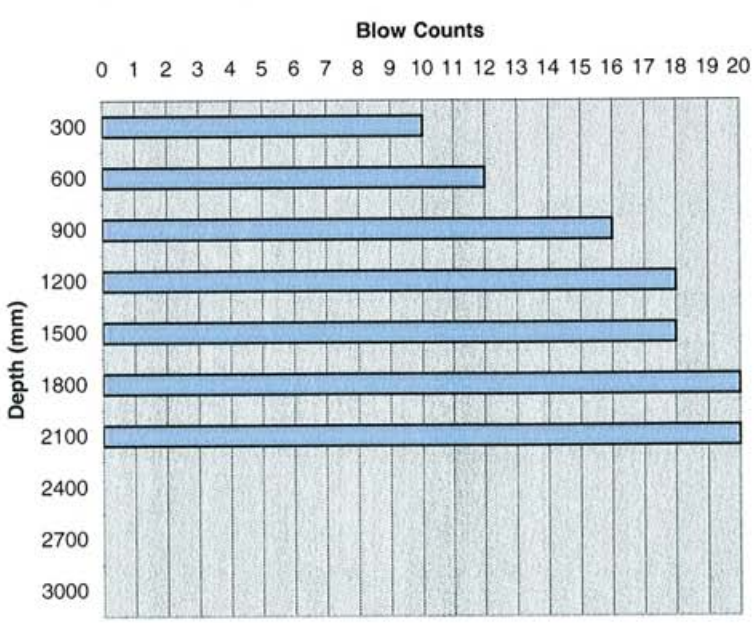


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	10
600	12
900	16
1200	18
1500	18
1800	20
2100	20
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 20



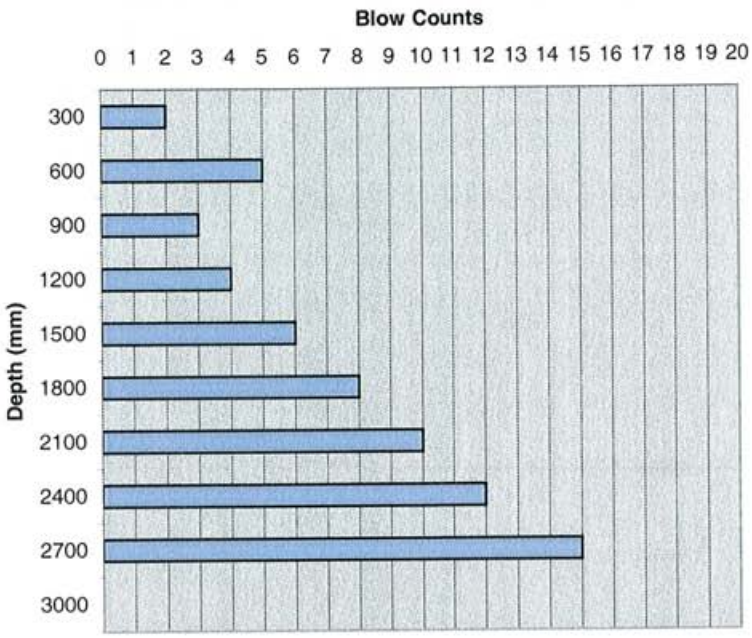
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	2
600	5
900	3
1200	4
1500	6
1800	8
2100	10
2400	12
2700	15
3000	

Perth Sand Penetrometer Results - Test 21

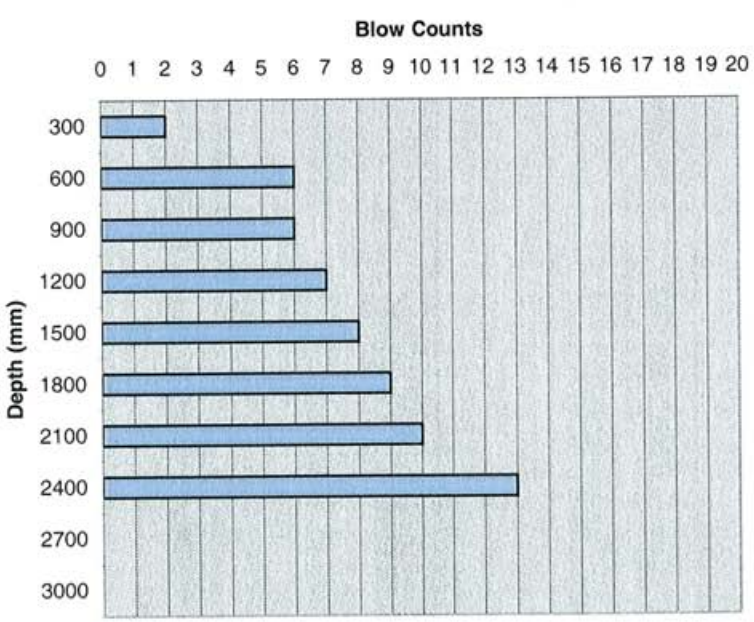


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	2
600	6
900	6
1200	7
1500	8
1800	9
2100	10
2400	13
2700	
3000	

Perth Sand Penetrometer Results - Test 22



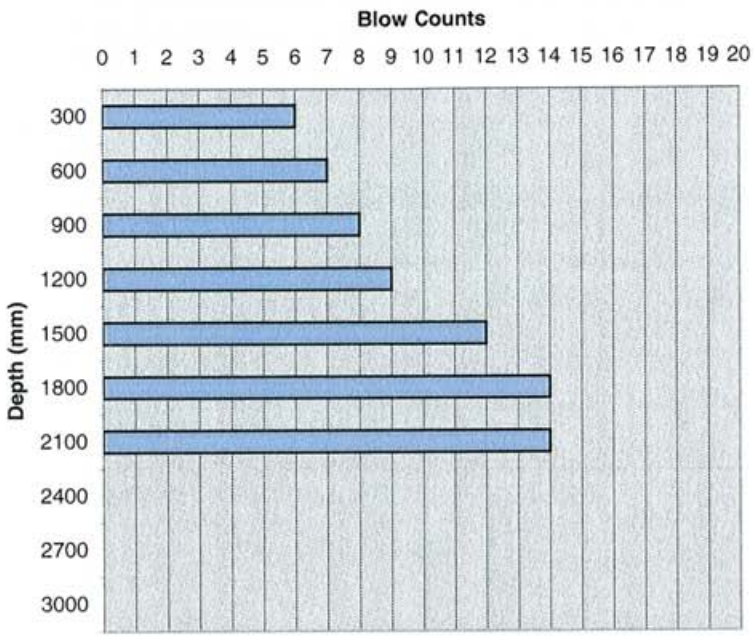
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	6
600	7
900	8
1200	9
1500	12
1800	14
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 23

