# Appendix A

**Results of Field Investigations** 



### Soil Description Explanation Sheet (1 of 2)

#### **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 (UCS) as shown in the table on Sheet 2.

#### PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 µm to 2.36 mm
	medium	200 μm to 600 μm
	fine	75 μm to 200 μm
1		

#### 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 S <sub>U</sub> (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 with the thumb, but not penetr					
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	d >200 The surface of the soil can be ma					
Friable	-	Crumbles or powders when scraped by thumbnail.				

#### **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:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

#### **SOIL STRUCTURE**

	ZONING	CE	MENTING
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 different material.		

## GEOLOGICAL ORIGIN WEATHERED IN PLACE SOILS

Extremely	Structure and fabric of parent rock visible.
weathered	
material	

Residual soil Structure and fabric of parent rock not visible.

#### TRANSPORTED SOILS

Aeolian soil Deposited by wind.

Alluvial soil Deposited by streams 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 Description** Explanation Sheet (2 of 2)

#### SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

(Exclu	ıding				ON PROCEDURES and basing fractions		USC	PRIMARY NAME							
Ø		arse 2.0 mm	CLEAN GRAVELS (Little or no fines)		range in grain size a unts of all intermediat		GW	GRAVEL							
3 mm is		'ELS Ilf of co r than 2	CLE GRAN (Lif	Predo with r	ominantly one size or more intermediate siz	a range of sizes es missing.	GP	GRAVEL							
SOILS s than 63		GRAVELS More than half of coarse fraction is larger than 2.0 mm	GRAVELS WITH FINES (Appreciable amount of fines)		plastic fines (for ident		GM	SILTY GRAVEL							
AIINED rials less 0.075 m	e naked	More fraction	GRAN WITH (Appre amc of fii		c fines (for identificat L below)	ion procedures	GC	CLAYEY GRAVEL							
COARSE GRAIINED SOIL 10% of materials less than larger than 0.075 mm	<u> </u>	arse 2.0 mm	SAN IDS IDS ttle or or ss)	Wide amou	range in grain sizes a	and substantial e sizes missing	SW	SAND							
CO/ an 50% lar	ticle visi	IDS If of coa	CLEAN SANDS (Little or no fines)	Predominantly one size or a range of sizes with some intermediate sizes missing.			SP	SAND							
More tha	More that	SANDS More than half of coarse fraction is smaller than 2.0 mm	SANDS WITH FINES (Appreciable amount of fines)		Non-plastic fines (for identification procedures see ML below).		SM	SILTY SAND							
	the sma More fraction		SAI WITH (Appre am of fi	Plastic fines (for identification procedures see CL below).		SC	CLAYEY SAND								
	ont		IDENTIFICAT	ION PF	ROCEDURES ON FR.	ACTIONS <0.2 mm.									
ם ת	s ab	(0	DRY STREN	GTH	DILATANCY	TOUGHNESS									
ILS less th	rticle i	CLAYS limit in 50	None to Low	,	Quick to slow	None	ML	SILT							
FINE GRAINED SOILS in 50% of material less is smaller than 0.075 r	nm pa	SILTS & CLAYS Liquid limit less than 50	SILTS & CLAY: Liquid limit less than 50	TS & ( iquid l iss tha	TS & ( iquid l iss tha	TS & ( iquid l iss tha	TS & C iquid I ss tha	TS & C iquid I ss tha	TS & C iquid I ss tha	Medium to High		None	Medium	CL	CLAY
SRAIN of ma	63 mm is smaller than 0.075 mm (A 0.075 mm particle is TS & CLAYS SILTS & CLAYS Iquid limit less than 50 less than 50		Low to medi	um	Slow to very slow	Low	OL	ORGANIC SILT							
FINE ( n 50% is sma	(A 0	& CLAYS id limit r than 50	Low to medi	um	Slow to very slow	Low to medium	MH	SILT							
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm		SILTS & CLAYS Liquid limit greater than 50	High		None	High	СН	CLAY							
M <sub>0</sub>		SILTS { Liqui greater	Medium to H	ligh	None	Low to medium	ОН	ORGANIC CLAY							
HIGHLY SOILS	Y OF	RGANIC	Readily ident frequently by		y colour, odour, spon s texture.	gy feel and	Pt	PEAT							
• Low p	lastic	city – Liqu	id Limit W <sub>L</sub> les	s than	35%. • Modium plasti	city – W <sub>L</sub> 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 <0.2 m 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 planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	



### Rock Description Explanation Sheet (1 of 2)

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:

Rock Substance In engineering terms roch substance is any naturally occurring aggregate of minerals and organic material which cannot be

disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively

homogenous material, may be isotropic or anisotropic.

Defect Discontinuity or break in the continuity of a substance or substances.

Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or Mass

more substances with one or more defects.

#### 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 Mainly 0.6mm to 2mm Mainly 0.2mm to 0.6mm Medium grained

Mainly 0.06mm (just visible) to 0.2mm Fine grained

**FABRIC** Terms for layering of penetrative fabric (eg. bedding,

cleavage etc.) are:

Massive No layering or penetrative fabric.

Indistinct Lavering or fabric just visible. Little effect on properties.

Layering or fabric is easily visible. Rock breaks more Distinct

easily parallel to layering of fabric.

### **CLASSIFICATION OF WEATHERING PRODUCTS**

Term Abbreviation Definition

xw

HW

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 Material

Residual Soil

> Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded in water. Original rock fabric

still visible.

Highly Weathered Rock

Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not

recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by leaching or may be decreased due to the

deposition of minerals in pores

Moderately MW Weathered Rock

The whole of the rock substance is discoloured, usually by iron staining or bleaching, to the extent that the colour of the fresh rock is no

longer recognisable.

Slightly SW Weathered Rock

Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance (usually by limonite) has taken place. The colour and

texture of the fresh rock is recognisable: strength properties are essentially those of the fresh rock substance.

Fresh Rock FR Rock substance unaffected by weathering.

#### Notes on Weathering:

- 1. AS1726 suggests the term "Distinctly Weathered" (DW) to cover the range of substance weathering conditions between XW and SW. For projects where it is not practical to delineate between HW and MW or it is judged that there is no advantage in making such a distinction. DW may be used with the definition given in AS1726.
- 2. Where physical and chemical changes were caused by hot gasses and liquids associated with igneous rocks, the term "altered" may be substituted for "weathering" to give the abbreviations XA, HA, MA, SA and DA.

#### **ROCK SUBSTANCE STRENGTH TERMS**

Abbrev- Point Load Term iation

Index, I<sub>S</sub>50 (MPa)

Very Low VL Less than 0.1 Material crumbles under firm

blows with sharp end of pick; can be peeled with a knife: pieces up to 30mm thick can be broken by finger pressure.

Field Guide

0.1 to 0.3 Low

Easily scored with a knife: indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.

0.3 to 1.0 Medium

Readily scored with a knife; a piece of core 150mm long by . 50mm diameter can be broken by hand with difficulty.

Hiah 1 to 3 A piece of core 150mm long by 50mm 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 after more than one blow of a pick: rock rings under

hammer.

Extremely EH High

More than 10 Specimen requires many blows with geological pick to break; rock rings under

hammer

#### Notes on Rock Substance Strength:

- 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.
- The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms.
- 3. The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index (Is50). The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.



## Rock Description Explanation Sheet (2 of 2)

COMMON ROCK MA Term	DEFECTS IN SSES Definition	Diagram	Map Symbol	Graphic Log (Note 1)	DEFECT SHAPE Planar	<b>TERMS</b> The defect does not vary in orientation
Parting	A surface or crack across which the rock has little or no tensile strength.		20	ied.	Curved	The defect has a gradual change in orientation
	Parallel or sub parallel to layering (eg bedding) or a planar anisotropy		Bed		Undulating	The defect has a wavy surface
	in the rock substance (eg, cleavage). May be open or closed.		Clear	vage (Note 2)	Stepped	The defect has one or more well defined steps
Joint	A surface or crack across which the rock has little or no tensile strength.				Irregular	The defect has many sharp changes of orientation
	but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance.		60	(Note 2)		sment of defect shape is partly by the scale of the observation.
	May be open or closed.			(1016-2)	ROUGHNESS Slickensided	TERMS Grooved or striated surface, usually polished
Sheared Zone (Note 3)	Zone of rock substance with roughly parallel near planar, curved or				Polished	Shiny smooth surface
(14010-0)	undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of		35	11/2/2	Smooth	Smooth to touch. Few or no surface irregularities
	the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.	71111		[4]	Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.		40	2 3500	Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.
Crushed Seam	Seam with roughly parallel almost planar boundaries, composed of				COATING TER	MS  No visible coating
(Note 3)	disoriented, usually angular fragments of the host rock substance which may be more	(a)	50		Stained	No visible coating but surfaces are discoloured
	weathered than the host rock. The seam has soil properties.			(2)	Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
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.			65	Coating	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein.
					BLOCK SHAPI	E TERMS Approximately
Extremely Weathered	Seam of soil substance, often with gradational boundaries. Formad by		32	∡ leli	•	equidimensional
Seam	weathering of the rock substance in place.		TITA	EL STA	Tabular	Thickness much less than length or width
		Seam		[2]	Columnar	Height much greate than cross section

#### Notes on Defects:

- 1. Usually 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.

Sheet

TP 1

1 of 1

Project No:

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

4.4.2007 CW

Test pit location:

REFER TO FIGURE 1

Checked by:

red by:	MI	
ÐΙ	Surface	2.58

mensi n info	notes	RL m	depth.	graphic log		ubstance  material  soil type: plasticity or particle colour, secondary and mind	Northing:	m	ture	consistency/ density index	pocket penetro- meter	itum:	AHD structure and tional observations
water	notes samples	RL n	depth netres			material soil type: plasticity or particle	e characteristics,		ture ition	stency/ ty index	pocket penetro- meter	ihhe	
	samples.	RL n	depth netres	graphic log	classification symbol	soil type: plasticity or particle	e characteristics,		ture ition	stency/ ty index	pocket penetro- meter	ihhe	
I		_2.5	-	3  }		· · · · · · · · · · · · · · · · · · ·			moisture condition	consi densi	kPa ₽888		
			0.5		CI	TOPSOIL: SAND, fine to medium brown with approximately 30% lor 300mm of rootlets.  Sandy CLAY: medium plasticity, sand fine to medium grained.	w plasticity fines,		М			TOPSOIL	
	D	2.0			SP	SAND: fine to medium grained, p	ale grey-white.			VD			
	D	1.5	1. <u>0</u> -			Becoming pale grey-brown.			w				
		_1.0	1. <u>5</u>										
04-04-07 8:54am	D	_0.5	2. <u>0</u>  			Test pit TP 1 terminated at 1.9m							
	04-04-07 8:54am	8:54am 🖸	D _1.5	D 1.5 1.5 1.5 2.0 2.0 2.0 2.5	D _1.5   1.0   1.5	D	D 1.5 Becoming pale grey-brown.  1.5 Test pit TP 1 terminated at 1.9m	SP SAND; fine to medium grained, pale grey-white.  1.0  D 1.5  Becoming pale grey-brown.  1.5  D 2.0  Test pit TP 1 terminated at 1.9m	SP SAND: fine to medium grained, pale grey-white.  1.0  D 1.5  Becoming pale grey-brown.  1.5	SP   SAND: fine to medium grained, pale grey-white.	SP   SAND; fine to medium grained, pale grey-white.   VD	SP SAND: fine to medium grained, pale grey-white.  D 1.5  Becoming pale grey-brown.  W  Test pit TP 1 terminated at 1.9m	SP   SAND: fine to medium grained, pale grey-white.   VD

	method		support	notes, s	samples, tests	clas	sification symbols and	П	consistency/	iensity Index
- 1	N	natural exposure	S shoring N nil	$U_{50}$	undisturbed sample 50mm diameter	soit	description		VS	very soft
1	Χ	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	ed on unified classification		S	soft
ŭ	8H	backhoe bucket	penetration	D	disturbed sample	syste	em.		F	firm
æ	В	bulldozer blade	1234	V	vane shear (kPa)			Į	St	stiff
ω.	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture		VSt	very stiff
e	E	excavator	ranging to	E	environmental sample	D	dry		Н	hard
183			water	R	refusal	M	moist		Fb	friable
5.2			water level	l		W	wet		VL	very loose
			on date shown	l		Wρ	plastic limit		L	loose
GEO			1.	l		W	liquid limit	ĺ	MD	medium dense
٤			water inflow	l				l	D	dense
For			→ water outflow	1				ŀ	VD	very dense

Excavation No.

TP 2

Sheet

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

Principal:

Date completed: 4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CN

Test pit location:

REFER TO FIGURE 1

Checked by:

M

equ	ipment	type	and	model: 4	4WD I	Backho	e		Pit Orientation: Easting:	n		R.l	Surface: 2.433
exc	avation	dime	ensic	ons:	1.5m l	long (	3.4m w	ide	Northing:	n		dat	tum: AHD
ęх	cavati	on i	nfo	rmation			mat	erial s	ubstance				
method	no penetration	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	100 pocket 200 penetro- 300 m meter	
НВ		N	07 9:13am	D D	_2.0	0. <u>5</u>		Cī	TOPSOIL: Silty Clayey SAND, fine to medium grained, dark brown with approximately 30% of low plasticity fines, with approximately 300mm of rootlets.  Sandy CLAY: medium plasticity, dark brown-orange, with some sand lenses.	M/W	St	×××	TOPSOIL
			V 04-04-07	D	_1.0	1.5		SP	SAND: fine to medium grained, brown-dark grey.  Test pit TP 2 terminated at 1.9m	w			Rapid inflow of groundwater and pit collapsing below 1.7m depth.
					_0.0	2.5							

	method		support	notes,	samples, tests	clas	sification symbols and	consi	stency/density index
	N	natural exposure	Sishoring Ninil	U <sub>50</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
	X	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
77	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
Ř	В	buildozer blade	1 2 3 4	٧	vane shear (kPa)			St	stiff
က	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
e n	E	excavator	refusal	Ε	environmental sample	D	dry	Н	hard
<u>88</u>			water	R	refusal	М	moist	Fb	friable
5.2			water level			W	wet	VL	very loose
			on date shown	İ		Wp	plastic limit	L	loose
GEO				į.		W <sub>L</sub>	liquid limit	MD	medium dense
Ε			water inflow					D	dense
ō			water outflow					VD	very dense

Excavation No.

TP 3

Sheet

1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

Date completed: 4.4.2007

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment	type	and	model; 4	4WD E	Backho	е		Pit Orientation: Easting:	m		•	R.L	. Surface: 2.571
excavation	dim	ensic	ons:	1.5m l	ong (	0.4m w	ide	Northing:	m			dati	ım: AHD
excavati	ion	info	rmation			mat	erial s	ibstance					
method 1 5 penetration	support	water	notes samples, tests, etc	RL I	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 poperetro- 400 meter	structure and additional observations
BH	N			_2.5	0.5	***************************************		TOPSOIL: Silty Clayey SAND, fine to coarse grained, pale brown-brown, low plasticity fines with some rootlets to 300mm.		М		The following of the following the following of the follo	TOPSOIL - - - -
			D	2.0	_	/.	SC	Clayey SAND: fine to medium grained, orange-brown / pale brown, low plasticity fines.			VD	1 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (	
	D _1.5		1. <u>0</u>		SP	SAND: fine to coarse grained to fine to medium grained, pale grey-white.		M/W			- -		
				_1.0	1.5			Becoming pale brown-white.					
		07	D	_,.0	- -			Becoming white.					Rapid inflow of groundwater and pit collapsing below 1.7m depth.
		04-04		_0.5	2. <u>0</u>			Test pit TP 3 terminated at 1.8m				THE REPORT OF THE PERSON OF TH	_
					2.5							en engeren energe i spere propie propie A Verdenia de Reina Austria de Lai Esta en est del california de Lai Esta en est del california de Lai	

1									
I	method		support	лotes, :	samples, tests	class	sification symbols and	consister	cy/density index
1	N	natural exposure	S shoring N nil	U <sub>50</sub>	undisturbed sample 50mm diameter	soil	description	vs	very soft
1	Х	existing excavation	1	Ues	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
ı	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
ı	8	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
ı	R	ripper	no resistance ranging to	Bs	bulk sample	mois	ture	VSt	very stiff
ı	Ε	excavator	ranging to	E	environmental sample	D	dry	Н	hard
ı			water	R	refusal	М	moist	Fb	friable
ı			water level	1		W	wet	VL	very loose
			on date shown	!		Wp	plastic limit	L	loose
						W	liquid limit	MD	medium dense
			water inflow	l		_	•	D	dense
ı			water cuttlow	L				MD	von domes

Excavation No.

TP 4

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

5.4.2007

Principal:

Date completed:

5.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

CW

Test pit location:

REFER TO FIGURE 1

equipment	type	and	model: 4	4WD E	Backho	e		Pit Orientation:	Easting:	m			R.I	Surface:	2.260	
excavation	dim	ensid	ons: 1	1.5m k	ong (	).4m w	ide	***************************************	Northing:	m			da	tum:	AHD	
excavati	ion	info	rmation			mat	erial s	ubstance								
method  L  N  penetration	support	water	notes samples, tests, etc	RL I	depth metres	graphic log	classification symbol	material soil type: plasticity or particle colour, secondary and min	or components.			consistency/ density index	100 pocket 200 penetro- 300 m meter		structure and tional observations	
HB BH	2	05-04-07 12:12pm	D D	_1.5	1. <u>0</u>		CH	TOPSOIL: Silty CLAY, medium p grey-black, small percentage of s rootlets.  CLAY: medium to high plasticity,  CLAY: medium to high plasticity,  SAND: fine to coarse grained, pa  Test pit TP 4 terminated at 2.1m	sand <10% with so		M>Wρ	St	XXXXXX X X X X X X X X X X X X X X X X	Rapid inflo	ow of groundwater at	

Sketch

	method		support	notes, s	samples, tests	ł .	sification symbols and	consisten	cy/density index
	N	natural exposure	S shoring N nil	. U <sub>so</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
	Х	existing excavation		Uas	undisturbed sample 63mm diameter	base	d on unified classification	s	soft
ŀ	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
9	В	buildozer blade	1234	٧	vane shear (kPa)			St	stiff
,	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
	E	excavator	ranging to	ε	environmental sample	D	dry	H	hard
			water	R	refusal	M	moist	Fb	friable
1			water level			W	wet	VL	very loose
5			on date shown			Wp	plastic limit	L	loose
3						W.	liquid limit	MĐ	medium dense
1			water inflow			_		D	dense
١			→ water outflow					VD	veni dense

Form GEO 5,2 Issue 3 Rev.2

Sheet

TP 5

1 of 1

Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Excavation No.

