Coffey Geotechnics Pty Ltd ABN 93 056 929 483
1/18 Hurley Drive Coffs Harbour NSW 2450 Australia
PO Box 704 Coffs Harbour 2450 Australia
T (+61) (2) 6651 3213 F (+61) (2) 6651 5194
www.coffey.com.au

16 September 2008

Certificate

The PRELIMINARY GEOTECHNICAL ASSESSMENT – PROPOSED SUBDIVISION DEVELOPMENT HEARNS LAKE, SANDY BEACH, CH1132-1AB Report, dated 28 January 2004, has been reviewed and it contains all available current information that is relevant to the environmental assessment of that aspect of the Concept Plan Approval Application to which the Report relates.

The information contained in this Report is neither false nor misleading.

I certify that I have reviewed the contents of the PRELIMINARY GEOTECHNICAL ASSESSMENT CH1132-1AB, 28 January 2004, and that it is true in all material particulars and does not by presentation or omission of information, materially mislead.

For and on behalf of Coffey Geotechnics Pty Ltd

Andrew Ballard

Associate Environmental Scientist
Environmental Team Leader – Coffs Harbour

BLUEGRASS NOMINEES

PROPOSED SUBDIVISION DEVELOPMENT

Hearns Lake, Sandy Beach

PRELIMINARY GEOTECHNICAL ASSESSMENT

CH1132/1-AB

28 January 2004

Coffey

CH1132/1-AB DJB
28 January 2004

Bluegrass Nominees
33 Windsor Crescent
BROWNSVILLE NSW 2530

Attention: Mr John Oliver

Dear Sir,

RE: PROPOSED SUBDIVISION DEVELOPMENT – HEARNS LAKE, SANDY BEACH
PRELIMINARY GEOTECHNICAL ASSESSMENT

Coffey Geosciences Pty Ltd (Coffey) is pleased to present our report on the preliminary geotechnical investigation for the proposed subdivisional development near Hearns Lake at Sandy Beach.

We draw your attention to the attached sheet entitled "Important Information About Your Coffey Report" which should be read in conjunction with this report.

We trust that this report meets with your requirements. If you require further information please contact the undersigned in our Coffs Harbour office.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

IAN SHIPWAY
Manager, Northern NSW

Distribution:

Original held by	Coffey Geosciences Pty Ltd
1 copy	Coffey Geosciences Pty Ltd Library (Coffs Harbour office)
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601 Coramba Road
Coffs Harbour
NSW 2450 Australia
PO Box 704 Coffs Harbour
NSW 2450 Australia
Telephone +61 2 6651 3213
Facsimile +61 2 6651 5194
Email coffs@coffey.com.au

TABLE OF CONTENTS

1. INTRODUCTION

Coffey Geosciences Pty Ltd has conducted a geotechnical assessment for proposed subdivision development of a 35 hectare site located near Hearns Lake at Sandy Beach. The client has indicated that the site will be split into 14 assemblages, with only Assemblages 1, 2 and 13 proposed for residential and rural-residential development. It has been estimated from plans provided by the client that the development area is about one half of the total site area or about 15 to 20 hectares.

The aims of the study, which was commissioned by Localplan Pty Ltd, were to provide a preliminary assessment of the suitability of the site for residential development including subsurface conditions across the development area, acid sulfate soils and potential for soil contamination and general advice on the geotechnical conditions encountered at the site relevant to residential development. An assessment of groundwater levels and fluctuations was also carried out, though the results of water level monitoring are not complete at this stage and will be forwarded when complete and assessed.

Coffey conducted the work in general accordance with proposal no. CH1132/1-AA of 26 November 2003. This report presents the results of the site investigation and provides comments and recommendations relevant to the above scope of work.

2. SITE DESCRIPTION & PROPOSED DEVELOPMENT

The site is situated just north of the residential area of Sandy Beach to the east of the Pacific Highway. The site, comprising Assemblages 1, 2 and 13 is about 15 to 20 hectares in area. The ground surface is generally flat lying with varying densities of scrub and trees. The more densely vegetated areas fall into assemblages which the client has indicated are not to be developed at this stage.

It is understood that Assemblages will be developed for residential use and part of assemblages 2 and 13 for rural-residential purposes.

3. FIELD WORK AND LABORATORY TESTING

Field work for the geotechnical assessment was conducted on 8 December 2003 and consisted of the excavation of twelve test pits (TP1 to TP12) to between 2.0m and 3.5m depth using a JCB 4WD Backhoe. In addition, five boreholes (GW1 to GW4 including GW2a) were drilled on 19 December 2003 to depths of about 4m using a 4WD mounted MD200 drill rig. Groundwater monitoring wells were installed in four of the boreholes (GW1, GW2a, GW3 and GW4) and equipped with electronic data loggers to monitor water level fluctuations.

The test pits/boreholes were excavated/drilled in the full time presence of a geotechnical engineer from Coffey who located the pits/boreholes, took samples and produced engineering logs of the subsurface conditions encountered. The engineering logs are presented in Appendix A, together with explanation sheets defining the terms and symbols used in their preparation. Test pit and borehole locations are shown on Figure 1.

Samples obtained during test pitting were placed in a chilled esky during field work and transport to our Coffs Harbour laboratory where they were placed in refrigerated storage. Laboratory testing was conducted in our Coffs Harbour laboratory and consisted acid sulphate soil screening tests on 12 samples of soils taken from a number of depths in TP2, TP5, TP8 and TP12. The results of the screening tests are shown in Table 1 presented in Appendix B. Samples were screened using laboratory methods 21Af and 21Bf of Ahern, CR,

Blunden, B and Stone, Y (eds) (1998), Acid Sulfate Soil Laboratory Methods Guidelines, ASSMAC, which tests pH of soils in distilled water and 30% Hydrogen Peroxide (H_2O_2). Screening test results are attached.

Following the screening tests, four samples were selected and sent to an external analytical laboratory for further Peroxide Oxidisable Combined Acidity and Sulfate (POCAS) testing. The results of this testing are also presented in Appendix B.