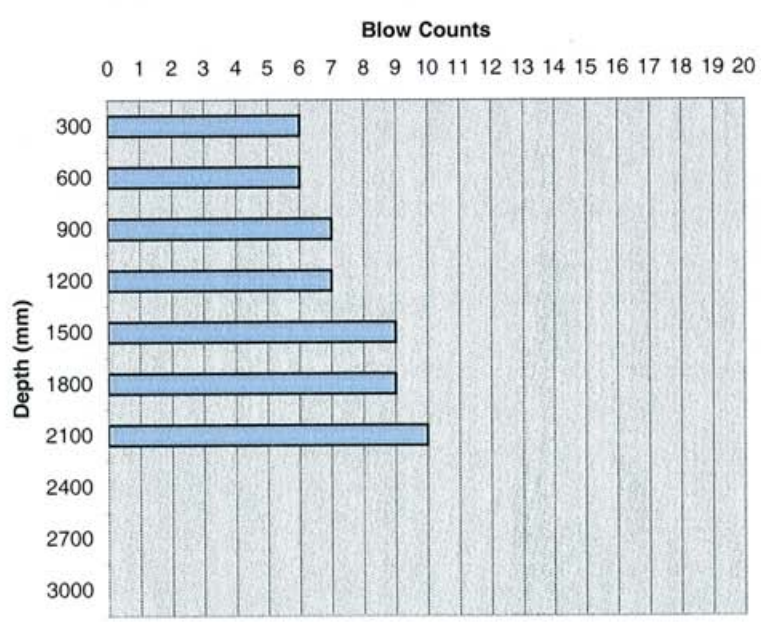


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	6
600	6
900	7
1200	7
1500	9
1800	9
2100	10
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 24



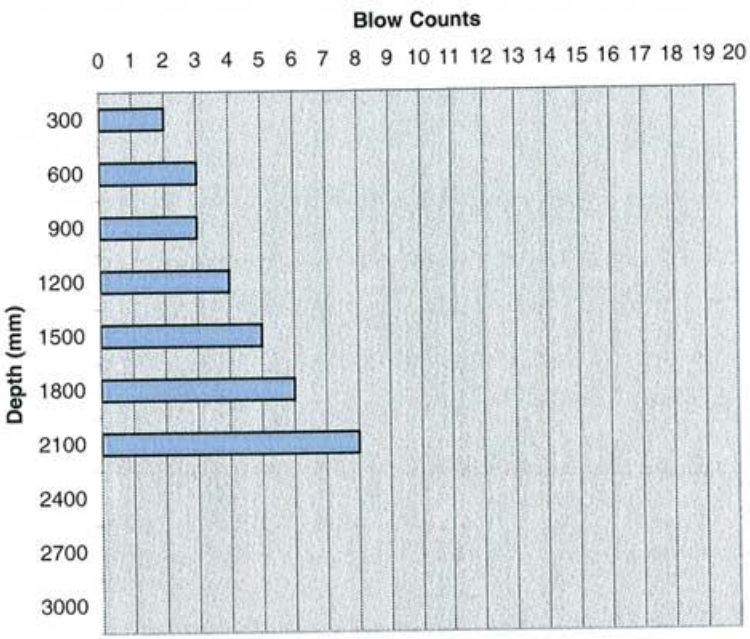
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	2
600	3
900	3
1200	4
1500	5
1800	6
2100	8
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 25

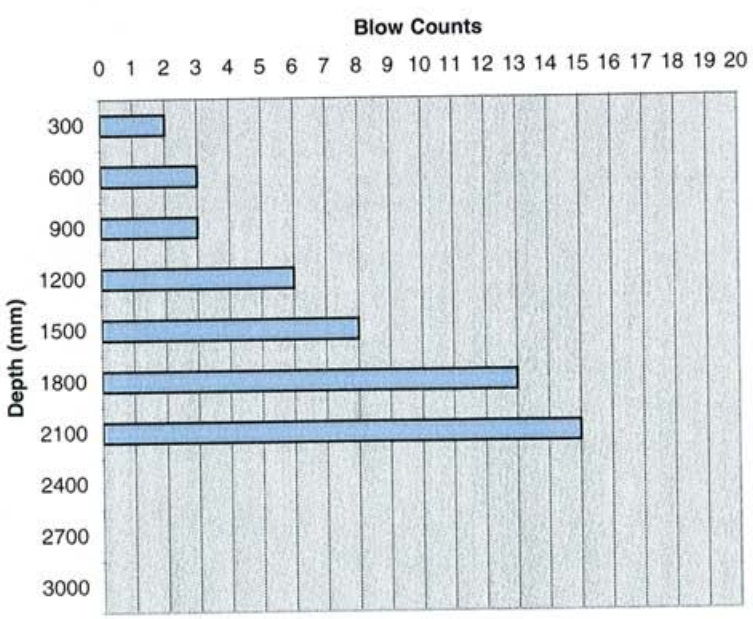


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	2
600	3
900	3
1200	6
1500	8
1800	13
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 26



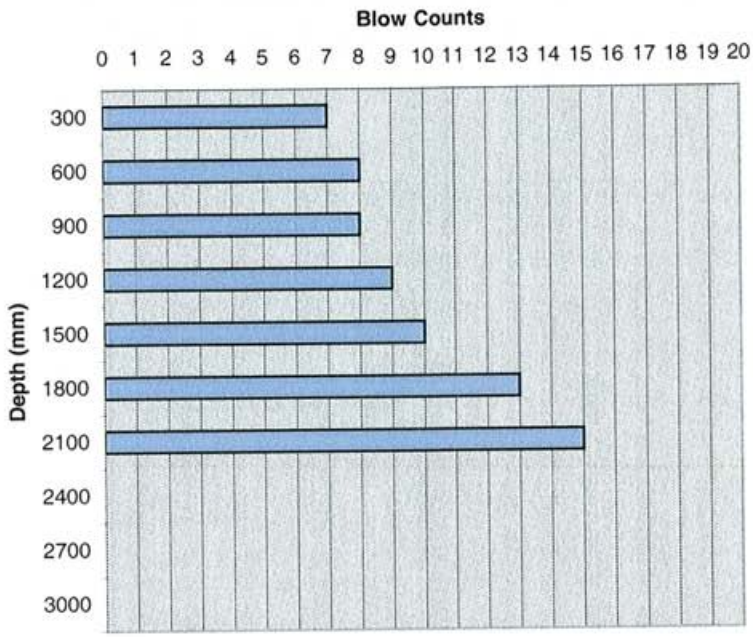
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	7
600	8
900	8
1200	9
1500	10
1800	13
2100	15
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 27