4.4.2007 4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

Date completed:

equ	ipment	type	and	model:	4WD I	Backho	е		Pit Orientation:	Easting:	m			ı	Ŕ.L.	. Surface: 2.765
	avation				1.5m l	ong (				Northing:	m			(	datu	ım: AHD
ex		on	info	rmation			mat	erial s	ubstance							
method	2 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle o colour, secondary and minor	components.		moisture condition	consistency/ density index	100 pocket 200 d penetro- 300 d penetro-	a	structure and additional observations
BH		N			_2.5	0.5		CI	TOPSOIL: SAND, fine to medium g brown, with low plasticity fines, app fines with some rootlets to approxin Sandy CLAY: medium plasticity, or	roximately 30% nately 150mm.		M	VSt	***************************************		TOPSOIL
				D	_2.0	3.5		SP	sand fine to medium grained.  SAND: fine to medium grained, pale				VD	SERVICE SERVICE SERVICE AND		-
			7 8:35am	D		1. <u>0</u>			Becoming pale grey-brown.	• /						-
			04-04-07		_1.5	1. <u>5</u>										_
				D	_1.0	 					-	w				Rapid groundwater inflow below 1.7m depth.
					_0.5	2. <u>0</u> - -			Test pit TP 5 terminated at 1.9m							-
	ketch			•		2.5								100 000 000 000		-

Sketch

Form GEO 5.2 Issue 3 Rev.2

	method		support	notes, s	amples, tests	class	sification symbols and	consisten	cy/density index
	N	natural exposure	S shoring N nil	U <sub>se</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
	Х	existing excavation		U <sub>ವ</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
Y	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
é	В	buildozer blade	1234	V	vane shear (kPa)			St	stiff
?	R	ripper	no resistance ranging to	Bs	bulk sample	mois	ture	VSt	very stiff
١٤	Ε	excavator	ranging to	E	environmental sample	D	dry	Н	hard
ű			water	R	refusal	M	moist	Fb	friable
2			water level	ľ		w	wet	VL	very loose
٥			on date shown			Wρ	plastic limit	L	loose
5						W <sub>t</sub>	liquid limit	MD	medium dense
≓			water inflow			•		D	dense
ŌΙ			→ water outflow	ŧ				l vo	very dense

Excavation No.

TP 6

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

5.4.2007 CW

Test pit location:

REFER TO FIGURE 1

Checked by:

///

equ	uipment	type	and	model:	4WD	Backho	е		Pit Orientation:	Easting:	m		•	R.ì.	. Surface: 2.846
exc	avation	dim	ensic	ons:	1.5m l	long (	).4m w	ide		Northing:	m			dat	um: AHD
ex	cavati	ion	info	rmation			mat	erial s	ubstance						
method	2 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle colour, secondary and mine	or components.		moisture condition	consistency/ density index	100 pocket 200 U penetro- 300 m meter	
BH		Z		D	_2.5	0.5	<u></u>	SM	TOPSOIL: Silty SAND, fine to me grey mottled white, with some roc 150mm.  Silty SAND: fine to medium grian cemented sand nodules.	otlets and roots to	irk	D	VD		INDURATED SAND?
				D	2.0	1. <u>0</u>		SP	SAND: fine to medium grained, p	ale brown-white					——————————————————————————————————————
			12:33pm		1.5	1. <u>5</u>			with some cemented sand nodule	<b>.</b>					- - - - -
			V 05-04-07 12:33pm		_1.0	2. <u>0</u>			Becoming pale grey-white.  Lenses of cemented sand nodule present.	s dark brown-red	ı	W			Water visible. Pit collapsing due to groundwater.
	Allahadd i madayan yayan i hayayi yaya				_0.5	2.5			Test pit TP 6 terminated at 2.1m						-

Sketch

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TESTRIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

method		support	notes,	samples, tests	clas	sification symbols and	consister	cy/density index
N	natural exposure	S shoring N nil	U <sub>se</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
Х	existing excavation		Ųes	undisturbed sample 63mm diameter	base	ed on unified classification	s	soft
8H	backhoe bucket	penetration	D	D disturbed sample system		em	F	រីហោ
8	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
R	ripper	no resistance ranging to	Bs	bulk sample	moi	sture	VSt	very stiff
Ε	excavator	ranging to refusal	E	environmental sample	D	dry	н	hard
		water	R	refusal	М	maist	Fb	friable
l		water level			W	wet	VL	very loose
l		on date shown			Wp	plastic limit	L	loose
1		ł			W,	liquid limit	MD	medium dense
1		➤ water inflow			l `	•	D	dense
í		— water outflow	I		ı		VO	MODI GODOO

### Excavation No.

Sheet

1 of 1

TP 7

TATTERSALL SURVEYORS PTY LTD

Project No: Date started: GEOTSGTE20248AA 13.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

JJT

13.4.2007

Test pit location:

REFER TO FIGURE 1

Checked by:

Date completed:

equipment	type	and	model:		•			Pit Orientation:	Easting:	m	•		R.L	. Surface:	2.388	
excavation	dim	ensid	ons: r	n long	g mv	vide			Northing:	m			dat	um;	AHD	
excavati	ion	info	rmation			mat	eriał s	ubstance								
method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle colour, secondary and mino	r components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 ponetro- 400 meter	addi	structure and tional observation	ns
НА	Z	•	D	2.0	0.5		CH	Sandy CLAY: high plasticity, dark to medium grained.  Clayey SAND: fine to medium gra			M	VD				
		_	D		1.0			Hole terminated at 1.0m, hole colla groundwater.	apsing because	of	W					
				_1.0	1. <u>5</u>			Test pit TP 7 terminated at 1m								-
				_0.5	2.0_											
				_0.0	2.5											-

Sketch

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TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

natural exposure
existing excavation
backhoe bucket
bulldozer blade
ripper
excavator

su	oport				
	shoring	ı	N	nil	
		on no resit ranging refusal		ice	
<b>Y</b>	water on da	level	M۵		

water outflow

notes,	samples, tests
J <sub>50</sub>	undisturbed sample 50mm diamete
Jes	undisturbed sample 63mm diamete
)	disturbed sample
/	vane shear (kPa)
3s	bulk sample
Ξ	environmental sample

refusal

s	oil d	ification symbols and lescription d on unified classification m
r	nois	ture
Œ	)	dry
٨	A	moist

plastic limit

liquid limit

Wp

consister	ncy/density index
vs	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
Н	hard
Fb	friable
1.0	

L MD

very loose

very dense

medium dense dense

Excavation No.

TP8

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

13.4.2007

Principal:

Date completed:

13.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

JJT

Test pit location:

REFER TO FIGURE 1

Checked by:

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ar an	
TIM.	
# 11W	

equipment	type	and	model:					Pit Orientation: Easting:	m			R.L	. Surface:	3.184
excavation	dim	ensid	ons: r	m long	g mv	vide		Northing:	m			dati	um:	AHD
excavat	ion	info	rmation			mat	erial s	ubstance						
method 1 7 penetration		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	100 x pocket 200 x penetro- 300 w meter		structure and tional observations
HA	Z	Not Measured	D	_3.0			SP	Clayey SAND: fine to medium grained, black.		М	D			-
					0. <u>5</u>	/								_
				_2.5	_			Hole terminated at 0.6m, sand too dry to retrieve. Test pit TP 8 terminated at 0.6m						_
				_2.0	1.0									
				_1.5	1. <u>5</u>									- - - -
				_1.0	2. <u>0</u>									

Sketch

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TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23,10.07

thod	
	natural exposure
	existing excavation
1	backhoe bucket
	bulidozer blade
	ripper
	excavator

	pport shoring	N	nil	
1	netration 2 3 4 no res rangir refusa ter water level on date sho	ig to	nce	

water inflow

water outflow

note	s, samples, tests
U <sub>50</sub>	undisturbed sample 50mm diameter
U <sub>63</sub>	undisturbed sample 63mm diameter
D	disturbed sample
٧	vane shear (kPa)
Bs	bulk sample
Ε	environmental sample
R	refusal

soil	sification symbols and description ed on unified classification em
moi	sture dry
М	moist

Wp

rication symbols and lescription d on unified classification m	VS S F St
ture	VSt
dry	н
moist	Fb
wet	VL
plastic limit	L
liquid limit	MD

consisten	cy/density inde:
V\$	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable

very loose

very dense

dense

medium dense

Sheet

Excavation No.

TP 9

Project No:

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

4.4.2007

Principal:

Date completed:

4.4.2007 CW

Project: Test pit location:

REFER TO FIGURE 1

Checked by:

M

equipment type ar	id model:	4WD Bac	hoe		Pit Orientation: Easting:	m			R,L	. Surface; 2.735
excavation dimen	sions:	1.5m long	0.4m w	ide	Northing:	m			dati	um: AHD
excavation in	ormation		mat	aterial substance						
notes samples, tests, etc deptr				classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 ponetro- 400 meter	structure and additional observations
BH Z	D	_2.5	G		TOPSOIL: Silty Clayey SAND, fine to medium grained, dark grey, low plasticity fines, with some rootlets and thick roots to 100mm.		M			TOPSOIL
	D	2.0	<u>-</u>	SC	Clayey SAND: fine to medium grained, dark brown-black, low plasticity fines with some black cemented sand nodules up to approximately 0.13m diameter.	)		D/VD		
10:41am	D	_1.5	- ( ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	SP	SAND: medium to coarse grained, pale grey-white.	- —				
▼ 04-04-07 1		_1.0	<u>-</u>		Becoming pale grey-brown.		w			Groundwater inflow below 1.8m
	D	2.	$\mathcal{A}$							depth.
\$\$ \$\$		_0.5	-		Test pit TP 9 terminated at 2m					

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS.ogged by:

Sketch

method support notes, samples, tests classification symbols and consistency/density index natural exposure undisturbed sample 50mm diameter soil description very soft X BH B R existing excavation undisturbed sample 63mm diameter based on unified classification S soft backhoe bucket D disturbed sample system firm buildozer blade vane shear (kPa) St stiff Вs bulk sample moisture VSt very stiff excavator environmental sample H Fb hard refusal М moist friable VL water level on date shown wet very loose plastic limit loose MD liquid limit medium dense dense water outflow νD very dense

GEO 5.2 Issue 3 Rev.2

Excavation No.

TP10

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

Principal:

·

Date completed:

4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

**REFER TO FIGURE 1** 

Checked by:

equ	ipment	type	and	model:	4WD I	Backho	e		Pit Orientation:	Easting:	m			R.	L. Surface:	2.585
ехс	avation	dim	ensid	ons:	1.5m l	ong (	0.4m w	0.4m wide Northing: m						da	tum:	AHD
ex	cavati	ion	info	rmation			mat	erial s	ubstance							
method	ر الا الا الا الا الا الا الا الا الا ال	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle o colour, secondary and minor	components.		moisture condition	consistency/ density index	100 pocket 200 penetro- 300 meter		structure and tional observations
BH	The state of the s	N			2.5		*********		TOPSOIL: Clayey SAND, fine to m brown, low plasticity fines, with son roots (10-30mm thick) to approximate the second sec	ne rootlets and		М			TOPSOIL	-
			ved	D	_2.0	0. <u>5</u> –		SC	Clayey SAND: fine to medium grain with some cemented sand nodules fines.	ned, pale brown , low plasticity	,		MD			
			None Observed		_1.5	1. <u>0</u>	Z:	SP	SAND: fine to medium grained, pal	e grey-white.			D D			- -
				D		- - 1.5										- - -
					1.0										No obviou	- s groundwater level or -
				D					One big, 0.7mm dia., cemented sal	nd nodule.		W			inflow but	pit collapsing.
	REARIAL CONTRACTOR CON				_0.5	2. <u>0</u> - -			Test pit TP10 terminated at 1.9m							 - -

в									
	method		support	notes, samples, te	ests	clas	sification symbols and	consistent	y/density index
	N	natural exposure	S shoring N nil	U <sub>so</sub> undistur	bed sample 50mm diameter	soil	description	VS	very soft
	Х	existing excavation		U <sub>s3</sub> undistur	bed sample 63mm diameter	base	d on unified classification	s	soft
	BH	backhoe bucket	penetration	D disturbe	d sample	syste	em	F	firm
2	В	bulldozer blade	1234	V vane sh	ear (kPa)			St	stiff
,	R	ripper	no resistance ranging to	Bs bulk san	nple	mois	sture	VSt	very stiff
	E	excavator	ranging to ■ refusal	E environr	mental sample	D	dry	Н	hard
			water	R refusal	·	М	moist	Fb	friable
!			water level			W	wet	VL	very loose
			on date shown			Wp	plastic limit	i L	loose
,			l			W,	liquid limit	MD	medium dense
			water inflow				·	D	dense
,			→ water outflow					1 1/0	veni donno

Sheet

**TP11** 

1 of 1

Project No:

GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

4.4.2007 4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

ecked by:			
R.L	. Surface:	2.732	

equipment typ	e and	l model:	4WD E	3ackho	е		Pit Orientation:	Easting:	m			R.L	. Surface:	2.732	
excavation dir	nensi	ons:	1,5m k	ong (	0.4m w	ide		Northing:	m			date	um:	AHD	
excavation	info	rmation			mat	erial s	ubstance								
method 1 2 penetration		notes samples, tests, etc	RL :	depth metres	graphic log	classification symbol	material soil type: plasticity or particle o colour, secondary and minor	components.		moisture condition	consistency/ density index	100 × pocket 200 × penetro- 300 © meter	addit	structure and ional observations	
BH Z		D	_2.5	0. <u>5</u>		SC	TOPSOIL: Silty SAND, fine to medigrey-brown, low plasticity fines? wit Clayey SAND: fine to medium grain grey-brown, low plasticity fines.  Clayey SAND: fine to medium grain orange-brown, dark brown-black, low the cemented sand nodules up to 0.13mm dia.	th some rootlets  ned, pale  ned,  ow plasticity fine		M	VD		TOPSOIL		
	am▼	D	_1.5	1.5		SP	SAND: fine to coarse grained, pale  Colour change.	grey-brown.		W					
	04-04-07 11:15am		0.5	2.0			Test pit TP11 terminated at 1.9m								

Sketch

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TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

ı	method		support	notes, s	amples, tests	class	sification symbols and	consisten	cy/density index
ı	N	natural exposure	S shoring N nil	Uso	undisturbed sample 50mm diameter	lios	description	VS	very soft
ı	X	existing excavation		Uea	undisturbed sample 63mm diameter	base	ed on unified classification	s	soft
1	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
į	В	buildozer blade	1234	٧	vane shear (kPa)		,	St	stiff
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
3	Е	excavator	ranging to refusal	E	environmental sample	D	dry	н	hard
í			water	R	refusal	M	moist .	Fb	friable
1			water level			W	wet	VL	very loose
Ś			on date shown			Wp	plastic limit	L	loose
3						WL	liquid limit	MD	medium dense
٤			water inflow					D	dense
3			water outflow					VD	very dense

Sheet

TP12

1 of 1

Project No:

Excavation No.

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

4.4.2007

4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

L. Surface: 3.126

equ	uipment	type	and	model:	4WD I	Backho	е		Pit Orientation:	Easting:	m			R.I	Surface:	3.126	
exc	avation	dim	ensid	ons:	1.5m l	long (	0.4m w	ide		Northing:	m			dat	tum:	AHD	
e	ccavati	on	info	rmation			material substance										
method	5 penetration	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				
H8		Z		D D	2.5	0.5 1.0 1.5		SC CL SP	TOPSOIL: Silty Clayey SANI grained, dark grey, low plast rootlets to approximately 350 Clayey SAND / Sandy CLAY grained, dark grey-brown, m Sandy CLAY: low to medium orange-brown, sand fine to respect to the sand sand fine to respect to the sand sand sand fine to respect to the sand sand sand sand sand sand sand sand	city fines, with some onm.  Think to medium edium plasticity fines.  In plasticity, medium grained.  It pale grey-white.	The state of the s	M	St	X	TOPSOIL		
			04-04-07 11:30am		_1.0	2.5			Test pit TP12 terminated at 2	?m							-

	method		support	notes,	samples, tests	clas	sification symbols and	consisten	cy/density index
	N	natural exposure	S shoring N nil	Uso	undisturbed sample 50mm diameter	soil	description	vs	very soft
	Х	existing excavation		Usa	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
Ø	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
è	В	bulldozer blade	1234	٧	vane shear (kPa)			St	stiff
က	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
e e	E	excavator	ranging to refusal	Е	environmental sample	D	dry	н	hard
SS			water	Ŕ	refusal	М	moist	Fb	friable
5.2			water level			W	wet	VL.	very loose
			on date shown			Wp	plastic limit	L	loose
GEO			_		1	WL	liquid limit	MD	medium dense
E			water inflow					D	dense
Ğ			─ water outflow					VD	very dense

### Excavation No.

**TP13** 

Sheet

1 of 1 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

4.4.2007

Principal:

4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment type and model:	4WD Backnoe	Pit Orientation: Easting: m		R.L. Surface: 2.8	25
excavation dimensions:	1.5m long 0.4m wid			datum: AH	D
excavation information	mate	erial substance			
notes sample tests, e	s,   발	material  material  poly soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition consistency/ density index	සි.සි.ස additional kPa kPa විදිලිලිලි	ure and observations
BH 2	_2.5	TOPSOIL: Silty SAND, fine to medium grained, dark grey-black with some rootlets and roots (10-30mm thick).	D/M	TOPSOIL	   
D	2.0	SM Silty SAND: dark brown-dark red, fine to medium grained, with cemented sand nodules to 0.16mm dia.	M VD	Bucket scraping	on hard layer.
04-04-07 11:51am	1.5	Becoming brown-pale brown cemented nodules of sand still present.			- - - - -
D 0-40	2.0	Becoming dark brown-brown weakly cemented nodules present.  Test pit TP13 terminated at 2m	w		
	_0.5				

Sketch

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Ε

TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

natural exposure
existing excavation
backhoe bucket
bulldozer blade
ripper
excavator

•	port shoring	N	nil
		esistar ing to	nce
wat		991	
<u>¥</u>	water leve on date st		

water outflow

notes, sa	mples, tests
$U_{50}$	undisturbed sample 50mm diameter
U <sub>63</sub>	undisturbed sample 63mm diameter
D	disturbed sample
٧	vane shear (kPa)
Bs	bulk sample
E	environmental sample
R	refusal

clas	sification symbols and	
soil	description	
base	ed on unified classification	
syste	em	
moi	sture	
D	dry	
М	moist	
W	wet	

plastic limit liquid limit

consistency/d	lensity index
VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
н	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense

dense

very dense

Excavation No.