4. GROUND CONDITIONS

4.1 Sub-Surface Stratigraphy

The Dorrigo/Coffs Harbour 1:250,000 geological map shows that the site is underlain by Quaternary aged alluvium and rock of the Coramba Beds, which mainly comprises siltstone and greywacke with minor volcanic intervals.

The subsurface conditions observed in the test pits generally fall into one of three geological units, comprising:

- Unit 1 – Residual soil overlying weathered siltstone observed in TP1. Subsurface conditions comprised shallow silty clay topsoil, overlying stiff to hard sandy and silty gravely clay, grading to weathered siltstone at about 1.5m depth.
- Unit 2 – Alluvial soil deposits observed in TP2 to TP9 and underlain by residual soils in TP2 and possibly TP3. The subsurface conditions for this unit generally consisted of a 100mm to 200mm thick topsoil layer overlying stiff to hard medium to high plasticity silty and sandy clay, to beyond the limit of investigation in TP6. In other test pits, clayey alluvial soils were underlain by either residual clay soils in TP2 and possibly TP3 from a depth of about 2m, or alluvial clayey sand and sand soils from depths of about 2m to 2.5m in TP4 and TP7 to TP9 and 0.5m in TP5 to beyond the limit of investigation.
- Unit 3 – Aeolian and alluvial beach deposits observed in TP10 to TP12. The subsurface conditions for this unit generally consisted of a 100mm to 300mm thick topsoil layer overlying mainly sand and sand with some clay fines, with some clayey sand layers observed in TP10, to beyond the limit of investigation.

As mentioned previously, information on groundwater levels at the site will be forwarded in a separate letter when monitoring has been completed. Water levels in the monitoring wells on the day of drilling were between about 0.6m and 2.4m depth below ground level. Water inflow in GW3 was first observed at 1.7m depth, with the water level rising after drilling to 0.6m depth. This borehole was drilled relatively close to the lake edge as shown on Figure 1, and thus a drop in ground level or the lake water level may have caused the high water level in this borehole. A water level of 1.95m was recorded in GW2a after drilling, which is located about 100m to the south west of GW3. More information on water levels at the site will be forwarded after the completion of monitoring.

5. DISCUSSION AND RECOMMENDATIONS

5.1 General Suitability with Respect to geotechnical Constraints

Based on the results of the preliminary assessment, the site is generally considered to be suitable for

residential and rural-residential development.

The test pits indicated that subsurface conditions are suitable for residential developments supported on high level footings founded in the natural clay or sand soils. Some additional site preparation may be required for developments founded in sand soils, particularly towards the eastern side of the site, which would most likely consist of compaction with a vibrating roller if required. This report should not be used for the design of footings for developments on the site. More detailed assessment of the site is recommended prior to development.

Subgrade soils for road construction are likely to vary between clay and sand soils, both of which are considered suitable for pavement support. Clay soils are expected to require a thicker pavement due to a generally lower California Bearing Ratio (CBR), though the need for unusually thick pavements is considered unlikely. Some subgrade replacement and/or use of geofabric may be required in some areas, though this is the case for many residential subdivision sites.

Where excavation is required, such as for service trenches, footings and roads, it is anticipated that all site materials could be excavated by conventional dozer blade or backhoe bucket at least to the depths indicated on the attached field logs. Excavations may experience water inflow, which is likely to occur more often and at a greater rate in sand soils than can be expected in clay soils. Depths of water inflows observed during test pitting are shown on the engineering logs. Additional information on water levels at the site will be forwarded separately. Results of the assessment of acid sulfate soils are presented below.

Soils observed in test pits are considered to be suitable for the placement of fill, though again some over excavation, geofabric or additional site preparation may be required in some areas. Soils appeared to be generally suitable for re-use as general site fill, though additional testing of soils may be required to confirm this. Topsoil or root affected material should not be re-used as general fill.

Based on the proximity of the site to environmentally sensitive areas, it is our opinion that that site is generally unsuitable for on-site effluent disposal. Further assessment of site suitability for effluent disposal should be carried out if this is proposed in rural-residential developments.

Sand soils may be suitable for disposal of stormwater from future developments by infiltration into site soils. Clay soils would be considered to have low potential for stormwater disposal by infiltration due to their relatively low permeability. Further assessment of infiltration suitability and flow rates should be carried out prior to development.

5.2 Acid Sulfate Soils

5.2.1 Formation and Potential Impacts

Acid Sulfate Soils (ASS) are soils which contain significant concentrations of pyrite which, when exposed to oxygen, in the presence of sufficient moisture, oxidises, resulting in the generation of sulfuric acid. Unoxidised pyritic soils are referred to as potential ASS. When the soils are exposed, the oxidation of pyrite occurs and sulfuric acids are generated, the soils are said to be actual ASS.

Pyritic soils typically form in waterlogged, saline sediments rich in iron and sulfate. Typical environments for the formation of these soils include tidal flats, salt marshes and mangrove swamps below about RL 5m AHD. They can also form as bottom sediments in coastal rivers and creeks.

Pyritic soils of concern on low lying NSW and coastal lands have mostly formed in the Holocene period, (ie. 10,000 years ago to present day) predominantly in the 7,000 years since the last rise in sea level. It is

generally considered that pyritic soils which formed prior to the Holocene period (ie: >10,000 years ago) would already have oxidised and leached during periods of low sea level which occurred during ice ages, exposing pyritic coastal sediments to oxygen.

Disturbance or poorly managed development and use of acid sulfate soils can generate significant amounts of sulfuric acid, which can lower soil and water pH to extreme levels (generally <4) and produce acid and salts, resulting in high salinity.

The low pH, high salinity soils can reduce or altogether preclude vegetation growth and can produce aggressive soil conditions which may be detrimental to concrete and steel components of structures, foundations, pipelines and other engineering works.

Generation of the acid conditions often releases aluminium, iron and other naturally occurring elements from the otherwise stable soil matrices. High concentrations of some such elements, coupled with low pH and alterations to salinity can be detrimental to aquatic life. In severe cases, affected waters flowing off-site can have detrimental effect on aquatic ecosystems.