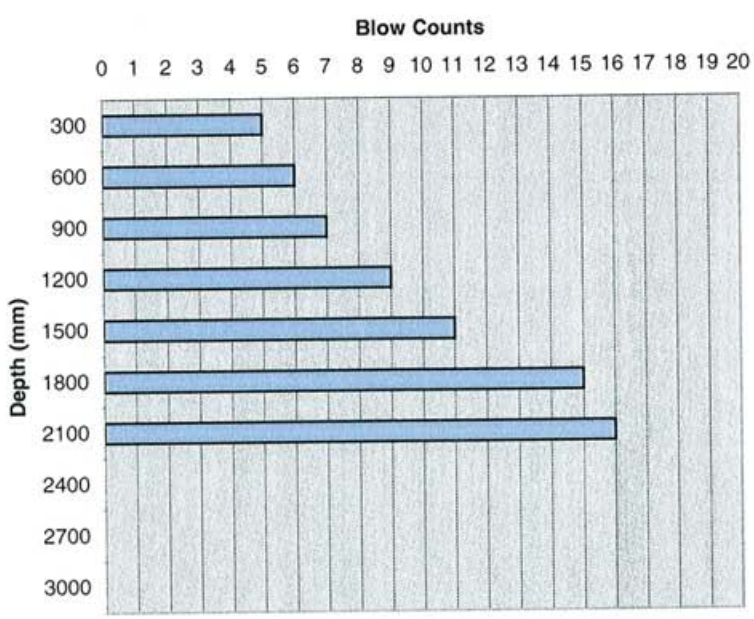


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	5
600	6
900	7
1200	9
1500	11
1800	15
2100	16
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 28



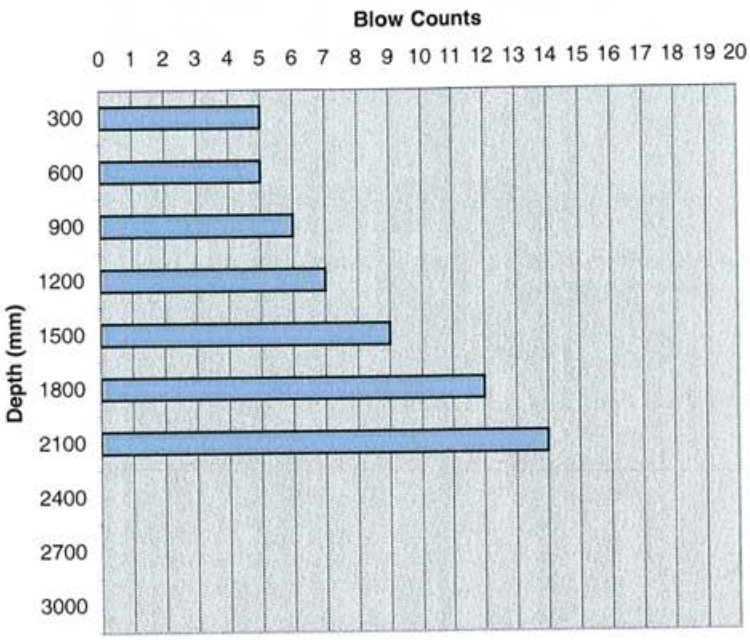
Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

Depth (mm)	Blow Counts
300	5
600	5
900	6
1200	7
1500	9
1800	12
2100	14
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 29

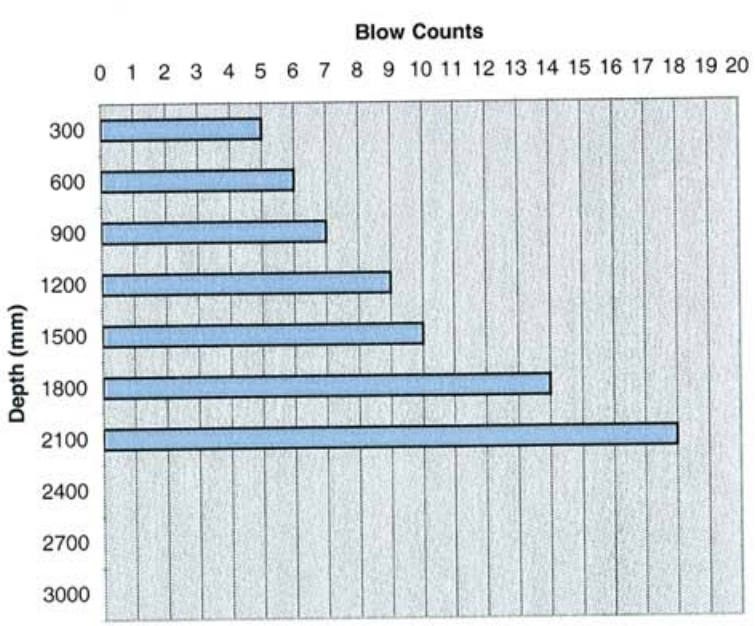


Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Depth	Blow Counts
300	5
600	6
900	7
1200	9
1500	10
1800	14
2100	18
2400	
2700	
3000	

Perth Sand Penetrometer Results - Test 30



Job Name: Area 19 Northlake Road, Jandakot **Job No**: J06036.01

Date: 15/03/2007

Brown Geotechnical & Environmental

APPENDIX C

Western Geotechnics Group
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

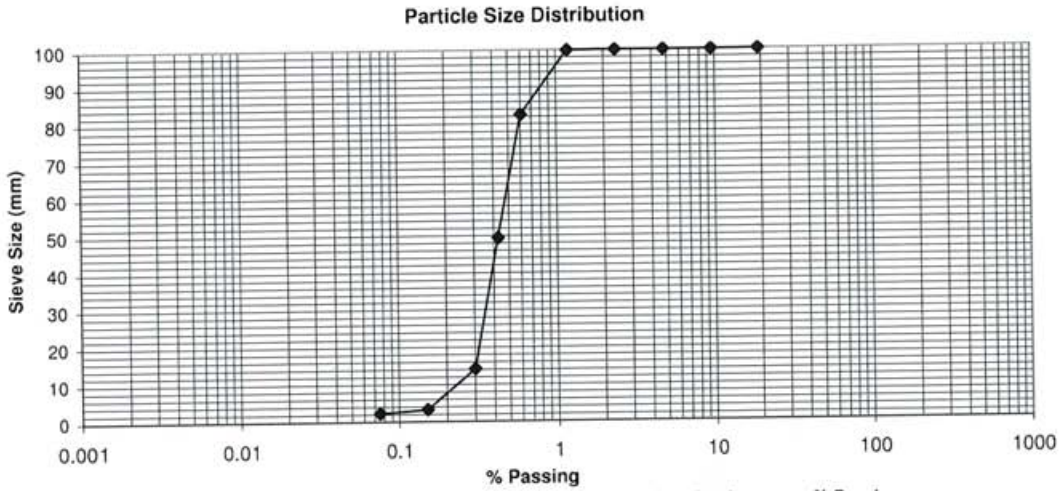
perth@westerngeo.com.au
ABN 91105324436
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	28/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-710
Sample ID.:	TP5	Depth:	0.5 - 1.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	83
		0.425	49
19.0	100	0.300	14
9.5	100	0.150	3
4.75	100	0.075	2