**TP14** 

Sheet

1 of 1

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started: GEOTSGTE20248AA 4.4.2007

Principal:

Date completed:

4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

1/11	
<i>• 00</i>	

equipment	type	and	model: 4	4WD	Backho	е		Pit Orientation:	Easting:	m			R.L.	Surface:	2.760	
excavation	dime	ensic	ons:	1.5m	long (	0.4m w	ide		Northing:	m			datu	ım:	AHD	
excavati	on i	nfo	rmation			mat	erial s	ubstance								
method	support	water	notes samples, tests, etc	RL.	depth metres	graphic log	classification symbol	material soil type: plasticity or particle cha colour, secondary and minor co	omponents.		moisture condition	consistency/ density index	100 × pocket 200 × penetro- 300 w meter 400 meter		structure and tional observations	
HH BH	N		D D	_2.5	1.0		СН	TOPSOIL: Silty CLAY, medium plastic brown with some rootlets approximate appro	ely 400mm.			VSt	** ** **	TOPSOIL		
				_0.5	2.5											- - -

1	method	•	support	notes,	samples, tests	class	sification symbols and	consist	ency/density index
	N	natural exposure	S shoring N nil	U₅o	undisturbed sample 50mm diameter	soil	description	VS	very soft
i	Х	existing excavation		Ue₃	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
7.	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
è.	В	bulldozer blade	1234	٧	vane shear (kPa)			St	stiff
ო	R	ripper	no resistance ranging to	8s	bulk sample	mois	ture	VSt	very stiff
97	E	excavator	ranging to refusal	Ε	environmental sample	D	dry	н	hard
20			water	R	refusal	М	moist	Fb	friable
5.2			water level			W	wet	VL	very loose
			on date shown	l		Wp	plastic limit	L	loose
GEO				l		WL	liquid limit	MD	medium dense
Ę۱			water inflow					D	dense
Ē			— water outflow	l				VD	very dense

REFER TO FIGURE 1

Excavation No.

TP15

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

Principal:

Date completed: 4.4.2007
Logged by: CW

Project:

Test pit location:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

Checked by:

////

equipment ty	/pe a	and i	model: 4	4WD	Backho	е		Pit Orientation:	Easting:	m			R	.L. Surfac	ce: 2.355	
excavation o	limer	nsio	ns: 1	1.5m l	ong (	0.4m w	ride		Northing:	m			d	atum:	AHD	
excavatio	n in	ıfor	mation			mat	erial s	ubstance								
120			notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	materia soil type: plasticity or parti colour, secondary and m	cle characteristics, inor components.		moisture condition	consistency/ density index	200 X pocket 300 V penetro-	904	structure and additional observation	s
Н8	N		D D		1.0 1.5		SP	TOPSOIL: Silty (Clayey) SANE grained, dark grey-black, with a rootlets to approximately 400m SAND: fine to coarse grained, small percent of fines <20%.  Becoming pale grey mottled bit is a small percent of fines services and percent of fines services are services as a small percent of fines serv	ome roots 10mm am.	end	M/VV	D/VD		Pit col	apsing no groundwater	
				_0.5	2. <u>0</u>		,	Pit collapsing. Test pit TP15 terminated at 1.7	m							
				_0.0	- 2.5											_

method		support	notes,	samples, tests	clas	sification symbols and	consister	cy/density index
N	natural exposure	Sishoring Ninil	U₅o	undisturbed sample 50mm diameter	soit	description	VS .	very soft
Х	existing excavation	!	U <sub>63</sub>	undisturbed sample 63mm diameter	base	ed on unified classification	s	soft
BH	backhoe bucket	penetration	D	disturbed sample	syst	em	F	firm
В	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
R	ripper	no resistance ranging to	Bs	bulk sample	moi	sture	VSt	very stiff
E	excavator	refusal	E	environmental sample	D	dry	Н	hard
		water	R	refusal	М	moist	Fb	friable
		water level	1		W	wet	VL	very loose
		on date shown	1		Wp	plastic limit	L	loose
			1		W <sub>c</sub>	liquid limit	MD	medium dense
İ		water inflow	l				D	dense
		water outflow			İ		VD	very dense

### Excavation No.

TP16

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

Date completed:

R.L. Surface: 2.683

equipme	ent ty	ре а	nd	model: 4	4WD E	Backho	е		Pit Orientation: Easting:	m			R,L	Surface:	2.683	
excavati	on di	mer	sio	ns: 1	1.5m l	ong (	0.4m w	ride	Northing:	m			dat	um:	AHD	
excav	atio	n in	for	mation			mat	erial s	ubstance							
method 1	3		waler	notes samples, tests, etc	RL i	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 popenetro- 400 meter		structure and tional observations	i
ВН		1			_2.5	-		SP	TOPSOIL: Silty SAND, fine to medium grained, dark grey-black mottled white, with some rootlets.  SAND: fine to medium grained, pale grey-brown.	_	D M	D		TOPSOIL		-
				D		0. <u>5</u>					·	-				-
					2.0							VD				
		9		D	1.5	1. <u>0</u>				-	M/W		ted tal ledikiral under ber energiet (e.).			
	Made for the desired comment with comment wi	04 04 07 42-E4mm				1. <u>5</u>										_
		<b>A</b>	5	D	_1.0	-		SP	SAND: fine to medium grained, dark grey-black, cemented sand nodules, coffee rock.	-	w			INDURAT	ED SAND	
						2. <u>0</u>			Pit collapsing. Test pit TP16 terminated at 1.8m							-
	A 101 101 101 101 101 101 101 101 101 10			;	_0.5	_ _ _							***************************************			_
						2.5										

method N X 8H	natural exposure existing excavation backhoe bucket buildozer blade	support S shoring N nil penetration 1 2 3 4	U <sub>so</sub> undisturbed sample 50mm diameter U <sub>so</sub> undisturbed sample 63mm diameter	classification symbols and soil description based on unified classification system	consistency VS S F St	//density index very soft soft firm stiff
R E	ripper excavator	no resistance ranging to refusal water	` '	moisture D dry M moist	VSt H Fb	very stiff hard friable
		water level on date shown water inflow water outflow		W wet Wp plastic limit W <sub>L</sub> liquid limit	VL L MD D VD	very loose loose medium dense dense very dense

Excavation No.

TP17

Sheet

1 of 1

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

Principal:

Date completed: 4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS\_ogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equ	ipment	type	and	model:	4WD	Backho	e		Pit Orientation:	Easting:	m			R.L	. Surface:	2.635
exc	avation	dim	ensid	ons:	1.5m l	long (	0.4m w	ide		Northing:	m			dati	um:	AHD
ех	cavati	ion	info	rmation			mat	erial s	ubstance			· ·				
method	1 2 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	materia soil type: plasticity or parti colour, secondary and m	cle characteristics, inor components.		moisture condition	consistency/ density index	100 pocket 200 U penetro- 300 m meter		structure and tional observations
H8		Z	<b>▲</b> 05-04-07 10:53am	D D		0.5 1.0 1.5		SC SC	TOPSOIL: Silty Clayey SAND, grained, dark grey-black mottle fines, with some rootlets.  Silty Clayey SAND: fine to medium placemented nodules of SAND. Clayey SAND: fine to medium brown, low plasticity fines, with nodules of sand.  SAND: fine to coarse grained, Becoming grey-brown.	dium grained, dark sticity fines, with grained, brown-pal weakly cemented bale grey-pale brown	e	M	VD		Rapid inflo	w of groundwater below h.

Sketch

method support notes, samples, tests classification symbols and consistency/density index natural exposure S shoring undisturbed sample 50mm diameter soil description very soft X BH U<sub>53</sub> existing excavation undisturbed sample 63mm diameter based on unified classification. S soft disturbed sample system firm penetration B R E bulldozer blade vane shear (kPa) - no resistance ranging to ■ refusal ripper excavator Bs bulk sample moisture VSt very stiff environmental sample D dη н hard refusal moist Fb friable very loose water level on date shown Wp plastic limit L MD loose liquid limit medium dense water inflow dense water outflow very dense

GEO 5.2 Issue 3 Rev.2

Excavation No.

**TP18** 

Sheet

1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

5.4.2007

Principal:

Date completed:

5.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipn	nent ty	ype	and	model: 4	4WD E	Backho	e		Pit Orientation:	Easting:	m			R.L	Surface:	2.302	
excava	ation c	dime	ensio	ns:	1.5m l	ong (	0.4m w	ide		Northing:	m			dati	ım:	AHD	
exca	vatio	n i	nfoi	mation			mat	erial s	ibstance								
ğ 1	2.0		water	notes samples, tests, etc	RL ı	depth metres	graphic log	classification symbol	material soil type: plasticity or particle colour, secondary and mind	or components.		moisture condition	consistency/ density index	100 pocket 200 penetro- 300 m meter	addit	structure an tional observ	
BH.		N			_2.0	0. <u>5</u>		CI	TOPSOIL: Sandy CLAY, low to m dark brown-black, sand fine to me some roctlets to 100mm.  CLAY: medium plasticity, dark grewith minor sand component appre	edium grained, wit		M	VSt	***************************************	TOPSO!L		- - 
			-	D	_1.5	1. <u>0</u>		SC SP	Clayey SAND: fine to medium graphasticity fines.  SAND: fine to coarse grained, pal Becoming grey / brown.				D				- - -
		Þ	05-04-07 10;35am	D	_1.0	1. <u>5</u>											- - - -
	007000000000		05-04	D	_0.5	_			Sand becoming indurated and da			W					
					_0.0	2. <u>0</u>			Pit collapsing due to inflow of grou from sides, Test pit TP18 terminated at 1.9m	ındwater, collapsi	ing						- - -
						2.5											_

-								
	method	support	notes	, samples, tests	clas	sification symbols and	consister	ncy/density index
1	N natural expos	ure Sishoring Ninil	U <sub>50</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
1	X existing excav	ration	U⇔	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
1	BH backhoe buck	peneriation	D	disturbed sample	syst	em	F	firm
Ď	B buildozer blad		V	vane shear (kPa)			St	stiff
2	R ripper	no resistance ranging to	Bs	bu <b>ik sample</b>	moi	sture	VSt	very stiff
9	E excavator	ranging to refusal	Ε	environmental sample	D	dry	н	hard
ñ		water	R	refusal	M	moist	Fb	friable
4		water level	1		W	wet	٧L	very loose
Ś		on date shown			Wp	plastic limit	L	loose
j			1		W	liquid limit	MD	medium dense
=		water inflow	1				D	dense
5	l	→ water outflow					VD	very dense

Excavation No.

TP19

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

Principal:

Date completed:

4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

L. Surface: 2.261

equ	uipment	type	and	model:	4WD I	Backho	е		Pit Orientation:	Easting:	m			R.I	Surface:	2.261	
ехс	avation	dim	ensi	ons:	1.5m l	ong	0.4m w	ide		Northing:	m			dal	tum:	AHD	
e)	ccavati	ion	info	rmation			mat	erial s	ubstance								
method	2 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle colour, secondary and mine	or components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 popenetro- 400 meter		structure and tional observations	
НВ		N	2:31pm	D	_2.0	0.5	<u></u>	СН	TOPSOIL: Clayey SAND, fine to dark brown-black, low plasticity fir rootlets.  Sandy CLAY: medium to high plabrown-black, sand fine to coarse  Becoming dark grey-grey.	nes with some		Ċ			TOPSOIL		- - - - - - - -
			▼ 04-04-07 2:3	D	_0.5	1. <u>5</u>		SP	SAND: fine to coarse grained, pa  Becoming pale brown / grey.  Pit collapsing due to groundwater			W	VD				
					_0.0	2. <u>0</u> - - - 2.5			Test pit TP19 terminated at 1.8m								-

- [	method		support	notes,	samples, tests	clas	sification symbols and	consisten	cy/density index
	N	natural exposure	S shoring N nil	U <sub>50</sub>	undisturbed sample 50mm diameter	soil	description	vs	very soft
	X	existing excavation		Ue₃	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
Ų,	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
Rev	В	buildozer blade	1234	V	vane shear (kPa)			St	stiff
ന	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
enss	E	excavator	ranging to refusal	Ε	environmental sample	D	dry	н	hard
8			water	R	refusal	M	moist	Fb	friable
5.2			water level			W	wet	VL	very loose
ő			on date shown			Wp	plastic limit	L.	loose
GEO						W <sub>L</sub>	líquid limit	MD	medium dense
			water inflow			_		D	dense
ero-			─ water outflow					VD	very dense

### Excavation No.

TP20

Sheet

1 of 1 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Principal:

Date completed:

4.4.2007 4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment type and	l model: 4WD Back	hoe	Pit Orientation:	Easting:	m		R.L	Surface: 2,255
excavation dimensi	ons: 1.5m long	0,4m wide		Northing:	m		dat	um: AHD
excavation info	rmation	material s	ubstance					
method  b penetration  support  water	notes samples, tests, etc dep RL metr	graphic log classification symbol	material soil type: plasticity or particl colour, secondary and min	or components.		condition consistency/ density index	100 pocket 200 uppenetro- 300 mmeter	
BH			TOPSOIL: Silty Clayey SAND, fir grained, dark grey-black mottled rootlets.  Sandy CLAY: low plasticity, dark fine to medium grained, trace of cemented sand nodules.  Sandy CLAY: low to medium pla grey-pale brown mottled orange, grained.  Becoming pale brown / grey.	white, with some brown-red, sand rootlets and sticity, pale sand fine to med	/ / jum	M W		TOPSOIL
	_0.5		Pit collapsing due to groundwate Test pit TP20 terminated at 1.7m					

method		support	notes,	samples, tests	clas	sification symbols and	consisten	cy/density index
N	natural exposure	S shoring N nil	U <sub>so</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
Х	existing excavation	1	Usa	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
В	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
R	ripper	no resistance ranging to	Bs	bulk sample	moi	sture	VSt	very stiff
E	excavator	ranging to refusal	E	environmental sample	Ð	dry	н	hard
		water	R	refusal	M	moist	Fb	friable
		water level	1		W	wet	VL	very loose
		on date shown	1		Wp	plastic limit	L	loose
		1	1		W,	liquid limit	MD	medium dense
		water inflow	1		_		D	dense
l		→ water outflow					VD	very dense

Excavation No.

TP21

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

Principal:

Date completed:

4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipr	nent t	ype	and	model:	WD!	Backho	е		Pit Orientation:	Easting:	m			F	R.L. S	Surface:	2.675
excava					1.5m l	ong (	0.4m w			Northing:	m			c	latum	1:	AHD
exca	vatio	on i	nfo	rmation	,		mat	erial s	ubstance								
일	ν penetration ω	support	water	notes samples, tests, etc	RL.	depth metres	graphic log	classification symbol	material soil type: plasticity or particl colour, secondary and min	or components.		moisture condition	consistency/ density index	100 pocket 200 to penetro- 300 to penetro-	400	additī	structure and onal observations
ВН		N		D D	_2.5	0. <u>5</u>		SP	TOPSOIL: Silty Clayey SAND, fir grained, dark grey, low plasticity rootlets and some thick roots to clayey SAND: fine to medium grown, low plasticity fines with so sand nodules.  SAND: fine to medium grained, p	fines with some 300mm. ained, orange-pal ome cemented rec	le d	М	VD			OPSOIL	
			04-04-07		1.0	1. <u>5</u>			Becoming pale brown-pale grey.		-	w			R 1	Rapid groui .7m depth	ndwater inflow below
				D	_0.5	2.5			Test pit TP21 terminated at 2m					TO NOT CALCULATE THE BROWN AND AN ADMINISTRATION AND ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATION ADMINISTRATI	THE REST OF LATERAL CONTACT OF LATERAL CANADISTICS OF THE PARTY.		

ı	method		support	пotes, s	samples, tests	class	sification symbols and	consister	ncy/density index
1	N	natural exposure	S shoring N nil	$U_{so}$	undisturbed sample 50mm diameter	soil	description	VS	very soft
1	Х	existing excavation	1	Ues	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
٧.	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
Ď	В	buildozer blade	1234	V	vane shear (kPa)			St	stiff
2	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
Š	E	excavator	ranging to	Ε	environmental sample	D	dry	н	hard
2			water	R	refusal	M	moist	Fb	friable
2			water level			W	wet	VL	very loose
š			on date shown	ŀ		Wp	plastic limit	L	loose
5			1.	i		W <sub>L</sub>	liquid limit	MD	medium dense
Ē			water inflow					D	dense
ō			—  ✓ water outflow	I				VD	very dense

Excavation No.

TP22

### **Engineering Log - Excavation**

Sheet

1 of 1

Client

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

GEOTSGTE20248AA 4.4.2007

4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

MI

equipment	type	and	model: 4	₽WD E	3ackho	В		Pit Orientation: Easting;	m			R.L	. Surface: 2.332	٦
excavation	dim	ensic	ons: 1	1.5m l	ong (	).4m w	ide	Northing:	m			dat	um: AHD	$\Box$
excavati	on	info	rmation			mate	erial s	ıbstance						
method 1 2 3 penetration	support	water	notes samples, tests, etc	RL ı	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 popenetro- 400 meter		
ВН	N			_2.0	0.5	***************************************		TOPSOIL: Sandy CLAY, low to medium plasticity, dark brown-black, sand fine to medium grained, wit some rootlets.	th	D			TOPSOIL	-
AND AND AND AND AND AND AND AND AND AND			D		-		Cł	CLAY: medium plasticity, dark brown-black, with some sand component approximately 30%.		М		ANTANA MANAGAMBAN MANA		-
1.0							SM	Silty SAND: fine to medium grained, brown-pale brown, with some cemented sand nodules.			D VD			-
			D	_1.0	- -		SP	SAND: fine to medium grained, pale grey-white.		M/W	VD			-
					1. <u>5</u>			Becoming pale grey / brown.						-
		_ ma	D	_0.5	-									
		04-04-07 2:50			2. <u>0</u>			Pit collapsing due to groundwtaer inflow. Test pit TP22 terminated at 1.9m						
		04-(		_0.0										
Skotch					2.5									_

	method		support	notes,	samples, tests	clas	sification symbols and	сопsister	ncy/density index
	N	natural exposure	S shoring N nil	Uso	undisturbed sample 50mm diameter	soil	description	VS	very soft
	Х	existing excavation	1	U <sub>63</sub>	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
ų	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
Ď	В	bulidozer blade	1234	٧	vane shear (kPa)			St	stiff
0	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
3	E	excavator	ranging to refusal	E	environmental sample	D	dry	н	hard
2			water	R	refusal	M	moist	Fb	friable
4			water level			W	wet	VL	very loose
š			on date shown			Wp	plastic limit	L	loose
H						W	liquid limit	MD	medium dense
≘			water inflow	I		l		D	dense
3			— water outflow	I	+	ı		VO	veni dence

Sheet

TP23

1 of 1

Project No:

Excavation No.