5.2.2 Acid Sulfate Soils Risk Map

Reference to the Acid Sulfate Soils Risk Map for Moonee Beach (reference 9537S4) indicates the site is located in an area where there is a high probability of the occurrence of acid sulfate soils at shallow depths (<1m) along the western edge of Hearns Lake for a distance of about 100m to 200m. The remainder of the site was judged to be in an area of high probability of acid sulfate soils at a depth of about 1m to 3m from the ground surface.

5.2.3 Test Results

Sampling and testing for the assessment of acid sulfate soils is discussed in section 3.

The results of all soil screening and laboratory tests conducted are presented in Appendix B, and are summarised in Table 2, which also compares results to action criteria presented in ASSMAC 1998 Acid Sulfate Soil Guidelines.

TABLE 2 – RESULTS OF LABORATORY TESTING

LOCATION	DEPTH (m)	TEXTURE	pH in H_2O_2	$\%S_{CR}$	Action Criteria Value for S_{POS} (%)	TPA (mole/tonne)	Action Criteria Value for TAA (mol/t)
TP2	0.5	Fine	6.7	-	0.1	-	62
TP2	1.0	Fine	5.4	-	0.1	-	62
TP2	2.0	Fine	5.2	-	0.1	-	62
TP5	0.2	Fine	3.9	<0.01	0.1	6	62
TP5	0.7	Coarse	3.4	**0.12**	0.03	224	18
TP5	2.0	Coarse	3.2	**0.05**	0.03	43	18
TP8	0.5	Fine	4.7	-	0.1	-	62
TP8	1.0	Medium	6.4	-	0.06	-	36
TP8	2.5	Coarse	6.3	-	0.03	-	18
TP11	1.0	Coarse	6.3	-	0.03	-	18
TP11	2.3	Coarse	6.2	-	0.03	-	18
TP11	2.7	Coarse	3.2	**0.04**	0.03	8	18

Note: Values in bold exceed action criteria for less than 1000 tonnes of soil disturbed.

Action criteria have been adopted from those presented in ASSMAC (1998) Acid Sulfate Soil Guidelines for excavations of less than 1000 tonnes of soil. Values exceeding action criteria for excavations of less than 1000 tonnes also exceed action criteria for excavations greater than 1000 tonnes.

The following points are noted from the soil screening and laboratory test results presented in Table 2:

- Soil pH<3 in the H_2O_2 test is an indication of potential acid sulfate soil. Soils samples with a value of about pH of 3 were considered to be potential acid sulfate soils;
- Oxidisable Sulfur in three of the four samples analysed exceeded the action criteria values in Table 4.4 of the ASSMAC Guidelines and hence construction work should be accompanied by an Acid Sulfate Soils Management Plan;
- Total Potential Acidity in two of the four samples analysed exceeded the action criteria values in Table 4.4 of the ASSMAC Guidelines and hence a management plan and development consent are required prior to development.

5.2.4 Interpretation of Results

The acid sulfate soils assessment was based on a limited amount of sampling over quite a large site. The preliminary assessment has indicated that acid sulfate soils are present within the Alluvial materials (Unit 2) . It is recommended that more detailed assessment of acid sulfate soils be carried out when the location and size of excavations is known, which may involve test pitting to further assess the extent of alluvial soils and/or additional sampling and testing on proposed excavation areas. Following assessment of the extent of the acid sulfate conditions, an Acid Sulphate Soils management plan should be prepared to guide development of the site.

5.3 Potential Contamination

Based on a walkover assessment during field work, the site does not appear to have been developed for any particular use apart from possibly grazing animals. No obvious signs of soil contamination were observed during the walkover assessment or during excavation/drilling of test pits/boreholes.

The site is currently zoned for low density residential and tourism purposes, with the surrounds of Hearns Lake zoned for environmental protection.

Based on there being no signs of contamination or potentially contaminating developments observed at the site, and the current zoning, it is our opinion that there is a low likelihood of significant concentrations of contaminants being present on the site. Areas of potential contamination, if any, would be likely to be isolated and result from minor spills and leaks from vehicles, plant or containers, or past agricultural use.

5.4 Additional Comments

The site is considered to be suitable for residential and rural-residential development in general.

It is recommended that a geotechnical consultant review the requirements for additional assessment of the site once the development type and location are known in more detail.

We trust that this information meets your requirements for the project at this stage. Details of groundwater monitoring will be forwarded as soon as possible.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

IAN SHIPWAY

Manager – Northern New South Wales

Information

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Coffey Geosciences Pty Ltd ABN 057 056 335 516