Notes:
Sample supplied by client

Certificate No.:07-WG-710 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

SN 2411

Western Geotechnics Group
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ABN 91105324436
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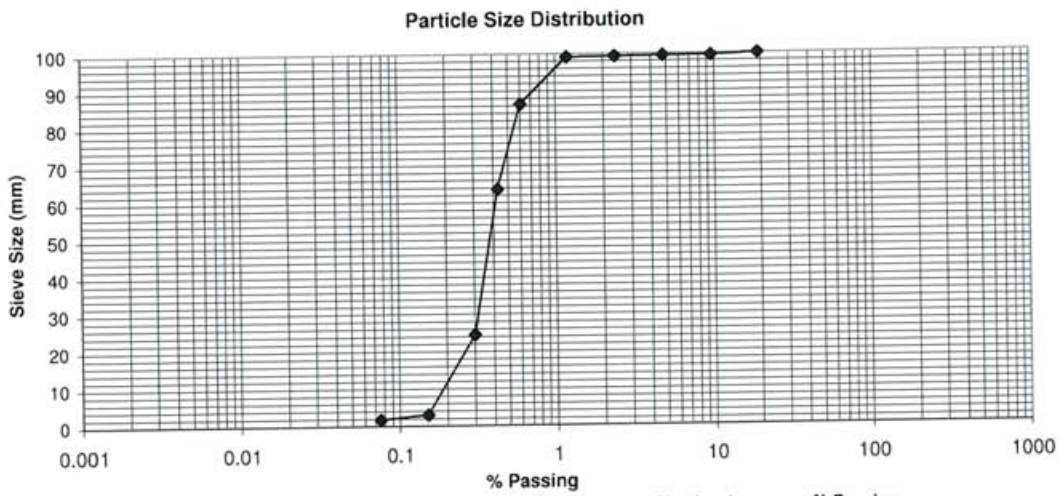
TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	29/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-718
Sample ID.:	TP7	Depth:	1.3 - 2.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	99
		1.18	99
		0.600	87
		0.425	64
19.0	100	0.300	24
9.5	100	0.150	3
4.75	99	0.075	2

Notes:
Sample supplied by client

Certificate No.:07-WG-718 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

SN 2411

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TEST CERTIFICATE

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Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No:	J06036/1
Project:	Muriel Court (Area 19)	Order No:	
Location:	Jandakot	Tested Date:	12/04/2007
Sample No:	07-WG-711	WG Job Number:	07-01-175
Sample ID:	TP11 0.5 - 1.5m	Lab:	Welshpool

PSD: PERCENT FINES <0.075MM

AS1289.3.6.1 (% Fines)

Part	Method	
Material Finer than 75µm (%)		1

Notes:

Note: Sample supplied by client

Approved Signatory: (M.Matthews) Date: 12/04/2007

Accreditation No.: 2418

This document is issued in accordance with NATA's accreditation requirements

Western Geotechnics Group
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TEST CERTIFICATE

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Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No:	J06036/1
Project:	Muriel Court (Area 19)	Order No:	
Location:	Jandakot	Tested Date:	12/04/2007
Sample No:	07-WG-712	WG Job Number:	07-01-175
Sample ID:	TP13 0.5 - 1.5m	Lab:	Welshpool

PSD: PERCENT FINES <0.075MM

AS1289.3.6.1 (% Fines)

Part	Method	
Material Finer than 75µm (%)		1

Notes:

Note: Sample supplied by client

Approved Signatory: (M.Matthews) Date: 12/04/2007

ilac-MRA NATA

This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Western Geotechnics Group
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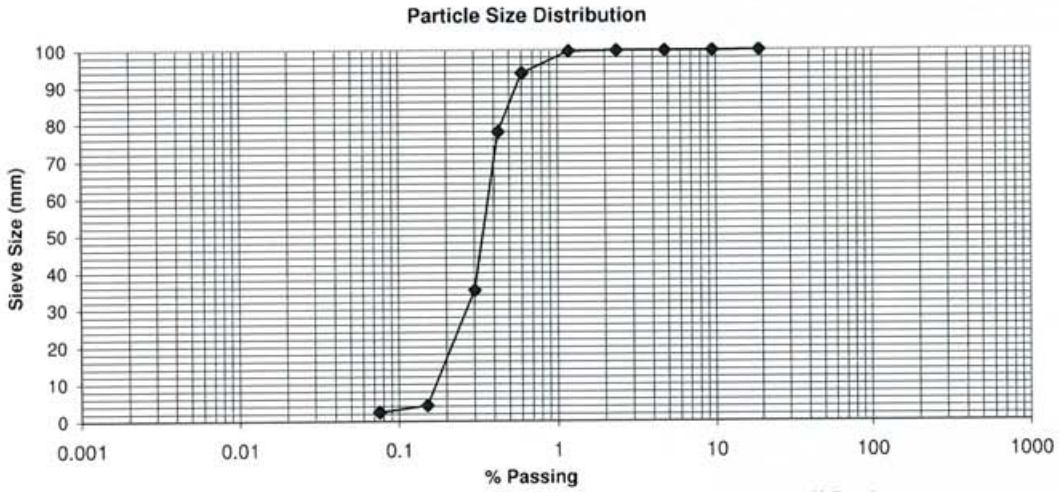
TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	29/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-713
Sample ID.:	TP15	Depth:	0.5 - 1.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	94
		0.425	78
19.0	100	0.300	35
9.5	100	0.150	4
4.75	100	0.075	2

Notes:
Sample supplied by client

Certificate No.:07-WG-713 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

SN 2411

Western Geotechnics Group
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

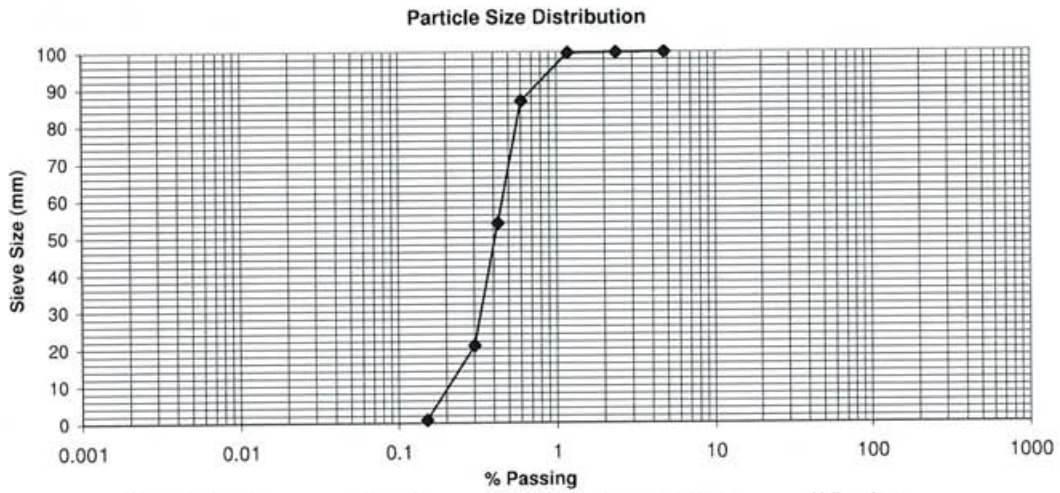
perth@westerngeo.com.au
ABN 91105324436
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	29/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-714
Sample ID.:	TP17	Depth:	0.9 - 2.0