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

5.4.2007

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equ	ipment	type	and	model: 4	IWD E	Backho	е		Pit Orientation: Easting:	m			R.L.	. Surface: 2.090
exc	avation	dim	ensio	ons: 1	1.5m k	ong (	0.4m w	ide	Northing:	m			datu	ım: AHD
ex	cavati	on	info	rmation			mat	erial s	ubstance					
method	2 penetration	support	water	notes samples, tests, etc		depth netres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 pocket 200 popenetro- 300 m meter 400 meter	structure and additional observations
ВН		N			_2.0	0. <u>5</u>		SC	TOPSOIL: Silty Clayey SAND, fine to medium grained, dark grey-black, low plasticity fines, with some rootlets to 300mm.  Clayey SAND: fine to medium grained, dark grey-black, low to medium plasticity fines.  Sandy CLAY: low to medium plasticity, pale brown /		D			TOPSOIL
	D 1.5								orange, sand fine to medium grained.		PVI		A STATE OF THE STA	_
	popusado 1.0							SC SP	Clayey SAND: fine to medium grained, pale grey / pale brown, low plasticity fines.  SAND: fine to coarse grained, pale grey-white.	-1		ο		-
	None Observation of the control of t													-
	AN PARAMETER METERS IN A SECURIOR SECUR				_0.5	1. <u>5</u>								- -
						-			Becoming grey / brown.		W			No visible water, but pit collapsing below 1.7m depth.
	D 2.0								7 1 1 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7					
					_0.0	- -			Test pit TP23 terminated at 2m					
<u> </u>	2.5													

Sketch

method notes, samples, tests classification symbols and consistency/density index support N X BH B R E undisturbed sample 50mm diamete very soft natural exposure Uရှာ D existing excavation undisturbed sample 63mm diameter based on unified classification S F soft backhoe bucket disturbed sample system firm vane shear (kPa) St bulldozer blade stiff ripper Bs bulk sample moisture VSt very stiff excavator environmental sample dry hard М Fb moist friable refusal VL very loose water level on date shown plastic limit loose MD liquid limit medium dense dense water outflow very dense

Form GEO 5.2 Issue 3 Rev.2

### Excavation No.

Sheet

TP24 1 of 1

Project No:

GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Date started: Date completed: 5.4.2007 5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

excavation dimensions: 1.5m long 0.4m wide Northing: m datum:    excavation dimensions: 1.5m long 0.4m wide Northing: m datum:   excavation information   material substance	(1)/
Potential Substance    Description   Potential Substance   Potenti	face: 2.177
TOPSOIL: Sandy CLAY: low to medium plasticity, orange, sand fine to coarse grained.  N  N  N  N  N  N  N  N  N  N  N  N  N	AHD
RL metres 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	
sand fine to medium grained, with some rootlets to 100mm.    D	structure and additional observations
SP SAND: fine to medium grained, pale grey-white D ND	
SP SAND: fine to medium grained, pale grey-white D VD	
	•
0.5	
D 2.0 Lenses of colour change to pale grey / brown, with W some clay lenses.	
Pit collapsing from groundwater table.  Test pit TP24 terminated at 2m	

	method		support	notes, s	amples, tests	class	sification symbols and	consisten	cy/density index
	N	natural exposure	S shoring N nil	U₅o	undisturbed sample 50mm diameter	soil	description	VS	very soft
	Х	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
C,	8H	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
Rev.2	8	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
3	R	ripper	no resistance ranging to	Bs	bulk sample	mois	iture	VSt	very stiff
9	E	excavator	refusal	E	environmental sample	D	dry	Н	hard
ssue			water	R	refusal	М	moist	Fb	friable
Ŋ			water level			W	wet	VL	very loose
GEO 5.2			on date shown			Wp	plastic limit	L	loose
핐						W,	liquid limit	MD	medium dense
۶			water inflow	ľ		_	•	D	dense
E								VD	veni dence

Excavation No.

TP25

Sheet

1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

5.4.2007

Principal:

Date completed:

5.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS..ogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equ	ipment	type	and	model: 4	4WD 6	3ackho	e		Pit Orientation:	Easting:	m			R.L	Surface:	2.611	
exc	avation	dim	ensid	ons:	1.5m l	ong (	).4m w	/ide		Northing:	m			dat	um:	AHD	
ex	cavati	on	info	rmation			mat	erial s	ubstance								
method	5 penetration	support	water	notes samples, tests, etc	RL :	depth metres	graphic log	classification symbol	TOPSOIL: Silty SAND, fine to medium grained, dark D				consistency/ density index	100 pocket 200 penetro- 300 m meter	addi	structure and iional observations	
BH		N			_2.5	-			TOPSOIL: Silty SAND, fine to m grey mottled white with some ro (10mm) to 150mm.	edium grained, da otlets and roots	irk	D			TOPSOIL		
D 2.0 0.5 } } }						0. <u>5</u>			Silty SAND: fine to medium gracemented nodules of SAND.	ned, dark grey-bla	ick,	M	D VD		INDURATI	ED SAND	
			u	D	_1.5	1. <u>0</u> - 			100mm band of pale grey-pale becoming grey-brown weakly condules.	prown and then emented sand		W					•
			05-04-07 11:08am		_1.0	1. <u>5</u>											-
			-	D		2.0			Becoming dark brown / red wea	kly sand nodules.					Rapid inflo 1.9m dept	w of groundwater be h.	low
					_0.5				Test pit TP25 terminated at 2m								

method	support	notes, samples, tests	classification symbols and	consistency/density index
N natural exposure X existing excavation BH backhoe bucket B bulldozer blade ripper E excavator E excavator	S shoring N nil  penetration 1 2 3 4 refusal water water level on date shown water outflow water outflow	U <sub>ss</sub> undisturbed sample 50mm diameter U <sub>ss</sub> undisturbed sample 63mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample E environmental sample R refusal	soil description based on unified classification system  moisture D dry M moist W wet Wp plastic limit W <sub>L</sub> liquid limit	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

Sheet 1 of 1

Excavation No.

Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

4.4.2007 4.4.2007

TP26

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment	type	and	model: 4	WD E	Backho	ę		Pit Orientation: Ea	asting:	m				R.L	Surface:	1.709	
excavation	dim	ensid	ons: 1	.5m le	ong (	0.4m w	ide	N	orthing:	m				dat	um:	AHD	
excavati	ion	info	rmation			mate	erial s	ubstance									
method 1 5 penetration	support	water	notes samples, tests, etc	RL r	depth netres	graphic log	classification symbol	material soil type: plasticity or particle chara colour, secondary and minor comp	ponents.		moisture condition	consistency/ density index	ki	300 m penetro-	addit	structure ar ional obser	
ВН	Z		D	_1.5	0. <u>5</u>		SP	TOPSOIL: Silty Sandy CLAY, medium production of dark grey-black, sand fine to medium greysome rootlets to 100mm.  SAND: fine to coarse grained, pale grey-	ained, with		М	D			TOPSOIL		
			D	_1.0	1. <u>0</u>			Becoming pale brown / grey.									- - - 
			D		1.5			Pit collapsing due to groundwater. Test pit TP26 terminated at 1.5m						A P A P A B A B A B A CAPACITA A A B A B A B A B A B A B A B A B A B			-
				_0.0	- 2. <u>0</u>									A CONTRACTOR OF THE PROPERTY O			- - - -
A PERSONAL PROPERTY AND A PERS				0.5	- - 2.5								Abandalan mendanka kadadan Abadhakia kida				- - -

	method		support	notes, samples, tests			sification symbols and	CC	onsistency/d	lensity index
	N	natural exposure	S shoring N nil	U <sub>so</sub>	undisturbed sample 50mm diameter	soil	description	V:	S	very soft
	Х	existing excavation		Uss	undisturbed sample 63mm diameter	base	d on unified classification	s		soft
~	BH	backhoe bucket	penetration	Ð	disturbed sample	syste	em	F		firm
è	В	bulldozer blade	1 2 3 4	V	vane shear (kPa)			St	t	stiff
2	R	ripper	no resistance ranging to	Bs	bulk sample	mois	ture	VS	St	very stiff
e e	Ε	excavator	ranging to	Е	environmental sample	D	dry	н		hard
<u>ss</u>			water	R	refusal	М	moist	Ft	b	friable
5.2			water level			W	wet	VI	L	very loose
Ö			on date shown			Wp	plastic limit	L		loose
ij			_			W <sub>L</sub>	liquid limit	M	D	medium dense
E			water inflow					D		dense
For			─ water outflow					VI	D	very dense

Sheet

TP27

1 of 1

Project No:

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

4.4.2007 4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment type ar	nd model:	4WD E	Backho	е		Pit Orientation:	Easting:	m			R.L.	. Surface:	1.536	
excavation dimen	sions:	1.5m k	ong (	0.4m w	ide		Northing:	m			datu	ım:	AHD	
excavation in	ormation			mat	erial s	ubstance								
method 5 penetration support	notes samples, tests, etc	RL r	depth netres	graphic log	classification symbol	material soil type: plasticity or particl colour, secondary and min	or components.		moisture condition	consistency/ density index	100 pocket 200 ponetro- 300 meter 400 meter	addit	structure and ional observati	ons
BH		_1.0	- 0. <u>5</u>			TOPSOIL: Silty (Clayey) SAND, grained, dark grey-black, with so 200mm.	fine to medium me rootlets to		Ď			TOPSOIL		- - - -
	D		_	יאטא	SM	Silty SAND: fine to medium grain with some cemented sand nodul	ned, dark brown, les.		M	VD	ATACAMATA TA CA FA			
		_0.5	1. <u>0</u>		SP	SAND: fine to coarse grained, br small percent of fines approxima clay lenses or nodules.	rown / grey, with tely 20-30% poss	ibly			(MANAGA) WAR WAR WAR STREET, AND AN AND AN AND AN AND AN AND AN AND AN AND AN AND AN AND AND			- 
04-04-07 3:46nm	D		1											-
4-04-07		_0.0	1. <u>5</u>			Becoming pale grey-white.			M/W					_
<b>I</b>			_			Becoming pale grey / brown.								-
		0.5	2.0			Pit collapsing due to groundwate Test pit TP27 terminated at 1.8m	er inflow. 1							-
THE REPORT OF THE PARTY OF THE			- - 2.5					į						-

ł	method		support	notes, s	samples, tests	class	ification symbols and		consistency/d	lensity index
	N	natural exposure	S shoring N nil	Uso	undisturbed sample 50mm diameter	soil	description	١ ١	VS	very soft
	Х	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification		S	soft
Ŋ	вн	backhoe bucket	penetration	D	disturbed sample	syste	em		F	firm
è	В	bulldozer blade	1234	٧	vane shear (kPa)			1 :	St	stiff
8	R	ripper	no resistance ranging to	Bs	bulk sample	mois	ture	l '	VSt	very stiff
ę	E,	excavator	ranging to	E.	environmental sample	D	dry		Н	hard
88			water	R	refusal	М	moist		Fb	friable
ζ.			water level			W	wet	l '	VL.	very loose
ိ			on date shown			Wp	plastic limit		L	loose
GEO					•	WL	liquid limit		MD	medium dense
٦			water inflow	l					Ð	dense
-01			→ water outflow	1				Ι '	VD	very dense

Excavation No.

TP28

Sheet

1 of 1 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

4.4.2007

Principal:

Date completed:

4.4.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

H8	info	notes		depth netres	draphic log		TOPSOIL: Silty SAND, fine to medium grained, dark grey-black, with some rootlets.  Silty SAND: fine to medium grained, dark	Moisture condition	consistency/ density index	100 pocket 200 penetro- 200 meter pa	
BH method  1		notes samples, tests, etc	RL n	netres		classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.  TOPSOIL: Silty SAND, fine to medium grained, dark grey-black, with some rootlets.  Silty SAND: fine to medium grained, dark	D		kPa	
HE 123 N	water	samples, tests, etc	RL n	netres	graphic log		soil type: plasticity or particle characteristics, colour, secondary and minor components.  TOPSOIL: Silty SAND, fine to medium grained, dark grey-black, with some rootlets.  Silty SAND: fine to medium grained, dark	D		kPa	
		D	_1.5	0.5	<del></del>	SM	grey-black, with some rootlets.  Silty SAND: fine to medium grained, dark		D		TOPSOIL -
		D		_		SM	Silty SAND: fine to medium grained, dark	M I	ו מ		
I	ا ا	D	_1.0	1. <u>0</u>			brown-black / red, cemented sand nodules.		J .		-
	V 04-04-07 3:31pm	D	0.5	1. <u>5</u>		SP	SAND: fine to coarse grained, pale brown / grey.  Becoming brown / grey mottled orange.	W			-
			_0.0	2.0			Test pit TP28 terminated at 1.8m				-

method	support	notes, samples, tests	classification symbols and		density index
N natural exposit X existing excav BH backhoe buck B bulldozer blad ripper E excavator	ation et penetration	U <sub>so</sub> undisturbed sample 50mm diameter U <sub>so</sub> undisturbed sample 63mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample E environmental sample R refusal	soil description based on unified classification system  moisture D dry M moist W wat Wp plastic limit W_ liquid limit	VS S F St VSt H D VD	very soft soft firm stiff very stiff hard friable very loose loose medium dense dense very dense

Sheet

TP29

1 of 1

Project No:

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

5.4.2007 5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

d by:

equipment type and model: 4WD Backhoe							е		Pit Orientation:	Easting:	m			F	L. Surface	e: 2.170						
excav	ation :	dim	ensid	ons:	1.5m l	ong (	0.4m w	ide		Northing:	m			d	atum:	tum: AHD						
exc	avati	on i	nfo	rmation			mat	material substance														
notes samples, tests, etc depth RL metres						depth metres	graphic log classification symbol		graphic log classification symbol		graphic log classification symbol		graphic log classification symbol		material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 pocket 200 d penetro- 300 p	400		
НВ		N		D	1.5	0. <u>5</u>		SC	TOPSOIL: Silty SAND, fine to medium griand brown.  Silty SAND: fine to medium griand brown.  Clayey SAND: fine to medium grand low plasticity fines.	ed, pale grey / p	nale	M	D		TOPSC							
				D	_0.5	1. <u>5</u>			SAME. IIIIS to modulin graines, po	no groy wind.												
			05-04-07 3:12pm		0.0	2. <u>0</u> - - - 2.5			Pit collapsing. Test pit TP29 terminated at 1.7m							;						

п					
1	method	support	поtes, samples, tests	classification symbols and	consistency/density Index
	N natural exposure	S shoring N nil	U <sub>so</sub> undisturbed sample 50mm diameter	soil description	VS very soft
	X existing excavation	on	U <sub>63</sub> undisturbed sample 63mm diameter	based on unified classification	S soft
į	8H backhoe bucket	penetration	D disturbed sample	system	F firm
2	B bulldozer blade	1 2 3 4	V vane shear (kPa)		St stiff
5	R ripper	no resistance ranging to	Bs bulk sample	moisture	VSt very stiff
3	E excavator	ranging to	E environmental sample	D dry	H hard
Š	_	water	R refusal	M moist	Fb friable
i		water level		W wet	VL very loose
3	ł	on date shown		Wp plastic limit	L loose
í				W, liquid limit	MD medium dense
-		water inflow			D dense
5	l	→ water outflow			VD very dense
5		— water outflow			VD very dense

**TP30** 

1 of 1

Sheet Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

5.4.2007

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment type	and	model; 4	4WD E	3ackho	е		Pit Orientation: Easting:	m			R.L	, Surface: 1,159	
excavation dim	ensid	ons:	1.5m l	ong (	0.4m w	ide	Northing:	m			date	am: AHD	
excavation	info	rmation			mat	material substance							
method 1 2 penetration support	water	notes samples, tests, etc	RL i	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics colour, secondary and minor components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 ponetro- 400 meter	structure and additional observations	
BH	05-04-07	D D	_0.5	0.5		SP	TOPSOIL: Silty Clayey SAND, fine to medium grained, dark grey-black mottled white, low plastifines, some rootlets 300mm and roots to 300mm.  SAND: fine to coarse grained, pale grey-white.  Becoming pale brown-grey.  Becoming dark brown-red, with some cemented nodules.  Pit collapsing. Test pit TP30 terminated at 1.7m		W	MD		Some inflow of groundwater to pit at 0.3m, 8:05am, pit slowly collapsing from sides, organic odour.	
			1.0	2.0								- - - - -	

Sketch

ı	method		support	notes, s	amples, tests	class	sification symbols and	consisten	ocy/density index	
ı	N	natural exposure	S shoring N nil	U <sub>50</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft	
ı	Х	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft	
٧l	вн	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm	
ě	В	bulldozer blade	1234	٧	vane shear (kPa)			St	stiff	
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff	
91	ε	excavator	refusal	E	environmental sample	D	dry	н	hard	
2			water	R	refusal	М	moist	Fb	friable	
١			water level			W	wet	VL	very loose	
S			on date shown			Wp	plastic limit	L	loose	
ų.						W,	liquîd limit	MD	medium dense	
É			water inflow	ŀ		· ·	·	D	dense	
5			— water outflow					VĐ	very dense	

Form GEO 5.2 Issue 3 Rev.2

Sheet

TP31

Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

5.4.2007 5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

4WD Backhoe equipment type and model: Pit Orientation: Easting: m R.L. Surface: 0.732 AHD excavation dimensions: 1.5m long 0.4m wide Northing m datum: material substance excavation information pocket penetro-meter classification symbol consistency/ density index penetratio graphic log material notes moisture condition structure and samples, additional observations tests, etc soil type: plasticity or particle characteristics, colour, secondary and minor components. k₽a dept RL 9200 TOPSOIL: Silty Clayey SAND, fine to medium TOPSOIL (swampy area) organic grained, dark grey-black mottled white, low to medium plasticity fines, with layer of mulch and rootlets to М MD 0.5 Clayey SAND: fine to medium grained, pale grey / pale brown, low plasticity fines. 0.<u>5</u> D D 0.0 W Becoming grey / brown. Very slow inflow of groundwater. 1.0 D SAND: fine to medium grained, dark brown-red, indurated cemented sand nodules. Rapid inflow of groundwater, 05-04-07 8:29am -0.51.5 Silty Gravelly SAND: fine to coarse grained, dark grey-black, gravel fine to medium grained, rounded-subrounded. D Pit collapsing due to inflow of groundwater. Test pit TP31 terminated at 1.8m 2.0

Sketch
--------

1										
Ī	method		support	notes, s	amples, tests	class	sification symbols and	cor	sistency:	density index
1	N	natural exposure	S shoring N nil	U <sub>so</sub>	undisturbed sample 50mm diameter	soil	description	VS		very soft
1	X	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	ed on unified classification	s		soft
Ņ	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F		firm
ě	В	buildozer biade	1234	٧	vane shear (kPa)			St		stiff
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VS	i	very stiff
9	E	excavator	refusal	Ε	environmental sample	D	dry	Н		hard
8			water	R	refusal	M	moist	Fb		friable
Ŋ			water level	ł		W	wet	٧L		very loose
5			on date shown	1		Wp	plastic limit	L		loose
Ķ				•		W,	liquid limit	ME	)	medium dense
۲			water inflow	•		•	•	D		dense
Ş			— water outflow	ļ				VD		very dense

Sheet

TP32

1 of 1

Project No:

Excavation No.