Coffey

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

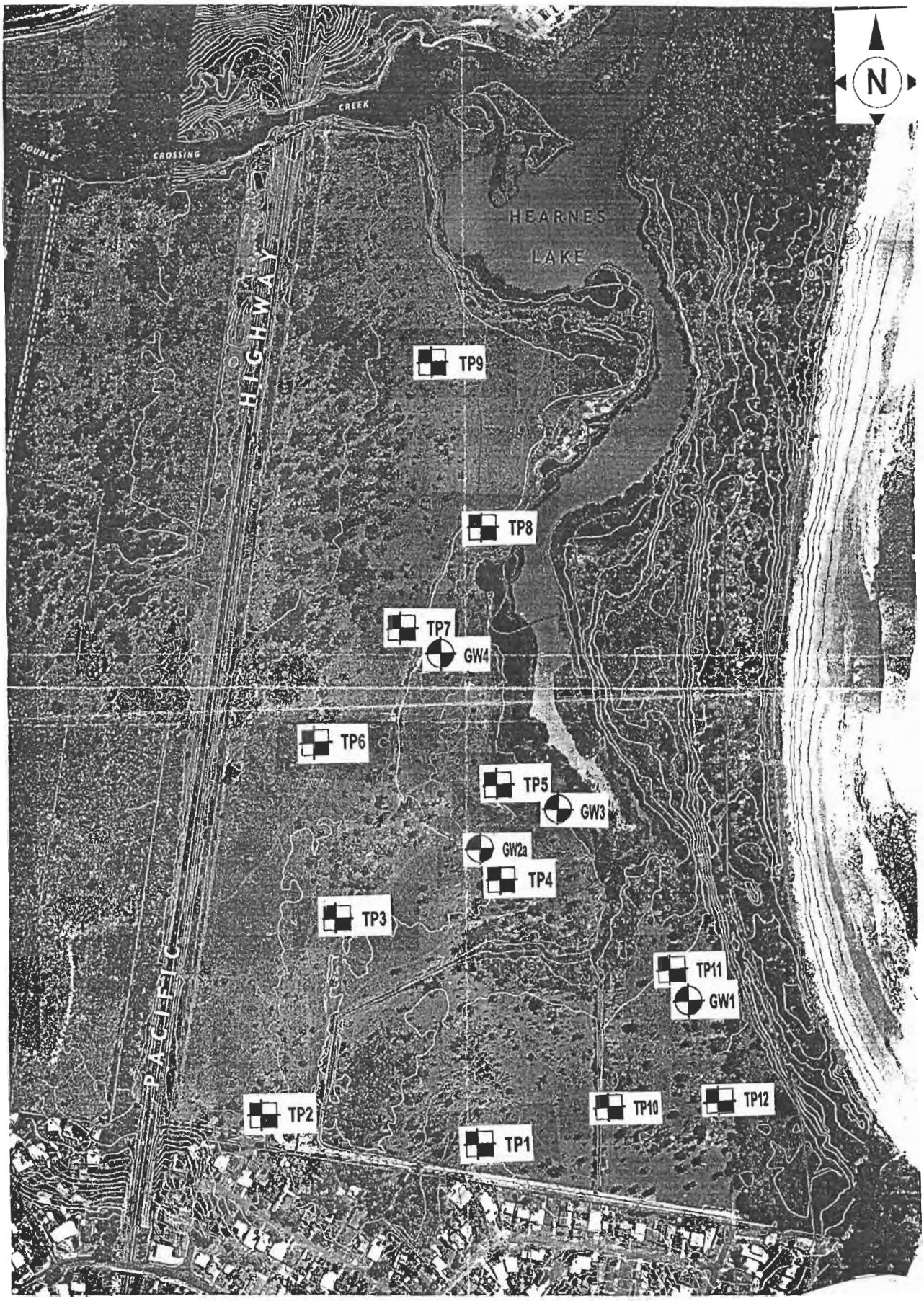
Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design toward construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

** For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, National Headquarters, Canberra, 1987.*



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ASQUITH & deWITT PTY LTD
SURVEYING, PLANNING, MAPPING
PROPERTY DEVELOPMENT MANAGERS

0 40 80 120 160 200 240
SCALE (m)

Coffey Geosciences Pty Ltd ACN 056 306 516		Geotechnical I **Resources** I Environmental I **Technical** I Project Management	
Drawn	DJB	LOCALPLAN PTY LTD PROPOSED DEVELOPMENT HEARNS LAKE SANDY BEACH TEST PIT LOCATION PLAN	Drawing no: FIGURE 1
Approved			
Date	30/1/04		
Scale	1:4000		Job no CH1132/1-AB

APPENDIX A

ENGINEERING LOGS

Soil Description

Explanation Sheet

Coffey

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil.

Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (USC) as shown in the table on the following page.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200mm
Cobbles		63mm to 200mm
Gravel	coarse	20mm to 63mm
	medium	6mm to 20mm
	fine	2.36mm to 6mm
Sand	coarse	600μm to 2.36mm
	medium	200μm to 600μm
	fine	75μm to 200μm

MOISTURE CONDITION

Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
Moist	Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH su (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	-	Crumbles or powders when scraped by thumb nail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very Loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:	
		Coarse grained	Fine grained
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	<5%	<15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	5% - 12%	15% - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample	Weakly cemented	Easily broken up by hand in air or water
Lenses	Discontinuous layers of lenticular shape	Moderately cemented	Effort is required to break up the soil by hand in air or water
Pockets	Irregular inclusions of differential material		

GEOLOGICAL ORIGIN

WEATHERED IN PLACE SOILS

Extremely weathered material	Structure and fabric of parent rock visible
Residual soil	Structure and fabric of parent rock not visible

TRANSPORTED SOILS

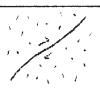
Aeolian soil	Deposited by wind
Alluvial soil	Deposited by stream and rivers
Colluvial soil	Deposited on slopes (transported downslope by gravity)
Fill	Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.
Lacustrine soil	Deposited by lakes
Marine soil	Deposited in ocean basins, bays, beaches and estuaries

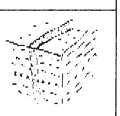
SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60mm and basing fractions on estimated mass)						USC	PRIMARY NAME
COARSE GRAINED SOILS More than 50% of material less than 63mm is larger than 0.075mm	(A 0.075mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.0mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.		GP	GRAVEL
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)		GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below).		GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.0mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes missing.		SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing.		SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		SM	SILTY SAND
				Plastic fines (for identification procedures see CL below).		SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63mm is smaller than 0.075mm			IDENTIFICATION PROCEDURES ON FRACTIONS <0.2mm				
			DRY STRENGTH	DILATANCY	TOUGHNESS		
		SILTS AND CLAYS Liquid limit less than 50	None to Low	Quick to slow	None	ML	SILT
			Medium to high	None	Medium	CL	CLAY
			Low to medium	Slow to very slow	Low	OL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to none	Low to medium	MH	SILT
			High	None	High	CH	CLAY
			Medium to high	None	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS			Readily identified by colour, odour, spongy feel and frequently by fibrous texture			Pt	PEAT

* Low plasticity - Liquid Limit W_L less than 35%. Medium plasticity - W_L between 35% and 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2m in length	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.	

TERM	DEFINITION	DIAGRAM
SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter.	
TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planer to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

Rock Description

Explanation Sheet

Coffey

AS1726-1993 – The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.

DEFINITIONS: Rock substance, defect and mass are defined as follows:

Substance	Effectively homogeneous material, may be isotropic or anisotropic.
Defect	Discontinuity or break in the continuity of a substance or substances.
Mass	Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects. In engineering terms rock substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or in water. Other material is described using soil descriptive terms.