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	87
		0.425	54
		0.300	21
		0.150	1
4.75	100	0.075	0

Notes:
Sample supplied by client

Certificate No.:07-WG-714 / S301

Approved Signatory: (Mark Matthews) **Date:** 12/04/2007

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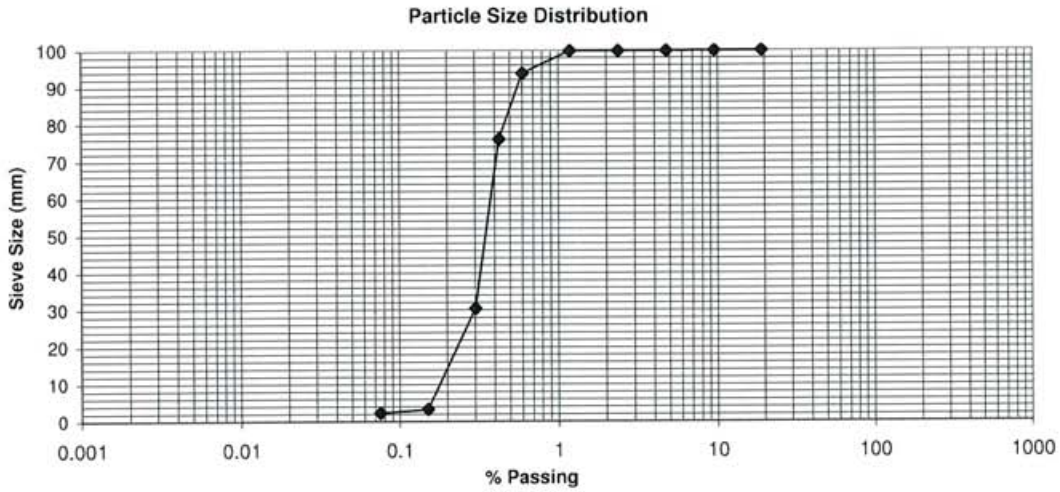
fx: (08) 9458 3700

TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	29/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-715
Sample ID.:	TP20	Depth:	0.5 - 1.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	94
		0.425	76
19.0	100	0.300	30
9.5	100	0.150	3
4.75	100	0.075	2

Notes:
Sample supplied by client

Certificate No.:07-WG-715 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

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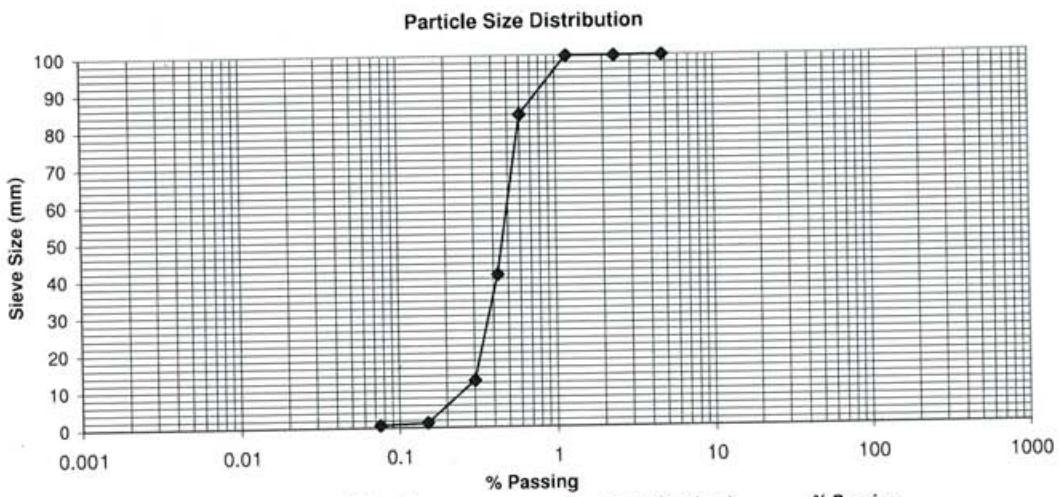
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	30/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-716
Sample ID.:	TP22	Depth:	1.5 - 2.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	84
		0.425	41
		0.300	13
		0.150	1
4.75	100	0.075	1

Notes:
Sample supplied by client

Certificate No.:07-WG-716 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

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Welshpool WA 6106

perth@westerngeo.com.au
ABN 91105324436
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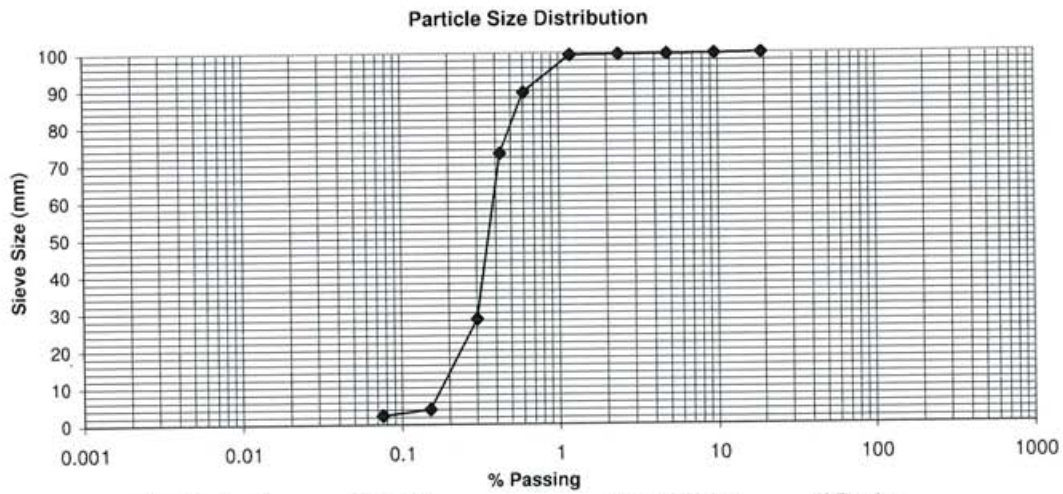
fx: (08) 9458 3700

TEST CERTIFICATE

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No.:	J06036/1
Project:	Muriel Court (Area 19)	Test Date:	28/03/07
Location:	Jandakot	WG Job No.:	07-01-175
Sample No.:		Lab No.:	07-WG-717
Sample ID.:	TP28	Depth:	0.5 - 1.5m

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	99
		0.600	89
		0.425	73
19.0	100	0.300	28
9.5	100	0.150	4
4.75	100	0.075	3

Notes:
Sample supplied by client

Certificate No.:07-WG-717 / S301

Approved Signatory: (Mark Matthews) Date: 12/04/2007

ilac-MRA NATA Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

SN 2411

TEST CERTIFICATE

CLIENT: Brown Geotechnical & Enviromental Pty Ltd
PROJECT: Muriel Court (Area 19)
LOCATION: Jandakot

JOB NO.: 07-01-175
CLIENT JOB NO.: J06036/1
DATE TESTED: 30/03/2007

Lab Ref No.: 07-WG-717
Sample Id:
Sample No.: TP28 – 0.5 - 1.5m
Description:

ORGANIC MATTER CONTENT - FURNACE METHOD

- according to ASTM D 2974, Part 9, Method C

Organic Content (%):	0.84

Note:

Certificate No.: WG717

Approved Signatory :_ (M.Matthews)

Date : 12/04/2007

QMS.Forms.Soils.WG086.01.C

36 Railway Parade Welshpool WA 6106 Phone (08) 9458 1700 Fax (08) 9458 3700

APPENDIX D

Acid Sulphate Soil Field Test Results

Test Pit No	Depth (m)	pH_F (field)	pH_{FOX} (post oxidation)	Reaction Strength
TP1	0.5	6.9	5.1	Moderate
TP1	1.5	7.2	5.5	Slight
TP1	2.5	6.9	5.0	Slight*
TP2	0.5	6.8	4.9	Slight
TP2	1.5	7.2	5.2	Slight
TP2	2.5	7.1	5.0	Slight
TP3	0.5	6.7	4.2	Slight
TP3	1.5	6.6	4.5	Slight*
TP3	2.5	7.1	5.2	Slight
TP4	0.5	7.0	3.8	Slight
TP4	1.5	5.8	3.8	Slight*
TP4	2.5	6.2	4.8	Slight
TP5	0.5	6.3	4.7	Slight
TP5	1.5	6.2	4.7	Slight
TP5	2.5	6.5	4.9	Slight
TP9	0.5	6.8	4.9	Slight
TP9	1.5	6.9	4.7	Slight
TP9	2.5	6.8	4.9	Slight
TP26	0.5	6.2	4.6	Slight
TP26	1.5	6.2	4.5	Slight*
TP26	2.5	6.3	4.6	Slight
TP27	0.5	6.0	4.8	Slight
TP27	1.5	6.3	4.8	Slight*
TP27	2.5	6.0	5.9	Slight
TP28	0.5	6.1	5.0	Slight
TP28	1.5	6.2	4.8	Slight
TP28	2.5	6.3	4.9	Slight
TP29	0.5	7.9	4.9	Slight
TP29	1.5	7.7	5.2	Slight
TP29	2.5	7.3	4.6	Strong*
TP30	0.5	7.3	4.3	Moderate*
TP30	1.5	6.8	4.7	Slight
TP30	2.5	6.8	4.6	Slight
TP31	0.5	7.0	4.5	Moderate*
TP31	1.5	7.0	5.0	Slight
TP31	2.5	7.0	5.1	Slight*
TP32	0.5	6.1	2.9	Moderate*
TP32	1.5	6.3	4.1	Slight*
TP32	2.5	5.9	4.2	Slight

* Selected for laboratory testing.

ALS Environmental

11/F, Chung Shun Knitting Centre
1-3 Wing Yip St, Kwai Chung
Tel : (852) 2610 1044
Fax : (852) 2610 2021
Email: alshk@hknet.com

SAMPLE SUBMISSION FORM

Please Note : The following information is required to expedite sample analysis. Please complete all the necessary details and return this form with your samples.

CLIENT DETAILS:
Company Name: Brown Geotechnical & Environmental

Client Contact Name: Ken Brown Date: 05/04/07

Postal Address: POBox 4000, Victotia Park WA6979

Email: bge@acidss.com.au

Phone: 9368 2615 Fax: 9367 7409

CLIENT ORDER No : J06036.01/2 ALS QUOTATION NUMBER : PEN/063/06

PROJECT NAME: Area 19, Muriel Court, Jandakot

SECONDARY CONTACT
Name :
Address:
Phone :

Environmental Division
Perth
Work Order
EP0701409

Telephone : 61-8-9209 7655

(office use only)
Batch No: EP0701409
Date Received: 5/4/07
Total No Samples: #13

Luke Jones
5/4/07 16:30

SAMPLE ANALYTIC

Lab ID (office use only)	Sample ID.	Matrix	Sampling Date/Time	Analysis Required
1	TP1 – 2.5m EP07012007003	Soil	15/03/07	ASS Chromium Suite
2	TP3 – 1.5m EP07012007008	Soil	15/03/07	ASS Chromium Suite
3	TP4 – 1.5m EP07012007011	Soil	15/03/07	ASS Chromium Suite
4	TP4 – 2.5m EP07012007012	Soil	15/03/07	ASS Chromium Suite
5	TP26 – 1.5m EP07012007020	Soil	15/03/07	ASS Chromium Suite
6	TP27 – 1.5m EP07012007023	Soil	15/03/07	ASS Chromium Suite
7	TP29 – 2.5m EP07012007027	Soil	15/03/07	ASS Chromium Suite
8	TP30 – 0.5m EP07012007028	Soil	15/03/07	ASS Chromium Suite
9	TP31 – 0.5m EP07012007031	Soil	15/03/07	ASS Chromium Suite

(CONTINUED OVERLEAF)

SAMPLE ANALYTICAL REQUIREMENTS (continued) :

(office use only)
Batch No:

Lab ID (office use only)	Sample ID.	Matrix	Sampling Date/Time	Analysis Required
10	TP31 – 2.5m EP07012007033	Soil	15/03/07	ASS Chromium Suite
11	TP32 – 0.5m EP07012007034	Soil	15/03/07	ASS Chromium Suite
12	TP32 – 1.5m EP07012007035	Soil	15/03/07	ASS Chromium Suite
13	QA1	Soil	15/03/07	ASS Chromium Suite
	Soil samples retained by ALS			

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	: BROWN GEOTECHNICAL AND ENVIRONMENTAL	Laboratory	: Environmental Division Perth	Page	: 1 of 6
Contact	: MR KEN BROWN	Contact	: Michael Sharp	Work Order	: EP0701409
Address	: SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	Address	: 10 Hod Way Malaga WA Australia 6090		
E-mail	: kenbrown@acidss.com.au	E-mail	: Michael.Sharp@alsenviro.com		
Telephone	: 93682615	Telephone	: 61-8-9209 7655		
Facsimile	: - Not provided -	Facsimile	: 61-8-9209 7600		
Project	: J06036.01 2 Ex EP0701207	Quote number	: PEN-063-06	Date received	: 5 Apr 2007
Order number	: - Not provided -			Date issued	: 17 Apr 2007
C-O-C number	: - Not provided -			No. of samples	- Received : 13
Site	: Area 19, Muriel Court, Janakot				Analysed : 13

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NATA Accredited Laboratory 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Stacey Hawkins	Instrument Chemist	Perth Inorganics - NATA 825 (15847 - Perth)

ALS Environmental

Comments

This report for the ALSE reference EP0701409 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical Results for Samples Submitted**
- **Surrogate Recovery Data**

The analytical procedures used by ALS Environmental 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 herein. Reference methods from which ALSE methods are based are provided in parenthesis.