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

5.4.2007

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

R.L. Surface: 0,994

equipment t	ype and	d model:	4WD I	Backho	е		Pit Orientation:	Easting:	m			R.L	. Surface:	0,994		
excavation of	dimensi	ions:	1.5m l	ong (	0.4m w	ide		Northing:	m			date	ım:	AHD		
excavation	on info	rmation			mat	erial s	ial substance									
123	support water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	colour, secondary and mir	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.				100 200 × pocket 300 v penetro- 400 meter	addii	structure and tional observations		
	05-04-07 8:47am ▼	D	_0.5	0.5 1.0		SC	TOPSOIL: Silty Clayey SAND, fir grained, dark grey-black mottled fines, with some rootlets and root clayey SAND: fine to coarse grabrown, low plasticity fines maybe fines approximately 30-40%.  Becoming grey-brown, some presand nodules.	ne to medium I white, low plastici Its (10mm). ained, pale grey-pa e low percentage o	ale of	≥	consistency/ density index	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Some inflo	(swampy area)  w of water.  inflow of groundwater		
		D	1.0	-			Becoming grey mottled brown / c of subrounded to rounded grave (grained) less than 10mm size. Pit continually collapsed due to w Test pit TP32 terminated at 1.7m	I (fine to medium	псе							

method	
N	natural exposure
х	existing excavati
ВH	backhoe bucket
8	bulldozer biade
Ŕ	ripper
E	excavator
ı	

sup	port			
Ss	horing	Ν	nil	
	etration 3 4			
<del></del>	no resis	slan	ice	
	a ranging			
****	refusal			
wat	er			
v	water level			
<u>-</u>	on date show	vn.		

notes,	samples, tests
Uso	undisturbed sample 50mm diameter
U <sub>63</sub>	undisturbed sample 63mm diameter
D	disturbed sample
V	vane shear (kPa)
Bs	bulk sample
Ē	environmental sample
R	refusal

soil	sification symbols and description d on unified classification em	consister VS S F St
mois	sture	VSt
D	dry	Н
M	moist	Fb
W	wet	VL
Wp	plastic limit	1 L
$W_L$	liquid limit	MD

consistency	/density Index
VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
Н	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Sheet

TP33

Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

5.4.2007 CW

Test pit location:

REFER TO FIGURE 1

Checked by:

oy: ////

equipment type and model: 4WD Backhoe							е	Pit O <i>r</i> ientation: Easting: m				R.L	. Surface: 0.923	
exca	avation	dim	ensid	ons:	1.5m k	ong (	0.4m w	wide Northing: m datum: AHD						
exe	cavati	ion	info	rmation			mat	erial s	ubstance	,	,			
method	5 penetration	support	water	notes samples, tests, etc	RL i	depth metres		classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	100 pocket 200 penetro- 300 penetro- 400 meter	structure and additional observations	
BH		N				_			TOPSOIL: Silty Clayey SAND, fine to medium grained, dark grey-black mottled white, low plasticity fines, with some rootlets to 250mm.	D/M			TOPSOIL (swampy area)	
					_0.5	0. <u>5</u>		SC	Clayey SAND: fine to coarse grained, pale grey-pale brown.	M	D	***************************************		
			<b>►</b> u	D		-			Becoming grey / brown.	-w				
			05-04-07 8:56am		_0.0	1. <u>0</u>			<b>,</b>				8:56am, organic odour.	
			05-04	D		_	/						-	
					0.5	1. <u>5</u>							- - - -	
				D	-1.0	2.0		SP	SAND: fine to medium grained, dark brown-black, some cemented nodules of sand.				-	
						_			Pit collapsing due to water table. Test pit TP33 terminated at 2m				-	
	***************************************				1.5	2.5								

ı	method		support	notes, s	amples, tests	class	sification symbols and	consisten	cy/density index
ı	N	natural exposure	S shoring N nil	U <sub>so</sub>	undisturbed sample 50mm diameter	lios	description	VS	very soft
ı	Х	existing excavation	1	U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
ı	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
	В	bulidozer blade	1234	ν	vane shear (kPa)			St	stiff
,	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
3	E	excavator	refusal	E	environmental sample	D	dry	Н	hard
3			water	R	refusal	M	moist	Fb	friable
1			w water level	1		W	wet	VL	very loose
,			on date shown	1		Wp	plastic limit	L	loose
;				}		W.	liquid limit	MD	medium dense
í			water inflow	I				Đ	dense
į			→ water outflow	Į		l		VD	very dense



Excavation No.

TP34

Sheet Project No:

GEOTSGTE20248AA

-..-...

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

5.4.2007 5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment type a	and model:	4WD I	Backho	е		Pit Orientation:	Easting:	m				R.L	. Surface: 0.893		
excavation dimer	nsions:	1.5m l	long (	0.4m w	ide		Northing:	m				dati	um: AHD		
excavation in	formation			mat	erial s	ubstance									
method  penetration  support	notes samples, tests, etc	:	depth metres		classification symbol	material soil type: plasticity or partic colour, secondary and mi	le characteristics, nor components.		moisture condition	consistency/ density index 100 pocket 200 penetro- 400 meter					
N			-		SC	TOPSOIL: Silty Clayey SAND, fi grained, dark grey-black mottled plasticity fines. Clayey SAND: fine to coarse gri	d white, low to med	dium	М	D			TOPSOIL		
		_0.5	0. <u>5</u>			grey-white, low plasticity fines.  Becoming pale grey-pale brown			. h.d.D.d.c				Manufacturate 0.42		
	1-07 9:13am		-		SP	SAND: with some clayey lenses grained, low plasticity fines.			M/VV				Very slow inflow of water, 9:13an		
	OS-04-07		1.0		SC	Clayey SAND: fine to coarse gri- low to medium plasticity fines.  Pit slowly collapsing due to water		n, "	W	MD					
		0.5	1. <u>5</u>							MD					
		1.0	2.0		SM	Silty SAND: fine to medium gra	ined, dark brown /					a Parillar de la Calenda de Antonio Paril Antonio Anto			
		-1.5	-			Pit collapsing due to groundwate Test pit TP34 terminated at 2m	er.					A SECURIAL Y A PROPERTY WAS BUILDING A A SECURIAL A VARIABLE A			
			2.5									The Variation C			

Sketch

			<b>,</b>					
method	d	support	notes,	samples, tests		sification symbols and	•	ncy/density index
N	natural exposure	S shoring N nil	Uso	undisturbed sample 50mm diameter	soil	description	vs	very soft
Х	existing excavation	ı	U <sub>63</sub>	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
BH	backhoe bucket	penetration	D	disturbed sample	syst	em	F	firm
В	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
R	ripper	no resistance ranging to	Bs	bulk sample	moi	sture	VSt	very stiff
E	excavator	refusal	Ε	environmental sample	D	dry	н	hard
3		water	R	refusal	M	moist	Fb	friable
!		water level			W	wet	VL	very loose
íl –		on date shown	Į.		Wp	plastic limit	Ĺ.	loose
<b>!</b>			l		$W_{\rm L}$	liquid limit	MD	medium dense
1		water inflow	l		I		D	dense
		— water outflow					VD	very dense

Form GEO 5.2 Issue 3 Rev.2



Borehole No.

BH35

Sheet Project No: 1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

11.4.2007 11.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

drill mo				n: REF	ER MD20	TO F	IGUI	RE 1	Casting	ope: -90°	C	Checke			1.000
unii mo hole dia			moul	·	100 m	m			_	ope: -90° earing:				.L. Surface:	1.006
drillis			rma		100 1/1	311	mate	erial si	ubstance	anng.			a:	atum:	AHD
ethod	υ penetration	support	water	notes samples, tests, etc	RL	depth metres	aphic log	classification symbol	material soil type: plasticity or particle char colour, secondary and minor cor	acteristics, aponents.	moisture condition	consistency/ density index	100 x pocket 200 x pocket 300 d penetro-		ructure and nal observations
HF		С		SPT 2,2,3 N*=5	_0	1		SP	SAND: fine to medium grained, grey.		W	MD			
				SPT 2,3,11 N*=14	1	2						D			
				SPT 6,4,12 N*=16	3	4			Borehole BH35 terminated at 4m						
					4	5 1									
					5	6 - - 7									
nethod SS AD RR V CT HA OT 33		au rol wa cai ha dia	ger dr ler/tric shbor ble too nd au itube ink bit	e ol ger	M C per	ter	1 to resistat anging to efusal 3 water i	evel	notes, samples, tests  U <sub>50</sub> undisturbed sample 50mm diamed by the sample 63mm diamed by the sample of the sample	based on u system  moisture  D dry  M mois  W wet	ption Inified c			consistency VS S F St VSt H Fb VL	//density index very soft soft firm stiff very stiff hard friable vory loose loose



Sheet

BH36

Project No:

1 of 1 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Date started: Date completed: 11.4.2007

Borehole No.

11.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

: ///	
R.L. Surface:	2.361

Borehol	le L	.oca	tion	REF	ER	TO F	IGUF	RE 1			(	Checke	ed by:	////	
drill mode	el ar	nd m	ounti	ng: N	MD20				Easting: slope	e: -90°	,		R.L	. Surface:	2.361
hole diam					100 m	ım			Northing bear	ng:			dati	um:	AHD
drilling	-	forn	natio	on			mate		bstance						
method 15		support	٠.	notes samples, ests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle charact	eristics, nents.	moisture condition	consistency/ density index	100 x pocket 200 x penetro- 300 m meter		structure and ional observations
HF			,	SPT	_2	-		SC SP	Clayey SAND: fine to medium grained, bla low plasticity.  SAND: fine grained, white.	ick, clay	M	D			
			_	4,4,5 N*=9	1	1		SP	SAND: fine to medium grained, black (coff	ee rock).	W				
					<u>_</u> 1	2		SP	SAND: fine grained, white.						
				SPT 2,9,11 N*=20	_0				Becoming grey.						
					1	3						VĎ			
				SPT 6,13,24 N*=37		4		CD.							
					2	-		SP	SAND: fine to medium grained, black (coff Becoming softer.	ее госк).					
				SPT 6,9,23 N*=32	3	<u>5</u> - -									
					4	<u>6</u>									
				SPT 8,16,14 N*=30		7			Borehole BH36 terminated at 7m						
					5	- 8									
method AS AD RR W CT HA DT B V T *bit shown e.g.	ı by s	auge roller, wash cable hand diatul blank V bit TC bi	r drilli: ftricor bore tool auge be bit	ne	M C per 1.2	mud casing netration 2 3 4 m m	o resistar anging to efusal 3 water k s shown		notes, samples, tests  U <sub>so</sub> undisturbed sample 50mm diameter  U <sub>so</sub> 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	soil des based o system moistur D di M m W w	cation syn coription in unified of re ry noist ret lastic limit quid limit	classificat		consiste VS S F St VSt H Fb VL L MD D VD	ncy/density index very soft soft firm stiff very stiff hard friable very loose loose medium dense dense very dense



Borehole No.

BH37

Sheet

1 of 1 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

11.4.2007 11.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

M		

Intil morthing MODO Resting stope 400" R.L. Surface: Not Measured defluting information  material substance  material substanc	В	oreh	ole L	.ocat	ion: <i>REF</i>	ER	TO F	IGUI	RE 1					Checke	ed by:			
The state of the	dri	ll mod	del a	nd mo	unting:	MD20				Easting:	slope:	-90°			۶	R.L. Surface:	Not Measured	
Popular   Popu						100 m	m	-			bearing	:			d	atum:	AHD	
SPT 0.1.8 PT	d	_	<del>- +</del>	torm	ation			mate		ubstance			<del>                                     </del>	,,	Υ			$\dashv$
SPT 4.8.10 SP SAND: fine to medium grained, white.  SPT 1.7.8 N°=16 1 SP SAND: fine to medium grained, white.  SPT 1.7.8 N°=16 1 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).  SPT 1.7.8 N°=16 SP SAND: fine to medium grained, black (coffee rook).	method			support water	samples,	RL	depth metres	graphic log	classification symbol	soil type: plasticity o colour, secondary	or particle characteris and minor compone	nts.		consistency/ density index	kPa			
SPT 4,510 N=15	Ŧ			С				/			edium grained, black	, clay	M					_
Becoming dark brown, with some organic material.    SPT   17.8							-		SP	SAND: fine to medium g	rained, white.			D				-
SPT 57.8 N*=15  SPT 6,18.7 N*=R  SPT 6,18.7 N*=R  SPT 6,18.7 N*=R  SPT 6,18.7 N*=R  SPT 6,7.8				V	SPT 4 6 10		-				•							
SPT 1,7,8 N°=15  SPT 6,18,R N°=R 4 SP SAND: fine to medium grained, black (coffee rock).  SPT 6,18,R N°=R 7  Becoming brown.  SPT 6,7,R N°=R 7  Borehole BH37 terminated at 7m  method AS auger screwing* N N nil Use undisturbed sample Somm diameter AS auger screwing* M M mud N nil Use undisturbed sample Somm diameter N S soft). Seed on united dissiplication S soft.				_	N*=16		1						W					4
SPT 1,7,8 N°=18  SPT 6,18,R N°=R  SPT 6,7,R N°=R  SPT 6,7,R N°=R  SPT 6,7,R N°=R  AS auger scowing* N N nil N nil U <sub>so</sub> undistutbed sample 50rm diametr AS auger scowing* N N nil U <sub>so</sub> undistutbed sample 50rm diametr Spt N Spt N N N N N N N N N N N N N N N N N N N							-											
SPT 1,7,8 N°=18  SPT 6,18,R N°=R  SPT 6,7,R N°=R  SPT 6,7,R N°=R  SPT 6,7,R N°=R  AS auger scowing* N N nil N nil U <sub>so</sub> undistutbed sample 50rm diametr AS auger scowing* N N nil U <sub>so</sub> undistutbed sample 50rm diametr Spt N Spt N N N N N N N N N N N N N N N N N N N										Becoming dark brown, w	ith some organic ma	aterial			.			
SPT 5,18 4 SP SAND: fine to medium grained, black (coffee rock).  SPT 6,18 R N*=R 4 SP SAND: fine to medium grained, black (coffee rock).  Becoming brown  SPT 5,7 R N*=R 7  Borehole BH37 terminated at 7/m  method AS auger screwing* M mud N nil notes, samples, tests Use undisturbed sample 50mm diameter auger cinting* M mud N nil undisturbed sample 50mm diameter based on unified classification S script Street Script Stre		33333								Becoming dark brown, w	nui some organic me	ichaj,						
1,7.8					CDT		2								.			-
SPT 6,18,R N*=R 4 SP SAND: fine to medium grained, black (coffee rock).  SPT 5,7,R N*=R 6 SAND: fine to medium grained, black (coffee rock).  SPT 5,7,R N*=R 7 Becoming brown.  SPT 6,7,R N*=R 7 Borehole BH37 terminated at 7m  Borehole BH37 terminated at 7m  support M M mud N nil U <sub>N</sub> undisturbed sample 50mm diameter visual support visual support visual support visual support visual visual support visual visual support visual visual support visuali		3333			1,7,8		-											1
SPT 6,18,R N*=R 4 SP SAND: fine to medium grained, black (coffee rock).  SPT 5,7,R N*=R 7  Becoming brown.  SPT 6,7,R N*=R 7  Borehole BH37 terminated at 7m  method AS auger screwing* AD auger criming* Support AD auger criming* C casing Use undisturbed sample 50mm diameter based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold scenario based on unif	1	33333			14 -15	-												
SPT 6,18,R N*=R 4 SP SAND: fine to medium grained, black (coffee rock).  SPT 5,7,R N*=R 7  Becoming brown.  SPT 6,7,R N*=R 7  Borehole BH37 terminated at 7m  method AS auger screwing* AD auger criming* Support AD auger criming* C casing Use undisturbed sample 50mm diameter based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold classification Symbols and sold scenario based on unifold scenario based on unif							2											-
SPT   SPT		3333					3											1
SPT   SPT		888888												:				]
N*=R		33333	$ \  \  $															4
Becoming brown.    SPT   5.7.R   N*=R   7   Borehole BH37 terminated at 7m					6,18,R N*=R		4		SP	SAND: fine to medium g	rained, black (coffee	rock).		VD		TNOURA	ATED SAND	
SPT 5,7,R N*=R 6  SPT 6,7,R N*=R 7  Borehole BH37 terminated at 7m  Borehole BH37 terminated at 7m    SPT 6,7,R N*=R 7																		
SPT 5,7,R N*=R 6  SPT 6,7,R N*=R 7  Borehole BH37 terminated at 7m  Borehole BH37 terminated at 7m    SPT 6,7,R N*=R 7							-											-
SPT 5,7,R N*=R 6  SPT 6,7,R N*=R 7  Borehole BH37 terminated at 7m  Borehole BH37 terminated at 7m    SPT 6,7,R N*=R 7							-											-
method AS auger screwling* AD auger drilling* Support N nil U <sub>so</sub> undisturbed sample 50mm diameter AD auger drilling* C casing U <sub>so</sub> undisturbed sample 63mm diameter U <sub>so</sub> undisturbed sample 63mm diameter based on unified classification S soft							5			Becoming brown.								
method AS auger screwing* AD auger drilling* C casing Use of the consistency idensity index of the consistency identity index of the consisten					5,7,R		-											
SPT 6.7.R N*=R 7  Borehole BH37 terminated at 7m  Borehole BH37 terminated at 7m    Recompleted at 7m   Re					N*=R		-											-
SPT 6.7.R N*=R 7  Borehole BH37 terminated at 7m  Borehole BH37 terminated at 7m  Borehole BH37 terminated at 7m  Consistency/density index soli description  AS auger screwing* M mud N nil Uso undisturbed sample 50mm diameter AD auger drilling* C casing  C casing																		_
method AS auger screwing* M mud N nil Uso undisturbed sample 50mm diameter AD auger drilling* C casing Uso undisturbed sample 63mm diameter based on unified classification S soft							6											-
method AS auger screwing* AD auger drilling* C casing  Borehole BH37 terminated at 7m  Borehole BH37 terminated at 7m  Consistency/density index  VS very soft Uso undisturbed sample 50mm diameter Uso undisturbed sample 63mm diameter Uso undisturbed sample 63mm diameter based on unified classification S soft		333333					-											-
method AS auger screwing* M mud N nil Uso undisturbed sample 50mm diameter AD auger drilling* C casing Uso undisturbed sample 63mm diameter based on unified classification S soft					SOT													
method AS auger screwing* M mud N nil Uso undisturbed sample 50mm diameter AD auger drilling* C casing Uso undisturbed sample 63mm diameter based on unified classification S soft					6,7,R													-
method     support     notes, samples, tests     classification symbols and     consistency/density index       AS     auger screwing*     M mud     N nil     U <sub>50</sub> undisturbed sample 50mm diameter     soll description     VS     very soft       AD     auger drilling*     C casing     U <sub>60</sub> undisturbed sample 63mm diameter     based on unified classification     S     soft	$\vdash$		++	+	11-11	-	$\vdash$			Borehole BH37 terminate	ed at 7m							
method     support     notes, samples, tests     classification symbols and     consistency/density index       AS     auger screwing*     M mud     N nil $U_{so}$ undisturbed sample 50mm diameter     soll description     VS     very soft       AD     auger drilling*     C casing $U_{so}$ undisturbed sample 63mm diameter     based on unified classification     S     soft																		
method     support     notes, samples, tests     classification symbols and     consistency/density index       AS     auger screwing*     M mud     N nil $U_{so}$ undisturbed sample 50mm diameter     soll description     VS     very soft       AD     auger drilling*     C casing $U_{so}$ undisturbed sample 63mm diameter     based on unified classification     S     soft							-											_
method     support     notes, samples, tests     classification symbols and     consistency/density index       AS     auger screwing*     M mud     N nil $U_{so}$ undisturbed sample 50mm diameter     soll description     VS     very soft       AD     auger drilling*     C casing $U_{so}$ undisturbed sample 63mm diameter     based on unified classification     S     soft							8											Ⅎ
AD auger drilling* C casing U <sub>ss</sub> undisturbed sample 63mm diameter based on unified classification S soft				aucer	screwing*		pport	N.	nil		nle 50mm diameter			nbols an	d			
washbore 1 2 3 4 N standard penetration test (SPT) St stiff	ΑĒ	)		auger	drilling*	C	casing		(1))	U <sub>60</sub> undisturbed sam	ple 63mm diameter	based or		classificat	tion	S	soft	
	Rev.			washb	ore	per	2 3 4	o resista		N standard penetra	ation test (SPT)		•				stiff	
CT cable tool N* SPT - sample recovered moisture VSI very stiff ranging to ranging to Nc SPT with solid cone D dry H hard	sue 3	4		hand a	auger		- (	anging to		No SPT with solid co	one	D dr	У			Н	hard	
Ø DT     diatube     water     V     vane shear (kPa)     M     moist     Fb     friable       B     blank bit     ▼ 10/1/98 water level     P     pressuremeter     W     Wet     VL     very loose	5.3 ls B D	ı		blank		wa	10/1/98			P pressuremeter	)	W we	et			VL	very loose	
V V bit	S T			TC bit		<u> </u>			1	E environmental sa	ample					MD	medium dense	j
© *bit shown by suffix	e.e		vn by			-				R refusal								