SUBSTANCE DESCRIPTIVE TERMS:

ROCK NAME – Simple rock names are used rather than precise geological classification.

PARTICLE SIZE – Grain size terms for sandstone are:

Coarse grained	0.6mm to 2mm
Medium grained	0.2mm to 0.6mm
Fine grained	0.6mm (just visible) to 0.2mm

FABRIC – Terms for layering or penetrative fabric (eg. bedding, cleavage) are:

Massive	No layering or penetrative fabric
Poorly developed	Layering or fabric just visible. Little effect on properties.
Well developed	Layering or fabric distinct. Rock breaks more easily parallel to layering or fabic.

CLASSIFICATION OF WEATHERING PRODUCTS

Term	Abbreviation	Definition
Residual Soil	**RS**	Soil derived from the weathering of rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely Weathered	**XW**	Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded, in water. Fabric of original rock still visible.
Distinctly Weathered	**DW**	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Slightly Weathered	**SW**	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	**FR**	Rock shows no sign of decomposition or staining.

Note: *Where physical and chemical changes were caused by hot gases and liquids associated with igneous rocks the terms slightly altered (SA), distinctly altered (DA) and extremely altered (XA) may be used.*

ROCK SUBSTANCE STRENGTH TERMS

Term	Abbreviation	Point Load Index, I_S50 (MPa)	Field Guide to Strength
Very Low	**VL**	Less than 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low	**L**	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	**M**	0.3 to 1	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	**H**	1 to 3	A piece of core 150mm long by 50mm diameter can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	**VH**	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High	**EH**	More than 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

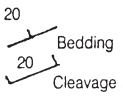
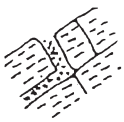
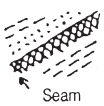
Notes:

1. *In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may break readily parallel to the planar anisotropy.*
2. *The term extremely low is not used as a rock substance strength term. The term is used in AS1726-1993 but the field guide to strength makes it clear that it is a soil in engineering terms.*
3. *The unconfined compressive strength to isotropic rocks and anisotropic rocks which do not fail parallel to the planar anisotropy is typically 10 to 25 times the point load index. The ratio may vary for different rock types and lower strength rocks often have lower ratios than higher strength rocks.*

Coffey

Rock Description Explanation Sheet

COMMON DEFECTS IN ROCK MASSES

Term	Definition	Diagram	Map Symbol	Graphic Log (Note 1)
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub parallel to layering (eg bedding) or a planar anisotropy in the rock substance (eg, cleavage). May be open or closed.			 (Note 2)
Joint	A surface or crack across which the rock has little or no tensile strength but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.			 (Note 2)
Sheared Zone (Note 3)	Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.			
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.			
Crushed Seam (Note 3)	Seam with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties.			
Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint. Infilled seams less than 1mm thick may be described as veneer or coating on joint surface.			
Extremely Weathered Seam	Seam of soil substance, often with gradational boundaries. Formed by weathering of the rock substance in places.			

Notes on defects:

1. *Borehole logs show the true dip of defects and face sketches and sections the apparent dip.*
2. *Partings and joints are not usually shown on the graphic log unless considered significant.*
3. *Sheared zones, sheared surfaces and crushed seams are faults in geological terms.*

DEFECT SHAPE TERMS

Planar	The defect does not vary in orientation
Curved	The defect has a gradual change in orientation
Undulating	The defect has a wavy surface
Stepped	The defect has one or more well defined steps
Irregular	The defect has many sharp changes in orientation

Note:
The assessment of defect shape is partly influenced by the scale of observation.

ROUGHNESS TERMS

Slickensided	Grooved or striated surface; usually polished
Polished	Shiny smooth surface
Smooth	Smooth to touch; few or no surface irregularities
Rough	Many small surfaxce irregularities (amplitude generally less than 1mm); feels like fine to coarse sand paper
Very rough	Many large surface irregularities (amplitude generally more than 1mm); feels like, or coarser than, very coarse sand paper

COATING TERMS

Clean	No visible coating
Stained	No visible coating but surfaces are discoloured
Veneer	A visible coating of soil or mineral too thin to measure; may be patchy
Coating	A visible coating up to 1mm thick . Thicker soil material is described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein

BLOCK SHAPE TERMS

Blocky	Approximately equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greater than cross section

Engineering log - Excavation

Excavation No. **TP1**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Test pit location: ***Refer to Figure 1***

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.0		CL	**TOPSOIL:** Silty Clay, low to medium plasticity, dark brown, some coarse grained sand, some fine to coarse grained gravel and rootlets	M	St		TOPSOIL
								CL	**Sandy Gravelly CLAY:** low to medium plasticity, orange-brown, fine to coarse grained gravel, trace of cobble				RESIDUAL SOIL
						0.5		CL	**Silty Gravelly CLAY:** low to medium plasticity, pale grey, orange mottling, coarse gravel and some cobble of silt stone		H	600	
						1.0							
						1.5			Highly weathered rock at 1.5 m.	D			
						2.0				M			
									Test pit TP1 terminated at 2m				
						2.5							
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration
1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description
based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP2**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: **LOCALPLAN PTY LTD**

Date started: **8.12.2003**

Principal:

Date completed: **8.12.2003**

Project: **PROPOSED DEVELOPMENT NEAR HEARNS LAKE**

Logged by: **AT**

Test pit location: **Refer to Figure 1**

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.0		CH	**TOPSOIL:** Silty Clay, high plasticity, brown-black, organic rich	M	F		TOPSOIL
								CH	**CLAY:** high plasticity, grey, with tree roots and silty layers				ALLUVIAL SOIL
				D		0.5						×	
				D		1.0						×	
						1.5							
				D		2.0		CH	**CLAY:** high plasticity, blue-grey,with some gravel of silt stone		St	×	RESIDUAL SOIL
						2.5		CH	**Sandy CLAY:** high plasticity, orange-brown, fine to coarse grained sand and some silt stone gravel, blue-grey mottling		VSt		
						3.0			Test pit TP2 terminated at 3m				
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description
based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