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

Specific comments for Work Order **EP0701409**

Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Retained Acidity not required because pH KCl greater than or equal to 4.5

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: TP1 2.5	TP3 1.5	TP4 1.5	TP4 2.5	TP26 1.5
Sample Matrix Type / Description:				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Date / Time:				15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00
Laboratory Sample ID:				EP0701409-001	EP0701409-002	EP0701409-003	EP0701409-004	EP0701409-005
EA033-A: Actual Acidity								
pH KCl (23A)		0.1	pH Unit	6.5	6.2	5.4	6.6	6.4
Titratable Actual Acidity (23F)		2	mole H+ / t	<2	2	10	<2	2
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)		10	mole H+ / t	<10	<10	<10	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A1)		0.01	% CaCO3	----	----	----	<0.01	----
acidity - Acid Neutralising Capacity (a-19A1)		10	mole H+ / t	----	----	----	<10	----
sulfidic - Acid Neutralising Capacity (s-19A1)		0.01	% pyrite S	----	----	----	<0.01	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	11	<10	<10
Liming Rate		1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	11	<10	<10
Liming Rate excluding ANC		1	kg CaCO3/t	<1	<1	<1	<1	<1

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: TP27 1.5	TP29 2.5	TP30 0.5	TP31 0.5	TP31 2.5
Sample Matrix Type / Description:				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Date / Time:				15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00
Laboratory Sample ID:				EP0701409-006	EP0701409-007	EP0701409-008	EP0701409-009	EP0701409-010
EA033-A: Actual Acidity								
pH KCl (23A)		0.1	pH Unit	6.2	6.6	6.7	6.9	6.2
Titratable Actual Acidity (23F)		2	mole H+ / t	2	<2	<2	<2	2
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)		10	mole H+ / t	<10	<10	<10	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A1)		0.01	% CaCO3	----	0.06	0.24	0.30	----
acidity - Acid Neutralising Capacity (a-19A1)		10	mole H+ / t	----	11	48	61	----
sulfidic - Acid Neutralising Capacity (s-19A1)		0.01	% pyrite S	----	0.02	0.08	0.10	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate		1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate excluding ANC		1	kg CaCO3/t	<1	<1	<1	<1	<1

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: TP32 0.5	TP32 1.5	QA1		
Sample Matrix Type / Description:				SOIL	SOIL	SOIL		
Sample Date / Time:				15 Mar 2007 15:00	15 Mar 2007 15:00	15 Mar 2007 15:00		
Laboratory Sample ID:				EP0701409-011	EP0701409-012	EP0701409-013		
EA033-A: Actual Acidity								
pH KCl (23A)		0.1	pH Unit	4.9	5.8	5.9		
Titratable Actual Acidity (23F)		2	mole H+ / t	5	2	2		
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S	<0.02	<0.02	<0.02		
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)		0.02	% S	<0.02	<0.02	<0.02		
acidity - Chromium Reducible Sulfur (a-22B)		10	mole H+ / t	<10	<10	<10		
EA033-E: Acid Base Accounting								
ANC Fineness Factor		0.5		1.5	1.5	1.5		
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02		
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10		
Liming Rate		1	kg CaCO3/t	<1	<1	<1		
Net Acidity excluding ANC (sulfur units)		0.02	% S	<0.02	<0.02	<0.02		
Net Acidity excluding ANC (acidity units)		10	mole H+ / t	<10	<10	<10		
Liming Rate excluding ANC		1	kg CaCO3/t	<1	<1	<1		

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Surrogate Control Limits

- No surrogates present on this report.

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QUALITY CONTROL REPORT

Client	:	**BROWN GEOTECHNICAL AND ENVIRO**	**Laboratory**	: Environmental Division Perth	**Page**	:	1 of 5
Contact	:	MR KEN BROWN	**Contact**	: Michael Sharp			
Address	:	SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	**Address**	: 10 Hod Way Malaga WA Australia 6090	**Work order**	:	EP0701409
					Amendment No.	:	
Project	:	J06036.01 2 Ex EP0701207	**Quote number**	: PEN-063-06	**Date received**	:	5 Apr 2007
Order number	:	- Not provided -			**Date issued**	:	17 Apr 2007
C-O-C number	:	- Not provided -					
Site	:	Area 19, Muriel Court, Janakot					
E-mail	:	kenbrown@acidss.com.au	**E-mail**	: Michael.Sharp@alsenviro.com	**No. of samples**		
Telephone	:	93682615	**Telephone**	: 61-8-9209 7655	**Received**	:	13
Facsimile	:	- Not provided -	**Facsimile**	: 61-8-9209 7600	**Analysed**	:	13

This final report for the ALSE work order reference EP0701409 supersedes any previous reports with this reference.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

Work order specific comments

Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Retained Acidity not required because pH KCl greater than or equal to 4.5

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NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory - 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IED 17025

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Stacey Hawkins	Perth Inorganics - NATA 825 (15847 - Perth)

Quality Control Report - Laboratory Duplicates (DUP)

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.
- Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** = *Limit of Reporting,* ***RPD*** = *Relative Percent Difference.*
* Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) 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%

Laboratory Duplicates (DUP) Report

Matrix Type: SOIL

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EA033-A: Actual Acidity						
EA033-A: Actual Acidity - (QC Lot: 389856)				pH Unit	pH Unit	%
EP0701409-001	TP1 - 2.5	pH KCl (23A)	0.1 pH Unit	6.5	6.5	0.0
		Titratable Actual Acidity (23F)	2 mole H+ / t	<2	<2	0.0
		sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	0.0
EP0701409-011	TP32 - 0.5	pH KCl (23A)	0.1 pH Unit	4.9	5.5	11.1
		Titratable Actual Acidity (23F)	2 mole H+ / t	5	4	28.4
		sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	0.0
EA033-B: Potential Acidity						
EA033-B: Potential Acidity - (QC Lot: 389856)				% S	% S	%
EP0701409-001	TP1 - 2.5	Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	0.0
		Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	0.0
EP0701409-011	TP32 - 0.5	Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	0.0
		Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	0.0
EA033-E: Acid Base Accounting						
EA033-E: Acid Base Accounting - (QC Lot: 389856)						%
EP0701409-001	TP1 - 2.5	ANC Fineness Factor		1.5	1.5	0.0
		Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate	1 kg CaCO3/t	<1	<1	0.0
		Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	0.0
EP0701409-011	TP32 - 0.5	ANC Fineness Factor		1.5	1.5	0.0
		Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate	1 kg CaCO3/t	<1	<1	0.0

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EA033-E: Acid Base Accounting - continued						
EA033-E: Acid Base Accounting - (QC Lot: 389856) - continued				% S	% S	%
EP0701409-011	TP32 - 0.5	Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	0.0

Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)

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 type is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. Abbreviations: LOR = Limit of reporting.