Borehole No.

BH38

Sheet Project No: 1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started: Date completed: 11.4.2007

11.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

Bor	rehole	e Lo	catio	n: <b>REF</b>	ER	TO F	IGUI	RE 1			(	Checke	ed by:	
drill	model	and	mou	nting: í	MD20				Easting: slope:	-90°			R.	L. Surface: 2.303
	diame				100 m	m	<b></b>		Northing bearing:				da	atum: AHD
dri	illing	info	rma	tion		1	mate		ıbstance	-			1	
method	1 penetration		water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristi colour, secondary and minor component	ts.	moisture condition	consistency/ density index	200 A pocket 300 B penetro-	37
HF		С		SPT 2,2,3	_2			CL	TOPSOIL: Clayey SAND, fine grained, dark gray low plasticity.  Sandy CLAY: medium to high plasticity, grey, fine grained.	ıľ	-Wp			TOPSOIL
				N*=5	_1	1 1		CL	Sandy CLAY: low to medium plasticity, dark br sand fine grained.	own,				
			<u>▼</u>	SPT 4,5,5 N*=10	_0	<u>2</u>		sw	SAND: fine to medium grained, grey.		W	D		
				14 - 10	1	3_								
				SPT 12,18,23 N*=41	2	- - 4 -			Becoming black,					
				SPT 4,8,11 N*=19	3	5								
				SPT	4	6 4						MD		
				4,8,8 N*=16		7								
					5	-			Borehole BH38 terminated at 7m					
AS AD RR W CT HA DT B V T	hod shown I	ai w ca ha di bl V To by su	uger d ller/tri ashbo able to and au atube ank bi bit C bit	re ol iger	M C pe 1	ter 10/1/9	n no resista ranging to refusal 8 water l e shown	evel	notes, samples, tests  U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> 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		ription unified o	classifica		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

Excavation No.

TP39

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

1.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

1.6.2007 RJP

Test pit location:

REFER TO FIGURE 1

Checked by:

Date completed:

*!||*|

equ	ipment	type	and	model: 4	₽WD E	3ackho	е		Pit Orientation:	Easting:	m			R.L	. Surface:	2.77	
exc	avation	dim	ensid	ons: 2	2m lon	ng 0.4	45m wi	de		Northing:	m			dat	um:	AHD	
ех	cavati	ion	info	rmation			mat	erial s	ubstance								
method	ນ penetration ຜ	support	water	notes samples, tests, etc	RL :	depth metres	graphic log	classification symbol	material soil type: plasticity or particle colour, secondary and mind	or components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 pocket 400 meter		structure and itional observation	ons
표		N				_	<b> </b>		TOPSOIL: Sandy Silty CLAY, me dark grey, sand fine to medium gr	dium plasticity, rained.		M			TOPSOIL	Root affected.	_
					_2.5	0.5		СН	CLAY: high plasticity, grey-brown mottled, some sand.	and orange		>Wp	St				-
				D										X			_
					_2.0					- <del></del>							-
						1. <u>0</u>		СН	CLAY: high plasticity, grey-grey-b orange mottled with a trace of sar grained.	rown, some nd fine to mediun	m			×			
				D		-											-
					_1.5	-			SAND: fine to medium grained, w			w			Oit selfens	dan balaw didan	
			•	D		1. <u>5</u> -		SP	grey-brown.	nite / light		VV			odour.	sing below 1.4m,	organic 
					_1.0	_			Moderate groundwater inflow belo Test pit TP39 terminated at 1.7m	w 1.4m,							_
	december of the second					2. <u>0</u>											_
					0.5	_ _ 								4)-41-41-41-41-41-41-41-41-41-41-41-41-41-			-
						2.5											

	method		support	notes, s	amples, tests	class	sification symbols and	consisten	cy/density index	Т
	N	natural exposure	S shoring N nil	Uso	undisturbed sample 50mm diameter	soil	description	VS	very soft	
	X	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft	
Ņ	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm	
Ó	В	bulldozer blade	1234	V	vane shear (kPa)			St	stiff	
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff	
Š	E	excavator	refusal	E	environmental sample	D	dry	Н	hard	
2			water	R	refusal	M	moist	Fb	friable	
'n			water level			W	wet	VL	very loose	
Ś			- on date shown			Wp	plastic limit	L	loose	
J						$W_L$	liquid limit	MD	medium dense	
ΞI			water inflow					D	dense	
٦l			— water outflow	I				VO	veni dense	

Excavation No.

TP40

1 of 1

Sheet

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

1.6.2007

1.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS.ogged by:

RJP

Test pit location:

REFER TO FIGURE 1

Checked by:

Date completed:

ednibitient tyl	pe a	nd model:	4WD E	Backho	е		Pit Orientation:	Easting:	m			R	L. Surface: 2.	59	
excavation di	mer	sions:	2m lon	g 0.4	45m wi	de		Northing:	m			da	itum: Al	HD	
excavatio	n in	formation			mat	erial s	ubstance								
method  7  8  9  9  10  10  10  10  10  10  10  10	lodding	notes samples, tests, etc		depth netres	graphic log	classification symbol	materia soil type: plasticity or parti colour, secondary and m	icle characteristics, inor components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 poperetro-	3	cture and observations	
H	1		_2.5	-	****		TOPSOIL: Silty Sandy CLAY, r dark grey, sand fine to medium			>Wp			TOPSOIL Root	affected.	-
				0.5		CI	Sandy CLAY: medium plasticit orange mottled, sand fine to m	y, grey-brown and edium grained.			St				-
		D	_2.0				Becoming grey-brown and san Sandy CLAY / Clayey SAND.	id content încreasinț	g to			X			-
		D	_1.5	1. <u>0</u>		SP	SAND: fine to medium grained	, grey-brown with		w		**************************************			-
	<b>&gt;</b>	D	_1.0	1. <u>5</u>		SP	SAND: fine to medium grained	, light grey-brown.					Rapid groundwa 1.4m. Organic c	ater inflow below dour.	
							Pit collapsing below 1.1m. Test pit TP40 terminated at 1.7	²m						<u> </u>	
			_0.5	2. <u>0</u> -								APPAYA PAPANA ANTINONA AA AM A PANIMANIY AA A			-
				2.5				_							

2	v	۵	ŧ,	_	h	

ı									
ı	method		support	notes, s	amples, tests	clas	sification symbols and	consisten	cy/density index
	N	natural exposure	Sishoring Ninil	U <sub>50</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
ı	Χ	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
į	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
Ģ	В	bulldozer blade	1234	٧	vane shear (kPa)			St	stiff
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
3	E	excavator	refusa	E	environmental sample	D	dry	Н	hard
8			water	R	refusal	М	moist	Fb	friable
4			water level			W	wet	VL	very loose
śl			on date shown			Wp	plastic limit	L	loose
j			1			W <sub>L</sub>	liquid limit	MD	medium dense
ĺ			water inflow					D	dense
5			water outflow					VD	very dense

**TP41** 

1 of 1

Sheet Project No:

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Excavation No.

1.6.2007

Principal:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS...ogged by:

1.6.2007 RJP

Project:
Test pit location:

REFER TO FIGURE 1

Checked by:

Date completed:

////

equipment ty	pe an	d model:	4WD I	3ackho	е		Pit Orientation:	Easting:	m			R.I	Surface:	3.63	
excavation di	mens	ions:	2m lor	ng 0.4	5m wi	de		Northing:	m			da	tum:	AHD	ı
excavatio	n info	ormation			mat	erial s	ubstance								
method 1 2 penetration	support	notes samples, tests, etc	RL	depth metres:	graphic log	classification symbol	material soil type: plasticity or partic colour, secondary and mit	or components.		moisture condition	consistency/ density index	100 pocket 200 penetro- 300 meter		structure and itional observations	
BH	1		_3.5	-	\{\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		TOPSOIL: Sandy CLAY, mediur grey-brown, sand fine to mediur	n plasticity, n grained.		М		THE STREET WEST AND THE STREET	TOPSOIL	Root affected.	_
		D	3.0	0. <u>5</u>		CI	Sandy CLAY: medium plasticity and orange mottled, sand fine to	, light grey-brown o medium grained.		>Wp	St	1000 1000 1000 1000 1000 1000 1000 100			
			_5.5	 - 1.0			Becoming light grey-light grey-b mottled.	rown and orange				**************************************			- - -
		D	2.5	1. <u>9</u> 			Sand content increasing light gr mottled.	ey-brown and orar	nge						-
		D	_2.0	1. <u>5</u>		SP	SAND: fine to medium grained, some orange mottled, cemented	ight grey-brown 1.		M		NAME - NA			- - - - -
	•		_1.5	2. <u>0</u> -		SP	SAND: fine to medium grained,	white-light		W				undwater inflow below	-
		D		2.5			grey-brown.							ganic odour.	

Sketch

Test pit TP41 terminated at 2.5m

Form GEO 5.2 Issue 3 Rev.2

ᆫ									
Γ	method		support	notes, s	amples, tests	clas	sification symbols and	consister	cy/density index
ı	N	natural exposure	S shoring N nil	$U_{so}$	undisturbed sample 50mm diameter	soil	description	VS	very soft
ı	X	existing excavation		Ues	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
ų.	BH	backhoe bucket	penetration	0	disturbed sample	syste	em	F	firm
او	В	bulldozer blade	1234	٧	vane shear (kPa)			St	stiff
5	R	ripper	no resistance ranging to	8s	bulk sample	mois	sture	VSt	very stiff
3	E	excavator	refusal €	Ε	environmental sample	D	dry	Н	hard
3			water	R	refusal	М	moist	Fb	friable
ž.			■ water level			W	wet	VL	very loose
ál.			on date shown			Wp	plastic limit	L	loose
4						W <sub>L</sub>	liquid limit	MD	medium dense
έŀ			water inflow			_	•	Ð	dense
3 l			water outflow			1		VO	very dence

Excavation No.

TP42

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

1.6.2007

Principal:

Date completed:

1.6.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

RJP

Test pit location:

REFER TO FIGURE 1

Checked by:

IAAA	
M	
DII N	
# 13 # "	

equipmen	nt typ	e and	model:	4WD i	Backho	е		Pit Orientation:	Easting:	m			R.L	. Surface:	2.82
excavatio	on din	ensi	ons:	2m lor	ng 0.4	45m wi	de		Northing:	m			datı	ım:	AHD
excava	ation	info	rmation			mat	erial s	ubstance							
method 1 N penetration	3 3	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	materia soil type: plasticity or parti colour, secondary and m	cle characteristics, inor components.		moisture condition	consistency/ density index	100 pocket 200 penetro- 300 mmeter		structure and tional observations
нв			D D	2.5	0. <u>5</u>		CI SP	TOPSOIL: Silty Sandy CLAY, loplasticity, sand fine to medium grey-brown.  Sandy CLAY: medium plasticity orange mottled, sand fine to medium plasticity orange mottled, sand fine to medium plasticity some orange mottled, sand fine sand content increasing.  SAND: fine to medium grained, Becoming grey-grey-brown, with	grained, dark  y, grey-brown and edium grained.  y, grey-grey-brown e to medium grained  white.		>Wp	St			Root affected. water inflow below 1.1m
	THE TAXABLE PROPERTY OF THE PR			_1.0	2.0	<u> </u>		Test pit TP42 terminated at 1.7	m						

	method	support	no	otes, sa	mples, tests	class	ification symbols and	consisten	cy/density index
	N natural ex	posure S shoring	N nil U	J <sub>so</sub>	undisturbed sample 50mm diameter	soil	descriptioл	vs	very soft
	X existing e	cavation	. U	J <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
į	BH backhoe i		D	)	disturbed sample	syste	·m	F	firm
,	B bulldozer	blade 1234	V	,	vane shear (kPa)			St	stiff
5	R ripper	no re rangi	sistance no to Bs	s	bulk sample	mois	ture	VSt	very stiff
3	E excavator	refus	aĭ E		environmental sample	O	dry	н	hard
ś		water	R		refusal	M	moist	Fb	friable
!		water level				W	wet	VL	very loose
í		on date sh	own			Wp	plastic limit	L	loose
,						W <sub>L</sub>	liquid limit	MD	medium dense
		water inflo	<b>~</b>					D	dense
š			ow					VD	very dense

Excavation No.

TP43

Sheet

1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

1.6.2007

Principal:

Date completed: RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

1.6.2007

Project:
Test pit location:

REFER TO FIGURE 1

Checked by:

RJP

equ	ipment	t type	and	model: 4	4WD E	3ackho	е		Pit Orientation:	Easting:	m			R,L	. Surface:	4.75
exc	avation	n dim	ensid	ons: 2	2m lor	ng 0.4	45m wi	de		Northing:	m			dat	um:	AHD
ex	cavat	ion	info	rmation			mat	erial s	ubstance							
method	ນ penetration ຜ	support	water	notes samples, tests, etc	RL I	depth metres	graphic log	classification symbol	material soil type: plasticity or partic colour, secondary and mir	or components.		moisture condition	consistency/ density index	100 pocket 200 penetro- 300 m meter		structure and itional observations
Н8		Z		D	_4.5	0. <u>5</u>		SP	SAND: fine to medium grained,  Becoming light grey-brown.  SAND: fine to medium grained, orange mottled, trace to some of	grey-brown and ay.		М			AEOLIAN	I Root affected to 0.15m.
			•	D	_3.0	-		SP	SAND: fine to medium grained, some weakly cemented nodules	ight grey-brown, , grey-brown.		w			Very slow	water inflow below 1.7m.
					_2.5	2. <u>0</u> -			Test pit TP43 terminated at 1.85	m						_
						2.5										

method		support	notes,	samples, tests	clas	sification symbols and	consister	cy/density index
N	natural exposure	S shoring N nil	U <sub>50</sub>	undisturbed sample 50mm diameter	soli	description	vs	very soft
Х	existing excavation		Ues	undisturbed sample 63mm diameter	bas	ed on unified classification	S	soft
BH	backhoe bucket	penetration	D	disturbed sample	syst	em	F	firm
В	bulldozer biade	1234	V	vane shear (kPa)			St	stiff
R	ripper	no resistance ranging to	Bs	bulk sample	moi	sture	VSt	very stiff
E	excavator	refusal	E	environmental sample	D	dry	H	hard
		water	R	refusal	М	moist	Fb	friable
		water level			W	wet	VL	very loose
Ì		on date shown	1	:	Wp	plastic limit	L	loose
		1.			W <sub>L</sub>	liquid limit	MD	medium dense
		water inflow					D	dense
ł		→ water outflow	1				VD	very dense

TP44

1 of 1

Sheet Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

1.6.2007 1.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

RJP

Test pit location:

REFER TO FIGURE 1

Checked by:

equ	ipment	type	and	model: 4	4WD E	Backho	e		Pit Orientation: Easting:	m			R.L	. Surface:	4.46	
exc	avation	dim	ensic	ons: 2	2m Ion	ig 0.4	45m wi		Northing:	m			date	um:	AHD	
ex	cavati	on	info	rmation			mat	erial s	ubstance							
method	2 penetration	support	water	notes samples, tests, etc	RL I	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		molsture condition	consistency/ density index	100 pocket 200 pocket 300 pocket 400 meter	addi	structure and tional observat	
ВН		N		D	_4.0	0. <u>5</u>		SP	SAND: fine to medium grained, dark grey-brown.  Becoming light grey-brown.		М			AEOLIAN	Root affected t	o 0.3m. -
			None Observed		_3.5	- - 1.0		SP	SAND: fine to medium grained, dark brown, some silt / Silty SAND.					INDURATI	ED SAND	
			Z	D												-
				D	_3.0	1. <u>5</u> -			Becoming cleaner and less cemented, brown.				A A ANDRON OPPERATOR AND AND AND AND AND AND AND AND AND AND			-
					_2.5	2. <u>0</u>			Test pit TP44 terminated at 1.8m							-
					_2.0	2.5							STATE OF THE STATE			

ı				_	_				
Ì	method		support	notes, s	amples, tests	class	ification symbols and	consister	cy/density index
ı	N	natural exposure	S shoring N nil	U <sub>50</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
ı	Х	existing excavation	1	U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
ł	BH	backhoe bucket	penetration	D	disturbed sample	syste	:m	F	firm
į	В	bulldozer blade	1 2 3 4	ν	vane shear (kPa)			. St	stiff
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	ture	∨St	very stiff
3	E	excavator	ranging to	E	environmental sample	D	dry	Н	hard
3			water	R	refusal	M	moist	Fb	friable
4			water level	l		W	wet	VL	very loose
3			on date shown	l		Wp	plastic limit	L	loose
ĺ				l		W.	liquid limit	MD	medium dense
1			water inflow	I		_	•	D	dense
5			→ water outflow	l				VD	very dense



Borehole No. **BH45** 

Sheet

1 of 2 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

5.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

RJP

5.6.2007

	•	

Bor	rehole	Lo	catio	n: <i>REF</i>	ER	TO F	IGUI	RE 1			(	Checke	ed by:	M
drill	model a	and	mou	nting:					Easting: slope:	: -90°	,	•	R.ŧ	. Surface: 3,20
	e diame				mm				Northing bearing	ıg:			dat	tum; AHD
dri	illing i	nfo	rma	tion	1		mate		ibstance		-			
method	2 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characte colour, secondary and minor compor	nents.	moisture condition	consistency/ density index	200 A pocket 300 B penetro- 400 meter	
노		С			_3			SP	SAND: fine to medium grained, grey-brown		M	D		AEOLIAN SAND
				SPT 2,5,7 N*=12	_2	1 2			Becoming light grey-brown.					-
			▼	SPT 5,6,8 N*≕14	_1	3			Secoming dark grey-brown.		w			
					_0	- - 4								_
				SPT 3,15,21 N*=36	1	5 -		SP	SAND: fine to coarse grained, dark brown, gravel fine grained and silt.	race of		VD		-
			_	SPT 9,21,20 N*=41	3	6			With a trace fine grained gravel.					20 blows for 100mm penetration.
				SPT 8,18,21 N*=39	4	7			Becoming fine to medium grained, light brobrown.	wn and				21 blows for 100mm penetration.
meth AS AD RR W CT HA DT B V T *bit s e.g.	hod shown by	rol wa ca ha dia bla V I	ger di ler/tric shboi ble toi nd au atube ank bil bit bit	one e ol ger	M C per	- "	o resistar anging to efusal I water k e shown		notes, samples, tests  U <sub>so</sub> undisturbed sample 50mm diameter undisturbed sample 63mm diameter disturbed sample 63mm diameter disturbed sample 63mm diameter disturbed sample 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	soil desibased or system  moisture D dr M m W we Wp pl	n unified c			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 No.