TESTPIT CH1132-1.GPJ COFFEY.GDT 10.31.05

Form GEO 5.2 Issue 3 Rev.2

Engineering log - Excavation

Excavation No. **TP3**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: **LOCALPLAN PTY LTD**

Date started: **8.12.2003**

Principal:

Date completed: **8.12.2003**

Project: **PROPOSED DEVELOPMENT NEAR HEARNS LAKE**

Logged by: **AT**

Test pit location: **Refer to Figure 1**

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	depth RL / metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa (100 200 300 400)	structure and additional observations
B		N			0.0		CH	**TOPSOIL:** Clay, medium to high plasticity, black, organic rich with rootlets	M	St		TOPSOIL
							CH	**CLAY:** high plasticity, grey/orange-brown				ALLUVIAL SOIL
					0.5						×	
					1.0						×	Minor seepage.
					1.5						×	
					2.0		CH	**CLAY:** high plasticity, pale grey, with rootlets		VSt		
					2.5						×	
					3.0		CH	**CLAY:** high plasticity, orange-brown, with pockets of black clay and rootlets		St	×	Minor seepage.
					3.5			Test pit TP3 terminated at 3.1m				
					4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description
based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP4**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Test pit location: ***Refer to Figure 1***

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N				0.0		CL	**TOPSOIL:** Clay, medium plasticity, brown-black	M	H		TOPSOIL
								CL	**CLAY:** medium plasticity, black				ALLUVIAL SOIL
						0.5		CH	**CLAY:** medium to high plasticity, grey/orange-brown, with rootlets		VSt	× ×	
						1.0						× ×	
						1.5						×	
						2.0		SP	**SAND:** fine to medium grained, pale grey	W	MD		
				D		2.5		SP	**SAND:** fine to medium grained, red/brown, with black organic smelling pockets Indurated below 2.8 m.				Coffee rock ?
						3.0			Test pit TP4 terminated at 3.1m				
						3.5							
						4.0							

Sketch

method

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator

support

S shoring N nil

penetration

1 2 3 4 — no resistance ranging to refusal

water

water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
V	vane shear (kPa)
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP5**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Test pit location: ***Refer to Figure 1***

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N		D		0.5		CH	**CLAY:** medium to high plasticity, yellow, with rootlets	M	St	×	20 mm BLACK TOPSOIL ALLUVIAL SOIL
				D		1.0		SP	**Clayey SAND:** fine to medium grained, pale grey, medium to high plasticity clay fines		MD		
			▶			1.5		SP	**SAND:** fine to medium grained, orange-brown, organic odour Indurated layer about 1.5 m.		D		
				D		2.0			**SAND:** fine to medium grained, dark brown	W			
			▶						Indurated rock layer at 2.0 - 2.15 m.		VD		
						2.5					D		
						3.0			Test pit TP5 terminated at 2.8m				
						3.5							
						4.0							

Sketch

method

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator

support

S shoring N nil

penetration

1 2 3 4 — no resistance ranging to refusal

water

water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
V	vane shear (kPa)
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP6**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: **LOCALPLAN PTY LTD**

Date started: **8.12.2003**

Principal:

Date completed: **8.12.2003**

Project: **PROPOSED DEVELOPMENT NEAR HEARNS LAKE**

Logged by: **AT**

Test pit location: **Refer to Figure 1**

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.5		CH	**TOPSOIL:** Silty Clay, medium to high plasticity, dark brown, with rootlets	M	VSt	×	TOPSOIL
						1.0		CH	**CLAY:** medium to high plasticity, grey, with orange mottling, tiny pockets of fine pale grey sand			×	ALLUVIAL SOIL
						1.5		CH	**CLAY:** medium to high plasticity, pale grey/orange, occassional orange silt stone gravel		H		
						2.0						×	
						2.5			Pocket of sandy clay.				
						3.0							
						3.5			Test pit TP6 terminated at 3m				
						4.0							

Sketch

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

support
S shoring
N nil

penetration
1 2 3 4
no resistance ranging to refusal

water
water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP7**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: **LOCALPLAN PTY LTD**

Date started: **8.12.2003**

Principal:

Date completed: **8.12.2003**

Project: **PROPOSED DEVELOPMENT NEAR HEARNS LAKE**

Logged by: **AT**

Test pit location: **Refer to Figure 1**

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.0		CH	**TOPSOIL:** Silty Clay, medium to high plasticity, dark brown	M	VSt		TOPSOIL
								CH	**Silty CLAY:** medium to high plasticity, brown, mottled red			× ×	ALLUVIAL SOIL
						0.5							
						1.0		CH	**CLAY:** medium to high plasticity, pale grey/orange, trace of orange silt stone gravel		H	× ×	
						1.5							
						2.0							
			►			2.5		SP	**Clayey SAND:** fine to medium grained, pale grey, with medium to high plasticity fines	W	D		
								SP	**SAND:** fine to medium grained, brown				
						3.0							
						3.5			Test pit TP7 terminated at 3.3m				
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP8**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Test pit location: ***Refer to Figure 1***

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N						CH	**TOPSOIL:** Sandy Clay, medium to high plasticity, dark brown, fine grained sand and rootlets	D	VSt		TOPSOIL
				D		0.5		CH	**Silty CLAY:** medium to high plasticity, orange-brown	M		×	ALLUVIAL SOIL
				D		1.0		CH	**Sandy CLAY:** medium to high plasticity, pale grey, fine to medium grained sand			×	Some collapse below 1.5 m.
			►	D		2.5		SP	**SAND:** fine to medium grained, brown, strong organic odour, some indurated layers		D		
						3.0			Test pit TP8 terminated at 2.8m				
						3.5							
						4.0							

Sketch

method

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator

support

S shoring N nil

penetration

1 2 3 4 — no resistance ranging to refusal

water

water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
V	vane shear (kPa)
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP9**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Test pit location: ***Refer to Figure 1***