Matrix Type: SOIL

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

Analyte name	LOR	Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
				LCS	Low	High
EA033-A: Actual Acidity						
EA033-A: Actual Acidity - (QC Lot: 389856)		pH Unit	pH Unit	%	%	%
pH KCl (23A)	0.1 pH Unit	<0.1	----	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	----	----	----	----
Titratable Actual Acidity (23F)	2 mole H+ / t	<2	----	----	----	----
EA033-B: Potential Acidity						
EA033-B: Potential Acidity - (QC Lot: 389856)		mole H+ / t	mole H+ / t	%	%	%
Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	----	----	----	----
Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	----	----	----	----
EA033-E: Acid Base Accounting						
EA033-E: Acid Base Accounting - (QC Lot: 389856)				%	%	%
ANC Fineness Factor		<0.5	----	----	----	----
Liming Rate	1 kg CaCO3/t	<1	----	----	----	----
Net Acidity (acidity units)	10 mole H+ / t	<10	----	----	----	----
Net Acidity (sulfur units)	0.02 % S	<0.02	----	----	----	----

Quality Control Report - Matrix Spikes (MS)

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 type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** *= Limit of Reporting,* ***RPD*** *= Relative Percent Difference.*

* Indicates failed QC

Matrix Spike (MS) Report

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration		MS	Low	High
- (QC Lot:)						%	%	%

- **No Matrix Spike (MS) carried out on this Work Order.**

ALS Environmental

INTERPRETIVE QUALITY CONTROL REPORT

Client	:	**BROWN GEOTECHNICAL AND ENVIRONMENTAL**	**Laboratory**	:	Environmental Division Perth	**Page**	: **1 of 5**
Contact	:	MR KEN BROWN	**Contact**	:	Michael Sharp		
Address	:	SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	**Address**	:	10 Hod Way Malaga WA Australia 6090	**Work order**	: **EP0701409**
						Amendment No.	:
Project	:	J06036.01 2 Ex EP0701207	**Quote number**	:	PEN-063-06	**Date received**	: 5 Apr 2007
Order number	:	- Not provided -				**Date issued**	: 17 Apr 2007
C-O-C number	:	- Not provided -					
Site	:	Area 19, Muriel Court, Janakot					
E-mail	:	kenbrown@acidss.com.au	**E-mail**	:	Michael.Sharp@alsenviro.com	**No. of samples**	
Telephone	:	93682615	**Telephone**	:	61-8-9209 7655	**Received**	: 13
Facsimile	:	- Not provided -	**Facsimile**	:	61-8-9209 7600	**Analysed**	: 13

This Interpretive Quality Control Report was issued on 17 Apr 2007 for the ALS work order reference EP0701409 and supersedes any previous reports with this reference.
This report contains the following information:

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

Interpretive Quality Control Report - Analysis Holding Time

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 preclude subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the sample aliquot was taken. Elapsed time to analysis represents time from sampling where no extraction / digestion is involved or time from extraction / digestion where this is present. For composite samples, sampling date/time is taken as that of the oldest sample contributing to that composite. Sample date/time for laboratory produced leaches are taken from the completion date/time of the leaching process. Outliers for holding time are based on USEPA SW846, APHA, AS and NEPM (1999). Failed outliers, refer to the 'Summary of Outliers'.

Matrix Type: SOIL

Analysis Holding Time and Preservation

Method / Container / Client Sample ID(s)	Date Sampled	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Pass?	Date analysed	Due for analysis	Pass?
EA033: Chromium Suite for Acid Sulphate Soils							
80° dried soil							
TP1 - 2.5, TP3 - 1.5, TP4 - 1.5, TP4 - 2.5, TP26 - 1.5, TP27 - 1.5, TP29 - 2.5, TP30 - 0.5, TP31 - 0.5, TP31 - 2.5, TP32 - 0.5, TP32 - 1.5, QA1	**15 Mar 2007**	**13 Apr 2007**	14 Mar 2008	Pass	**16 Apr 2007**	12 Jul 2007	Pass

Interpretive Quality Control Report - Frequency of Quality Control Samples

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which this work order was processed. Actual rate should be greater than or equal to the expected rate.

Frequency of Quality Control Samples

Matrix Type: SOIL

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
EA033: Chromium Suite for Acid Sulphate Soils	2	13	**15.4**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Laboratory Control Samples (LCS)					
EA033: Chromium Suite for Acid Sulphate Soils	1	13	**7.7**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Method Blanks (MB)					
EA033: Chromium Suite for Acid Sulphate Soils	1	13	**7.7**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement

Interpretive Quality Control Report - Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged on the 'Quality Control Report'. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot.

Non-surrogates

- **For all matrices, no RPD recovery outliers occur for the duplicate analysis.**
- **For all matrices, no method blank result outliers occur.**
- **For all matrices, no laboratory spike recoveries breaches occur.**
- **For all matrices, no matrix spike recoveries breaches occur.**

Surrogates

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

Outliers : Analysis Holding Time

The following report highlights outliers within this 'Interpretive Quality Control Report - Analysis Holding Time'.

- **No holding time outliers occur.**

Outliers : Frequency of Quality Control Samples

The following report highlights outliers within this 'Interpretive Quality Control Report - Frequency of Quality Control Samples'.

- **No frequency outliers occur.**

Method Reference Summary

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure 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 herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Matrix Type: SOIL

Preparation Methods

EN020PR : Drying at 85 degrees, bagging and labelling (ASS) - In house

Analytical Methods

EA033 : Chromium Suite for Acid Sulphate Soils - Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

APPENDIX E

APPENDIX E

Soil Assessment Criteria

Western Australia's Draft Acid Sulphate Soil Guidelines (2006) have established action criteria for the assessment of the environmental risk of acid sulphate soils. The action criteria are based on the sum of existing plus, potential acidity, calculated as equivalent sulphur (e.g. s-TAA + S_{CR} in %S units) or equivalent acidity (e.g. TAA + TPA in mol H^+/tonne). The highest laboratory result was used to assess against the action criteria.

As clay content tends to influence the soils natural pH buffering capacity, the action criteria are grouped by three broad texture categories – coarse, medium and fine. The criteria are used to define when acid sulphate soils disturbed at a site will need to be treated and managed. The Table below summarises the action criteria.

Texture based acid sulphate soils action criteria

Type of Material		Action Criteria if <1,000 tonnes of material is disturbed		Action Criteria if >1,000 tonnes of material is disturbed	
Texture Range	**Approx. Clay Content**	**Equivalent Sulphur (%)**	**Equivalent Acidity (mol H^+/tonne)**	**Equivalent Sulphur**	**Equivalent Acidity (mol H^+/tonne)**
Coarse – sands to loamy sands	≤ 5%	0.03	18.7	0.03	18.7
Medium – sandy loams to light clays	5 – 40%	0.06	37.4	0.03	18.7
Fine – medium to heavy clays and silty clays	≥ 40%	0.1	64.8	0.03	18.7

In addition to the action criteria, the guidelines define indicator pH values for field pH (pH_F) and field peroxide pH (pH_{FOX}) to assist with identifying likely acid generating soils. The pH indicator values are defined as:

- $pH_F \leq 4$ (when pH >4 but<5 may indicate some existing acidity); and
- pH_{FOX} <3 or a much lower pH_{FOX} than pH_F (greater than 1 pH unit change).