BH45

2 of 2 Sheet GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

5.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

RJP

5.6.2007

				on: <b>REF</b>	ER	TO F	IGUI	RE 1				Checke	ed by			
	nodei		mou	-					Easting:	slope: -90	•			R.L.	Surface: 3.20	
	diame				mm				Northing	bearing:				datu	m: AHD	
nethod	ing benefication 3	upport		notes samples, tests, etc	RL	depth metres	aphic log	classification symbol	materi soil type: plasticity or pan colour, secondary and r	ticle characteristics,	moisture condition	consistency/ density index	200 × pocket	а	structur additional ob	
		С		SPT 5,13,17 N*=30	5			SP	SAND: fine to coarse grained, gravel fine grained and silt. (co		W	D				
					-6	09										
000000000000000000000000000000000000000				SPT 1,6,15 N*≔21	7	10			Borehole BH45 terminated at	10.45m						
			ϗ		8	1 <u>1</u>										
			Collapsed back to 2.3ml		9	1 <u>2</u>	-									
			Colla		10	1 <u>3</u>										
					11	1 <u>4</u> -										
					12	1 <u>5</u>										
etho	od	au	iger se	crewing*		16 pport	N	nil	notes, samples, tests U <sub>50</sub> undisturbed sample 50		cation syr	nbois an	d		consistency/densi VS ver	ty index / soft
		au rol wa ca ha dia bla V	ger di ler/trid shboi ble to ind au stube ank bil	rilling* cone re ol iger	C per	casing netration 2, 3, 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	n resista anging to efusal 3 water I	level	Uss undisturbed sample 63 D disturbed sample N standard penetration to N* SPT - sample recovere Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample	ast (SPT) ast (MPT) ast (M	on unified o	dassifical	ion		S soft F firm St stiff VSI ver H har Fb frial VL ver L loos	y stiff d ole y loose



BH46

Sheet Project No: 1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Borehole No.

6.6.2007

6.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

RJP

				n: REF	ER	TO F	IGUI	RE 1		0.00	(	Check			M
	nodei		moui	_					·	90°					Surface: 1.07
	diame Iling i		rmai		mm		mate	rial e	Northing bearing:					datu	m: AHD
method	2 penetration	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.	en follow	condition	consistency/ density index	100 pocket	a	structure and additional observations
#		С		SPT 3,2,2 N*=4 SPT 7,12,14 N*=26	_0	1 2		SP	TOPSOIL: Sandy CLAY / Clayey SAND, low plasticity, dark grey, sand fine to medium grained, some silt.  SAND: fine to medium grained, grey-brown.  Becoming light grey-brown.  SAND: fine to medium grained, dark brown, trace silt.		w	MD		9 4	TOPSOIL
				SPT 5,16,23 N*=39	2 3	3 4 5 1		SP	SAND: fine to medium grained, some clay, brown and dark brown, trace fine grained gravel.						
				SPT 2,9,18 N*=27	5 6	6 		SP	SAND: fine to medium grained, light brown.  Becoming fine to coarse grained, trace fine grained gravel, light grey-brown.						
				N*=28					Borehole BH46 terminated at 7.45m						,, <u>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>
meth AS AD RR W CT HA DT B V T *bit sl e.g.	od hown by	roll wa cal ha: dia bla V &	ger dr ler/tric shbor ole too nd au itube ink bit oit bit	one e ol ger	M C per	ter	o resistar anging to efusal 3 water k e shown		U <sub>so</sub> undisturbed sample 50mm diameter <b>soil o</b>	descrip d on un m	tion ified o	nbols an			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

**Results of Laboratory Testing** 



### **ALS Environmental**

		CERTII	CERTIFICATE OF ANALYSIS			
Client	: COFFEY GEOTECHNICS	Laboratory	: Environmental Division Brisbane	Page	: 1 of 10	
Contact	: MR ROB PEARCE	Contact	: Tim Kilmister	Work Order	: FB0704186	
Address	7 13 MANGROVE ROAD SANDGATE NSW AUSTRALIA 2304	Address	: 32 Shand Street Stafford QLD Australia 4053			
E-mail	: robert_pearce@coffey.com.au	E-mail	∴ Services.Brisbane@alsenviro.com			
Telephone	. 49676377	Telephone	: 61-7-3243 7222			
Facsimile	: 49675402	Facsimile	: 61-7-3243 7259			
Project	: GEOTSGTE 20248AA	Quote number	: EN/007/07	Date received	: 17 Apr 2007	
Order number	: 2524			Date issued	: 8 May 2007	
C-O-C number	: 0361-0362			No. of samples	- Received	
Site	: - Not provided -				Analysed	19

### ALSE - Excellence in Analytical Testing

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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	Position	Department
Lea-Ellen Catt	Laboratory Technician - Acid Sulphate	Inorganics - NATA 825 (818 - Brisbane)
	Soils	



Page Number : 2 of 10
Client : COFFEY GEOTECHNICS
Work Order : EB0704186

Comments

This report for the ALSE reference EB0704186 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.

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 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 Recoveries.

Specific comments for Work Order EB0704186

Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. Conversion to liming rate in kg/m3 = kg/t x wet bulk density in t/m3. Excess ANC not required because pH OX less than 6.5.



Client : COFFEY GEOTECHNICS Work Order : EB0704186	OTECHNICS					•	ALS: Enulraryment
Analytical Results	Samı	Client Sample ID: Sample Matrix Type / Description: Sample Date / Time:	BH36.0.5-1.0 SOIL 11 Apr 2007	BH36 3.54.0 SOIL 11 Apr 2007	BH37/5.0-5.5 SOIL 11 Apr 2007	BH37.6.5-7.0 SOIL 11 Apr 2007	BH38 0.5-1.0 SOIL 11 Apr 2007
		Laboratory Sample ID :	15:00	15:00	15:00		15:00
Analyte	CAS number	LOR Units	EB0704186-001	EB0704186-002	EB0704186-003	EB0704186-004	EB0704186-005
EA029-A: pH Measurements							
pH KCI (23A)		0.1 pH Unit	4.6	5.2	4.5	4.6	4.2
pH OX (23B)		0.1 pH Unit	4.2	3.8	2.7	2.7	4.1
EA029-B: Acidity Trail							
Titratable Actual Acidity (23F)		2 mole H+/t	26	-	37	a the Body Body Body and a companies of the companies of the same of the companies of the c	108
Titratable Peroxide Acidity (23G)			28	19	120	118	137
Titratable Sulfidic Acidity (23H)		2 mole H+ / t	<2	8	83	7.7	29
surraic - Inratable Actual Acidity (s-23F)		0.02 % pyrite S	0.04	<0.02	90'0	90'0	0.17
sulfidic - Titratable Peroxide Acidity (s-23G)		0.02 % pyrite S	0.04	0.03	0.19	0,19	0.22
sulfidic - Titratable Sulfidic Acidity (s-23H)		0.02 % pyrite S	<0.02	<0.02	0.13	0,12	0.05
EA029-C: Sulfur Trail							
KCI Extractable Sulfur (23Ce)		0.02 % S	<0.02	<0.02	<0.02		<0.02
Peroxide Sulfur (23De)		0.02 % S	<0.02	<0.02	0.09	0.10	0.04
Peroxide Oxidisable Sulfur (23E)		0.02 % S	<0.02	<0.02	0.09	0.10	0.04
acidity - Peroxide Oxidisable Sulfur		10 mole H+/t	<10	<10	56	63	25
(a-23E)							
EAUZ9-D: Calcium Values	ANTICOLOGICA CONTRACTOR CONTRACTO	TATA AND THE REPORT OF THE PARTY OF THE PART					
KCI Extractable Calcium (23Vh)		0.02 % Ca	0.02	<0.02	<0.02	<0.02	<0.02
retoxide Calcium (23VVn)		0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)		0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
suffice - Acid Reacted Calcium (s-23X)		1/+H alone Ut	015	<10	000	<10	<10
EA029-F: Magnesium Values	The state of the s	0.02 70.0	20,02	<b>50,02</b>	20.02	Z0.0Z	CO.OZ
KCI Extractable Magnesium (23Sm)		0.02 % Mg	0.02	<0.02	<0.02	<0.02	0.04
Peroxide Magnesium (23Tm)			<0.02	<0.02	<0.02	<0.02	0.04
Acid Reacted Magnesium (23U)		0.02 % Mg	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Magnesium (a-23U)		10 mole H+ / t	<10	<10	<10	<10	× 410
sulfidic - Acid Reacted Magnesium (s-23U)		0.02 % S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-G: Retained Acidity							
Net Acid Soluble Sulfur (20Je)	Prototo and American Control of C	0.02 % S			-		0.03
acidity - Net Acid Soluble Sulfur (a-20J)		10 mole H+/t	******			passage	14
sulfidic - Net Acid Soluble Sulfur (s-20J)		0.02 % pyrite S	*****	***************************************	Bases and the second se	The state of the s	0.02
HCI Extractable Sulfur (20Be)		0.02 % S		1	*******	breadon)	0.03

: 4 of 10 : COFFEY GEOTECHNICS : EB0704186 Page Number Client Work Order

Analytical Docults		Client	Client Sample ID :	BH36 0.5-1.0	BH36 3.5-4.0	BH37.5.0-5.5	BH37,6,5-7,0	BH38 0,6-1,0
Alialytical Nesults	Sampl	Sample Matrix Type / Description :	Description :	SOIL	SOIL	SOIL	SOIL	TIOS
		Sample	Date / Time :	11 Apr 2007				
			•••	15:00	15:00	15:00	15:00	15:00
		Laboratory	Laboratory Sample ID:					
Analyte	CAS number	LOR	Units	EB0704186-001	EB0704186-002	EB0704186-003	EB0704186-004	EB0704186-005
EA029-H: 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		0.04	<0.02	0.15	0.17	0.24
Net Acidity (acidity units)		10 mole H+/t	e H+/t	26	11	93	104	147
Liming Rate		1 kg (	1 kg CaCO3/t	2	<1	7	8	41



: 5 of 10 : COFFEY GEOTECHNICS : EB0704186 Page Number Client Work Order

Cilent COFFEY GEOTECHNICS Work Order : EB0704186	ECHNICS					ALS Enutronmental
Analytical Results	Client Sample ID: Sample ID: Sample Matrix Type / Description: Sample Date / Time: Laboratory Sample ID:	BH38- <b>6.5-7.0</b> SOIL 11 Apr 2007 15:00	T <b>TP34 (.0-1</b> :1 SOIL 5 Apr 2007 15:00	TP33.1.1.1.2 SOIL 5 Apr 2007 15:00	TP32.1.6-1;7 SOIL 5 Apr 2007 15:00	TP30 (15-116 SOIL 5 Apr 2007 15:00
Analyte	CAS number LOR Units	EB0704186-006	EB0704186-007	EB0704186-008	EB0704186-009	EB0704186-010
EA029-A: pH Measurements	-		And the second s			The state of the s
pH KCI (23A)	0.1 pH Unit	5.2	4,9	5.7	5,0	5.0
pH OX (23B)	0.1 pH Unit	4.2	2.8	3.0	2,8	3.5
EA029-B: Acidity Trail						
Titratable Actual Acidity (23F)	2 mole H+/t	=	15	~	7	<b>—</b>
Titratable Peroxide Acidity (23G)	2 mole H+/t	17	66	42	55	99
Titratable Sulfidic Acidity (23H)	2 mole H+/t	9	84	40	47	45
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	0.02	<0.02	<0.02	<0.02
sulfidic - Titratable Peroxide Acidity (s-23G)	0.02 % pyrite S	0.03	0.16	0.07	60.0	0.09
sulfidic - Titratable Sulfidic Acidity (s-23H)	0.02 % pyrite S	<0.02	0.13	0,06	0.08	0.07
EA029-C: Sulfur Trail						
KCI Extractable Sulfur (23Ce)	0.02 % S	<0.02	0.04	<0.02	<0.02	<0.02
Peroxide Sulfur (23De)	0.02 % S	<0.02	0.21	0,12	0,12	0.08
Peroxide Oxidisable Sulfur (23E)	0.02 % S	<0,02	0.16	0.12	0,12	80'0
acidity - Peroxide Oxidisable Sulfur (a-23E)	10 mole H+ / t	<10	102	75	92	47
EA029-D; Calcium Values						
KCI Extractable Calcium (23Vh)	0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Calcium (23Wh)	0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)	0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Calcium (a-23X)	10 mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	0.02 % S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-E: Magnesium Values						
KCI Extractable Magnesium (23Sm)	0.02 % Mg	<0.02	0.03	<0.02	<0.02	<0.02
Peroxide Magnesium (23Tm)	0.02 % Mg	<0.02	0.03	0.02	<0.02	<0.02
Acid Reacted Magnesium (23U)	0,02 % Mg	<0.02	<0.02	0.02	<0.02	<0.02
acidity - Acid Reacted Magnesium (a-23U)	10 mole H+/t	<10	<10	18	<10	۷10
sulfidic - Acid Reacted Magnesium (s-23U)	0.02 % S	<0.02	<0.02	0.03	<0.02	<0.02
EA029-H: 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	0.19	0.12	0.13	0.09
Net Acidity (acidity units)	. 10 mole H+ / t	11	117	77	84	58
Liming Rate	1 kg CaCO3/t	₹	6	9	9	4



VOIA CIGE! . EBU/04186					7	ALS Entificational
Analytical Results	Client Sample ID: Sample Matrix Type / Description: Sample Date / Time;	TP28 0:6-0.7 SOIL 5 5 47007	TP27 11/11/2 SOIL 5 Apr 2007	TP261:5-1:6 SOIL 5 Apr 2007	TP25 1.9-2.0 SOIL 5 Apr 2007	TP19.0.5.0.6 SOIL 5 Apr 2007
	Laboratory Sample ID :	00:61	19:00	15:00	15:00	15:00
Analyte	CAS number LOR Units	EB0704186-011	EB0704186-012	EB0704186-013	EB0704186-014	EB0704186-015
EA029-A: pH Measurements			The state of the second state of the second state of the second s			
pH KCl (23A)	0.1 pH Unit	4.4	5.0	5.4	4,3	4.5
рн ОХ (23В)	0.1 pH Unit	3.1	2.8	3.3	2.2	3,6
EA029-B: Acidity Trail						
Titratable Demoids Addits (23F)	Z mole H+/t	53	21			36
Titratable Sulfidic Acidity (23H)	1/+H alom 2	40	33	197	53	98
sulfidic - Titratable Actual Acidity (s-23F)	١.,	90.0	0.03	<0.02	20.0	90.0
sulfidic - Titratable Peroxide Acidity (s-23G)	0.02 % pyrite S	0.15	0.05	0.32	0.08	0.15
sulfidic - Titratable Sulfidic Acidity (s-23H)	0.02 % pyrite S	0.06	<0.02	0:30	<0.02	0.09
EA029-C: Sulfur Trail						
KCI Extractable Sulfur (23Ce)	0.02 % 8	<0.02	<0,02			<pre></pre>
Peroxide Sulfur (23De)	0.02 % S	<0.02	<0,02	<0.02	0,05	0.02
Peroxide Oxidisable Sulfur (23E)	0.02 % S	<0.02	<0.02	<0.02	0.05	0.02
acidity - Peroxide Oxidisable Sulfur (a-23F)	10 mole H+ / t	<10	<10	<10	30	13
EA029-D: Calcium Values						
KCI Extractable Calcium (23Vh)	0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Calcium (23Wh)	0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)	0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Calcium (a-23X)	10 mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	0.02 % 8	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-E: Magnesium Values KCI Extractable Magnesium (23Sm)		0.00	< 0.00	<		
Peroxide Magnesium (23Tm)	0.02 % Mg	<0.02	<0.02	<0.02	<0.02	0.02
Acid Reacted Magnesium (23U)	0.02 % Mg	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Magnesium (a-23U)	10 mole H+ / t	<10	×10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	0.02 % S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-G: Retained Acidity						
Net Acid Soluble Sulfur (20Je)		<0.02	-	Management .	<0.02	
acidity - Net Acid Soluble Sulfur (a-20J)		<10			<10	
sulfidic - Net Acid Soluble Sulfur (s-20J)	0.02 % pyrite S	<0.02	PARAGE.	******	<0.02	