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
BH		N				0.0		CH	**TOPSOIL:** Silty Clay, medium to high plasticity, dark brown, with rootlets	D	H		TOPSOIL
								CH	**Silty CLAY:** medium to high plasticity, orange-brown, with red mottling	M		×	ALLUVIAL SOIL
						0.5		CH	**CLAY:** high plasticity, pale grey, red and orange mottling and rootlets			600 ×	
						1.0							
						1.5							Blocky
						2.0						×	
						2.5		SP	**Clayey SAND:** fine to medium grained, pale grey, with pockets of orange clayey sand	W	D		
						3.0			Test pit TP9 terminated at 3m				
						3.5							
						4.0							

Sketch

method

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator

support

S shoring N nil

penetration

1 2 3 4 — no resistance ranging to refusal

water

water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
V	vane shear (kPa)
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP10**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Test pit location: ***Refer to Figure 1***

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.0		CH	**TOPSOIL:** medium to high plasticity, dark brown, fine grained sand and rootlets	M	St		TOPSOIL
						0.5		SP	**Clayey SAND:** fine to medium grained, orange-brown, medium to high plasticity clay		MD		AEOLIAN/ALLUVIAL SOIL
						1.0		SP	**SAND:** fine to medium grained, white				
						1.5				W			
						2.0		SP	**Clayey SAND:** fine to medium grained, yellow-brown				
			▶			2.5		CH	**Sandy CLAY:** medium to high plasticity, dark brown, fine grained sand				
				D				SP	**SAND:** fine to medium grained, orange/yellow/grey				
						3.0							
						3.5			Test pit TP10 terminated at 3.5m				
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP11**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Test pit location: ***Refer to Figure 1***

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.0		CH	**TOPSOIL:** Sandy Clay, medium to high plasticity, dark brown, with fine grained sand and rootlets	D	St		TOPSOIL
						0.5		SP	**SAND:** fine to medium grained, orange-brown, with some clay fines		MD		AEOLIAN/ALLUVIAL SOIL
								SP	**SAND:** fine to medium grained, white				AEOLIAN/ALLUVIAL SOIL
				D		1.0							
						1.5							
						2.0							
			▶	D		2.5		SP	**SAND:** fine to medium grained, grey	W			Seepage at 2.3m.
				D				SP	**SAND:** fine to medium grained, brown/black				
						3.0			Test pit TP11 terminated at 3m				
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering log - Excavation

Excavation No. **TP12**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Test pit location: ***Refer to Figure 1***

Checked by:

Coffey

equipment type and model: JCB 4CX | Pit Orientation: | Easting: m | R.L. Surface: Not measured

excavation dimensions: 2m long 0.5m wide | Northing: m | datum: -

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N				0.0		CH	**TOPSOIL:** Gravelly Sandy Clay, medium to high plasticity, brown, fine to coarse grained sand, fine to medium grained gravel	M	St		TOPSOIL
								SP	**SAND:** medium grained, grey, with a trace of clay fines		MD		AEOLIAN SOIL
						0.5		SP	**SAND:** fine to medium grained, yellow-white		L		
						1.0		SP	**SAND:** fine grained, black/red-brown, with some clay fines, indurated at top		D		
						1.5							
						2.0							
						2.5		SM	**SAND:** fine to medium grained, grey/brown/black, with some clay fines	W			
						3.0							
						3.5			Test pit TP12 terminated at 3.1m				
						4.0							

Sketch

method

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator

support

S shoring N nil

penetration

1 2 3 4 — no resistance ranging to refusal

water

water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
V	vane shear (kPa)
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering Log - Borehole

Borehole No. **GW1**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***8.12.2003***

Principal:

Date completed: ***8.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Borehole Location: ***Refer to Figure 1***

Checked by:

Coffey

drill model and mounting: MD200 4WD | Easting: | slope: -90° | R.L. Surface: Not measured

hole diameter: 100 mm | Northing | bearing: | datum: -

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADV		N				0		ML	**Sandy SILT:** low plasticity, black, fine grained sand	M			ALLUVIAL SOIL
								SP	**SAND:** fine to medium grained, pale yellow, trace of silt fines	D			
						1		SP	**SAND:** fine to medium grained, grey, trace of clay fines	M			
			19.12.03 / 1500			2		SC	**Clayey SAND:** fine to medium grained, grey-brown, high plasticity fines	W			
						3							
						4			Groundwater monitoring well installed to 3.6m depth. Borehole GW1 terminated at 4m				
						5							
						6							
						7							
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering Log - Borehole

Borehole No. **GW2**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***19.12.2003***

Principal:

Date completed: ***19.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Borehole Location: ***Refer to Figure 1***

Checked by:

Coffey

drill model and mounting: MD200 4WD | Easting: | slope: -90° | R.L. Surface: Not measured

hole diameter: 100 mm | Northing | bearing: | datum: -

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N				0		CH	**CLAY:** high plasticity, dark brown	M			ALLUVIUM
						1		CH	**CLAY:** high plasticity, pale brown, with some fine grained sand				
								SC	**Clayey SAND:** fine grained, pale grey, medium to low plasticity fines				
						2		CH	**CLAY:** brown				
			19.12.03 / 1500					CH	**Silty CLAY:** high plasticity, pale grey, with a trace of fine grained sand				
						3							
						4		CH	**Sandy CLAY:** high plasticity, orange/brown, coarse grained sand	W			RESIDUAL SOIL
									Borehole GW2 terminated at 4.4m				
						5							
						6							
						7							
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering Log - Borehole

Borehole No. **GW2A**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***19.12.2003***

Principal:

Date completed: ***19.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Borehole Location: ***Refer to Figure 1***

Checked by:

Coffey

drill model and mounting: MD200 4WD | Easting: | slope: -90° | R.L. Surface: Not Measured

hole diameter: 100 mm | Northing | bearing: | datum: -

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N				0		CH	**TOPSOIL:** Silty Clay, high plasticity, dark brown	M			TOPSOIL
								CH	**CLAY:** high plasticity, pale grey, mottled orange, some fine grained sand				ALLUVIUM
						1		CH	**Sandy CLAY:** high plasticity, pale grey, fine grained sand				
			19.12.03 / 1445			2				W			
								SC	**Clayey SAND:** fine to medium grained, pale grey/pale brown. high plasticity fines				
						3		SC	**Clayey SAND:** fine grained, brown, Indurated layer 2.9-3.0m				
						4			Borehole GW2A terminated at 4m				
						5							
						6							
						7							
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*bit shown by suffix	
e.g.	ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering Log - Borehole

Borehole No. **GW3**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***19.12.2003***

Principal:

Date completed: ***19.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Borehole Location: ***Refer to Figure 1***

Checked by:

Coffey

drill model and mounting: MD200 4WD | Easting: | slope: -90° | R.L. Surface: Not Measured

hole diameter: 100 mm | Northing | bearing: | datum: -

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N	19.12.03 / 1430			1		CH	**Sandy CLAY:** high plasticity, pale yellow-brown, fine grained sand	M			ALLUVIUM
								SC	**Clayey SAND:** fine grained, pale grey, high plasticity fines				
						2		SC	**Clayey SAND:** fine grained, brown, high plasticity fines				
								SC	**Clayey SAND:** fine grained, brown, high plasticity fines	W			
						3							
						4			Borehole GW3 terminated at 4m				
						5							
						6							
						7							
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

BOREHOLE CH1132-1.GPJ COFFEY.GDT 10.31.05

Form GEO 5.3 Issue 3 Rev.2

Engineering Log - Borehole

Borehole No. **GW4**

Sheet 1 of 1

Office Job No.: **CH1132/1**

Client: ***LOCALPLAN PTY LTD***

Date started: ***19.12.2003***

Principal:

Date completed: ***19.12.2003***

Project: ***PROPOSED DEVELOPMENT NEAR HEARNS LAKE***

Logged by: ***AT***

Borehole Location: ***Refer to Figure 1***

Checked by:

Coffey

drill model and mounting: MD200 4WD | Easting: | slope: -90° | R.L. Surface: Not measured

hole diameter: 100 mm | Northing | bearing: | datum: -

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N	19.12.03 / 1415			1		CH	**CLAY:** high plasticity, orange/brown	M			ALLUVIUM
								CH	**CLAY:** high plasticity, pale grey				
						2		SC	**Clayey SAND:** fine grained, brown, high plasticity fines	M			
						3							
						4			Borehole GW4 terminated at 4m				
						5							
						6							
						7							
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

APPENDIX B

LABORATORY TEST RESULTS

CH1132/1
LOCALPLAN PTY LTD
PROPOSED DEVELOPMENT
HEARNS LAKE SANDY BEACH

TABLE 1 - RESULTS OF ACID SULFATE SOIL SCREENING TESTS

Location	Depth (m)	pH in Distilled Water	pH in Hydrogen Peroxide
TP2	0.5	6.6	6.7
TP2	1.0	6.5	5.4
TP2	2.0	6.7	5.2
TP5	0.2	7.0	3.9
TP5	0.7	6.8	3.4
TP5	2.0	6.5	3.2
TP8	0.5	5.6	4.7
TP8	1.0	6.2	6.4
TP8	2.5	5.7	6.3
TP11	1.0	5.1	6.3
TP11	2.3	5.3	6.2
TP11	2.7	5.2	3.2

DETERMINATION OF ACID SULFATE SOIL PROPERTIES

CERTIFICATE OF ANALYSIS

Analysis By: **Bio-Track Pty Ltd** ABN 91 056 237 275

781 Mt. Glorious Road Highvale, Brisbane, Australia, 4520 Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 29 JANUARY 2004
CLIENT NAME MR DAVID PARKER c/o COFFEY GEOSCIENCES PTY LTD
CLIENT ADDRESS PO BOX 704 COFFS HARBOUR NSW 2450
PROJECT NAME CH1132/1
SAMPLING DATE 1/2004 NUMBER OF SAMPLES 4 SAMPLE TYPE:SOIL SAMPLE FOR ACID SULFATE STUDY
PACKAGING SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING ** SAMPLES DISPOSED ON 1/7/2004
DATE RECEIVED 18 JANUARY 2004 LAB REF. LR1814.117

Page 1 of 1 Report Pages.

YOUR PROJECT/JOB REFERENCE CH1132/1

METHODOLOGY: As per SPOCAS (DNR QASSIT June 2003) for <850 um fraction, S,Ca & Mg by ICP; CLAY (H) for >40% clay, (M) for 5-40% clay or (L) for <5% clay (approximate estimation only)
LIME1 rates calculated to neutralise TPA (or TAA if >TPA), LIME2 rates calculated from TAA+aS POS- carbonate buffer (aCa A + aMg A)/fineness factor (1.51.5).
NB. Lime rates assume 97% lime neutralisation and Bulk Density = 1.6 g/cc but DO NOT include any safety factors. Suggested factor=1.5-1.8.
Equivalent Sulphur (%S eq)= sTAA (%S) + S POS (%S) where sTAA (%S)=TAA/624. [Reported as oven dry (85°C) mass]
Carbonate POS = moles carbonate alkalinity released by oxidation assuming (Ca POS - Ca KCl) + (Mg POS - Mg KCl) is due to carbonate solution. This buffers TPA.

I.D.	DEPTH m	CLAY	pH KCL	pH ox	SHIFT pH	TAA m/t	TPA m/t	TSA m/t	S KCl %	S P %	S POS %	POS ACID m/t	LIME1 kg/m3	LIME2 kg/m3	%S eq	Ca KCl mg/kg	Ca P mg/kg	Mg KCl mg/kg	Mg P mg/kg	Carbonate POS m/t
TP5	0.2 FINE	nd	5.37	5.86	0.5	7	6	0	0.01	0.02	<0.01	6	0.5	0.5	0.02	160	230	365	450	11
TP5	0.7 COARSE	nd	4.49	4.53	0.0	22	224	203	<0.01	0.13	0.12	78	18.5	8.1	0.16	220	255	150	145	2
TP5	2.0 COARSE	nd	5.63	5.30	-0.3	3	43	40	<0.01	0.06	0.05	34	3.5	2.9	0.06	300	345	225	225	2
TP11	2.7 COARSE	nd	5.76	5.64	-0.1	3	8	5	0.01	0.05	0.04	23	0.7	2.1	0.04	95	100	175	190	2

Signatory P. Coulton

For and behalf of Bio-Track Pty Ltd