Page Number Client Work Order	: 7 of 10 : COFFEY GEOTECHNICS : EB0704186	ECHNICS			·			ALS Environmental
Analytical Results	esults	Sample	Client Sample ID: Sample Matrix Type / Description : Sample Date / Time : Laboratory Sample ID :	TP28'0.6-0.7 SOIL 5 Apr 2007 15:00	TP27 1/1/1/2 SOIL 5 Apr 2007 15:00	TP261,5-1:6 SOIL 5 Apr 2007 15:00	TP25,1:9-2.0. SOIL 5 Apr 2007 15:00	TP19.0.5.0.6 SOIL 5 Apr 2007 15:00
Analyte		CAS number	LOR Units	EB0704186-011	EB0704186-012	EB0704186-013	EB0704186-014	EB0704186-015
EA029-H: Acid Base Accounting								
ANC Fineness Factor			0.5	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	its)		0.02 % S	0.08	0.03	<0.02	0.12	0.08
Net Acidity (acidity units)	nits)		10 mole H+/t	53	21	<10	76	49
Liming Rate			1 kg CaCO3/t	4	2	۲۶	9	4



Page Number : 8 of 10							
Client : COFFEY GE Work Order : EB0704186	COFFEY GEOTECHNICS						(ALS)
cal Re		Client Sample ID : Sample Matrix Type / Description : Sample Date / Time :	TP14.0.6-0.7 SOIL 5 Apr 2007 15:00	TP6.2:0-2:1 SOIL 5 Apr 2007 15:00	BH37.0.5-1.0 SOIL (5 Apr 2007) (15:00)	BH37.2.0-2.5 SOIL (5 Apr 2007) (15:00)	
Analyte	CAS number	LOR Inits	EB0704186-016	EB0704186-017	EB0704186-018	FR0704186.019	
EA029-A: pH Measurements							
pH KCI (23A)	The transfer of the transfer o	0.1 pH Unit	4.1	4,9	5.1	5.0	
pH OX (23B)		0.1 pH Unit	4.1	3.9	4.1	3.2	
EA029-B: Acidity Trail							
Titratable Actual Acidity (23F)		2 mole H+/t		16	1	24	
Titratable Peroxide Acidity (23G)	(1)		22	15	102	102	
Titratable Sulfidic Acidity (23H)		1	42	<2	88	78	
sulfidic - Titratable Actual Acidity	Ŋ.	0.02 % pyrite S	0.11	0.02	0.02	0.04	
(S-20F)	, in the second						
(s-23G)	iaity	0.02 % pyrite s	40.0	0.02	0.16	0.16	
sulfidio - Titratable Sulfidic Acidity (s-23H)	ity	0.02 % pyrite S	<0,02	<0.02	0.14	0.12	
EA029-C: Sulfur Trail							
KCI Extractable Sulfur (23Ce)		8% 200	700	0000		-	
Peroxide Sulfur (23De)	The state of the s		0.06	\$0.05 \$0.05	20.02	20.02	
Peroxide Oxidisable Sulfur (23E)	(;	0.02 % \$	<0.02	<0.02	<0.02	0.03	
acidity - Peroxide Oxidisable Sulfur	ılfur	10 mole H+ / t	10	<10	<10	21	
EA029-D: Calcium Values						a source of the control of the contr	選出の記憶を表現の記憶をある。 マー・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・
KOI Extractable Calcium (23Vh)		0.02 % Сэ	1 50 02	6007	000		
Peroxide Calcium (23Wh)		0.02 % Ca	<0.02	<0.02	<0.02	<0.02 <0.02	
Acid Reacted Calcium (23X)		0.02 % Ca	<0.02	<0.02	<0.02	<0.02	
acidity - Acid Reacted Calcium (a-23X)	(a-23X)	10 mole H+ / t	<10	<10	<10	<10	
sulfidic - Acid Reacted Calcium (s-23X)	(s-23X)	0.02 % S	<0.02	<0.02	<0.02	<0.02	
EA029-E: Magnesium Values	Ş						
KCI Extractable Magnesium (23Sm)	SSm)	0.02 % Mg	0.08	<0.02	<0.02	<0.02	
Peroxide Magnesium (23Tm)		0.02 % Mg	60'0	<0.02	<0.02	<0.02	
Acid Reacted Magnesium (23U)	)	0.02 % Mg	<0.02	<0.02	<0.02	<0.02	
acidity - Acid Reacted Magnesium (a-23U)	E.B.	10 mole H+ / t	12	<10	<10	<10	
sulfidic - Acid Reacted Magnesium (s-23U)	ım	0.02 % S	<0.02	<0.02	<0.02	<0.02	
EA029-G: Retained Acidity				新の大学を表現している。 1000年の大学の大学の大学の大学の大学の大学の大学の大学の大学の大学の大学の大学の大学の			
Net Acid Soluble Sulfur (20Je)		0.02 % S	<0.02				
acidity - Net Acid Soluble Suffur (a-20J)	r (a-20J)	10 mole H+ / t	<10	***************************************		-	
sulfidic - Net Acid Soluble Sulfur (s-20J)	<b>-</b>	0.02 % pyrite S	<0.02	ikaman	Planning	***************************************	
HCI Extractable Sulfur (20Be)		0.02 % S	0.05	· ·			



ALS: Enulranmental BH37 2.0-2.5 SOIL ( 5 Apr 2007 ) ( 15:00 ) EB0704186-019 1.5 0.07 44 3 BH37 0.5-10 SOIL (5 Apr 2007) (15:00) EB0704186-018 1.5 EB0704186-017 TP6.2.0-2.1 SOIL 5 Apr 2007 15:00 1.5 EB0704186-016 TP14.0.6-0.7 SOIL 5 Apr 2007 15:00 0.14 84 84 Laboratory Sample ID: Client Sample ID : Sample Matrix Type / Description : Sample Date / Time : 0.5 0.02 % S 10 mole H+ / t Units LOR CAS number : EB0704186 EA029-H: Acid Base Accounting Analytical Results Net Acidity (sulfur units)
Net Acidity (acidity units)
Liming Rate ANC Fineness Factor Work Order Analyte

: COFFEY GEOTECHNICS

: 9 of 10

Page Number

Client

1 kg CaCO3/t



Page Number : 10 of 10
Client : COFFEY GEOTECHNICS
Work Order : EB0704186
Surrogate Control Limits

Page Number

No surrogates present on this report.

Report version: COANA 3.02



op no:

GEOTSGTE20248AA sheet 1 of 1

acid sulfate soil screening test

PING TEST office: Newcastle (LABTSGTE00173AA)

						gen peroxide)	PH Change (ie pH-pH <sub>Fox</sub> ) Additional comments	1.75	1.12	1.4	0.91	2.11	1.1	1.4	1.23	0.32		Vicorous affervescent reaction
12/04/07	Newcastle	NH/GR			22.3	PHFox (oxidation in 30% hydrogen peroxide)	Colour change during reaction	Z	z	z	z	z	z	z	Z	z		c. Vigorou
12/0	Nev	NH		ation:	or to use:	oxidatio	Odour	<b>&gt;</b>	z	>	z	z	z	z	z	z		cence
date:	test location:	tested by:	checked by:	date of calibration:	hydrogen peroxide temperature prior to use:		Effervescence (see note below)	q	æ	q	ro	В	Ø	Ø	æ	Ф		effervescenceb. Slight to moderate effervescence
		TION		Horiba	gen pero		temp (°C)	25	25	25	25	25	25	24	24	24		Slight
		PLICA			hydro		pH FOX	3.85	3.35	3.55	4.68	2.60	4.15	3.63	3.88	5.24		scencer
		CT AP		used/serial			time (mins)	10	10	10	10	10	10	10	10	10		
YORS		PROJE		meter		H <sub>C</sub>	pH in 1:5 distilled water	2.60	4.47	4.95	5.59	4.71	5.25	5.03	5.11	5.56		a. No visible
TATTERSAL SURVEYORS		RIVERSIDE ESTATE PROJECT APPLICATION	TEA GARDENS	Hd	use: <b>5.46</b>		soil description	Sand/ Clay	Sand	Sand / Clay	Sand	Sand	Sand	Clay / Sand	Sand	Sand		1. Observed Reaction: a
TATTE		RIVER	TEA G	red:	H prior to	V 27.0 (2) 20 1.75 1.75 1.75 1.75	RL (mAHD)											Observe
				date samples recovered:	hydrogen peroxide pH prior to use:		depth (m)	1.0-1.1	1.1-1.2	0.6-0.7	1.8-1.9	1.5-1.6	1.9-2.0	0.5-0.6	1.0-1.1	1.9-2.0		1
client:	principal:	project:	location:	date sam	hydrogen		sample location	ТРЗ	TP27	TP28	TP22	7P6	779	TP24	TP24	TP24		NOTES:



LABTSGTE00173AA sheet 1 of 1 on doj

acid sulfate soil screening test

Newcastle office:

Newcastle 13/04/07 test location: date: TATTERSAL SURVEYORS principal:

HN tested by: RIVERSIDE ESTATE PROJECT APPLICATION

project:

client:

date of calibration: checked by: pH meter used/serial Horiba Tea Gardens date samples recovered: location:

hydrogen peroxide temperature prior to use: **22.3** hydrogen peroxide pH prior to use: 5.46

				T.					oxidation	PHFox (oxidation in 30% hydrogen peroxide)	gen peroxide)	
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	Fo Xo	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	рН Change (ie рНг-рНгох)	Additional comments
TP18	0.6-0.7		Sand	4.81	10	4.17	23	А	Z	Z	0.64	
TP18	1.8-1.9		Sand	5.27	10	4.45	23	٧	Z	z	0.82	
тРб	0.6-0.7		Silty Sand	4.76	10	4.15	23	٧	z	z	0.61	
7P6	1.0-1.1		Sand	4.80	10	4.15	23	٧	z	z	0.65	
TP4	0.5-0.6		Clay	5.62	10	4.13	23	A	<b>&gt;</b>	z	1.49	
TP17	1.1-1.2		Sand	5.46	10	5.21	23	٧	z	z	0.25	
TP11	1.0-1.1		Sand	5.70	10	5.37	24	Ą	Z	z	0.33	
TP22	0.5-0.6		Silty Sand	5.83	10	5.40	24	q	Z	Z	0.43	
NOTES:	←] VVI	<ol> <li>Observed Real</li> <li>Strong Odour:</li> </ol>	ction:	a. No visible	efferve	scenceb	. Slight t	effervescenceb. Slight to moderate effervescence	scence	c. Vigorous	c. Vigorous effervescent reaction	ıction



LABTSGTE00173AA sheet 1 of 1

test
screening
soil
sulfate
acid

Newcastle office:

Newcastle 12/04/07 HN test location: tested by: date: RIVERSIDE ESTATE PROJECT APPLICATION TATTERSAL SURVEYORS principal: project: location: client:

22.3 hydrogen peroxide temperature prior to use: date of calibration: checked by: pH meter used/serial Horiba hydrogen peroxide pH prior to use: 5.46 TEA GARDENS date samples recovered: 10-04-07

	Additional comments												ction
gen peroxide)	PH Change (ie PHF-PHFOX)	2.01	1.53	1.73	1.02	1.94	1.47	66'0	0.88	1.76	1.1	4.97	c. Vigorous effervescent reaction
PH <sub>FOX</sub> (oxidation in 30% hydrogen peroxide)	Colour change during reaction	Z	Z	z	Z	Z	Z	Z	Z	Z	Z	Z	c. Vigorous
oxidation	Odour	Z	Z	z	z	Z	Z	Z	Z	Z	Z	<b>&gt;</b>	scence
)	Effervescence (see note below)												effervescenceb. Slight to moderate effervescence
	temp (°C)	22	22	23	23	23	23	23	23	23	23	30	o. Slight
	H <b>q</b>	3.98	4.13	4.71	4.28	3.26	3.42	3.85	5.45	4.80	4.90	1.43	scencet
	time (mins)	10	10	10	10	10	10	10	10	10	10	10	
H.	ᇫᅙ	5.99	5.66	6.44	5.30	5.20	4.89	4.84	6.33	6.56	00.9	6.40	a. No visible
	RL (mAHD) soil description	Sand	Sand	Sand	Sand	Clay	Clay	Sand	Sand	Sand	Sand	Sand	ction:
	RL (mAHD)												<ol> <li>Observed Rea</li> <li>Strong Odour.</li> </ol>
	depth (m)	0.6-0.7	1.1-1.2	1.9-2.0	1.1-1.2	0.6-0.7	1.7-1.8	1.1-1.2	1.9-2.0	0.6-0.7	2.0-9.0	1.6-1.7	-  ci
11 12 12 13 14	sample location	TP12	TP12	TP12	TP13	TP14	TP14	TP15	TP34	TP31	TP30	TP32	NOTES:



LABTSGTE00173AA sheet 1 of 1

# acid sulfate soil screening test

principal:

client:

location:

project:

22.3 Newcastle 12/04/07 hydrogen peroxide temperature prior to use: HN Newcastle date of calibration: test location: checked by: tested by: office: RIVERSIDE ESTATE PROJECT APPLICATION pH meter used/serial Horiba TATTERSAL SURVEYORS 5.46 TEA GARDENS 10-04-07 hydrogen peroxide pH prior to use: date samples recovered:

Additional comments					Lighter in peroxide							xlion
PH Change (ie pHr-pHrox)	2.37	2.25	1.29	4.89	4.99	2.44						c. Vigorous effervescent reaction
Colour change during reaction	Z	Z	Z	Z	Yes	Z						c. Vigorous e
Odour	Ν	Yes	Z	sək	Yes	Yes						ence
Effervescence (see note below)	А	В	S	Я	Я	q						a. No visible effervescenceb. Slight to moderate effervescence
temp (°C)	24	25	24	30	33	25						Slight to
pH Fox	3.63	4.51	3.91	1.45	1.36	2.81						enceb.
time (mins)	10	10	10	10		10						effervesc
pH in 1:5 distilled water	6.00	6.76	5.20	6.34	6.35	5.25						No visible e
soil description	Sand	Sand	Sand	Sand	Sand	Sand						ction:
RL (mAHD)												<ol> <li>Observed Rea</li> <li>Strong Odour:</li> </ol>
depth (m)	1.0 – 1.1	0.55 - 0.65	0.7 – 0.8	1.1-1.2	1.0 – 1.1	1.5 – 1.6						2, 5
sample	TP31	TP34	TP32	TP33	TP34	TP30						NOTES:
	depth RL soil description distilled time pH temp Effervescence Colour change PH Change water (mins) Fox (°C) (see note below) reaction	depth (mAHD) soil description distilled time pH temp temp (see note below) hater (mins) Fox (°C) (see note below) reaction (ie pH-pHFox) (ie pHFox) (ie p	depth (m)         RL (mAHD)         soil description distilled water (mins)         time of the content of	depth (m)         RL (mAHD)         soil description distilled water (mins)         time of control (mins)         pH (manulation distilled (mins))         time of control (mins)         ph (mins)	depth (m)         RL (mAHD)         soil description distilled water (mins)         time of control (mins)         pH (m)         temp (see note below)         Effervescence change during during during (se PH-PH-Pox)         Colour change during during during (se PH-PH-Pox)           1.0 - 1.1         Sand         6.00         10         3.63         24         A         N         N         2.37           0.55 - 0.65         Sand         6.76         10         4.51         25         B         Yes         N         1.29           1.1-1.2         Sand         6.34         10         1.45         30         B         Yes         N         4.89	depth (m)         RL (m)         soil description distilled water (mins)         time office (mins)         pH (temp office (mins))         temp office (mins)         Effervescence change during during (moning office pH;-pH; ox)         Colour change during during (moning office pH;-pH; ox)         PH Change change during during (moning office pH;-pH; ox)         PH Change change during during during (moning office pH;-pH; ox)         PH Change change during (moning office pH;-pH; ox)         PH Change change during during (moning office pH;-pH; ox)         PH Change change during (moning office pH;-pH; ox)         PH Change during (moning office pH;-pH; ox)         PH Change during (moning office pH;-pH;-ox)         PH Change during office pH;-pH;-ox) </td <td>depth (m)         RL (mAHD)         soil description distilled time distilled water (mins)         pH in 1:5 (°C)         pH in 1:5 (see note below)         Effervescence change during change during (ie pH-pH-cx)         Colour change during (ie pH-pH-cx)           1.0-1.1         Sand         6.00         10         3.63         24         A         N         N         2.37           0.55-0.65         Sand         6.76         10         4.51         25         B         Yes         N         1.29           1.1-1.2         Sand         6.36         1         1.45         30         B         Yes         N         4.89           1.0-1.1         Sand         6.35         1         1.36         33         B         Yes         Yes         4.99           1.5-1.6         Sand         5.25         10         2.81         25         b         Yes         Yes         A</td> <td>depth (m)         RL (mAHD)         soil description distilled time pH (mins)         pH (time pH</td> <td>depth (m)         RL (mAHD) (mAHD)         soil description distilled water (mins) are mins)         time (m)         pH in 1:5 (mins) are more below)         pH in 1:5 (mins) are more below)         change during during (ie pH-p-Hrox)           1.0-1.1         Sand         6.00         10         3.63         24         A         N         N         2.37           0.55-0.65         Sand         6.76         10         4.51         25         B         Yes         N         2.25           1.1-1.2         Sand         6.36         1.36         3.91         24         S         N         N         4.89           1.0-1.1         Sand         6.35         1.36         33         B         Yes         Yes         4.99           1.5-1.6         Sand         5.25         10         2.81         25         b         Yes         Yes         4.99</td> <td>depth (m)         RL (mAHD)         soil description distilled water (mins)         time pH (mins)         temp (accordance)         Heave (cc) (see note below)         Colour change (de pH-p-Hcx)           1.0-1.1         Sand         6.00         10         3.63         24         A         N         N         2.37           0.7-0.8         Sand         6.76         10         4.51         25         B         Yes         N         1.29           1.0-1.1         Sand         6.34         10         1.45         30         B         Yes         N         4.89           1.0-1.1         Sand         6.35         1.36         33         B         Yes         N         2.44           1.5-1.6         Sand         5.25         10         2.81         25         b         Yes         N         2.44</td> <td>depth (m)         RL (mAHD)         soil description distilled (mins)         pH in 1:5 and (mins)         ph in 1:5 and (mins)         temp (ac) (ac) (ac) (ac) (ac) (ac) (ac) (ac)</td> <td>depth (m)         RL (mAHD)         soil description distilled time (mins)         pH (mins) rox (°C)         temp (°C)         Effervescence during distilled time (mins)         pH (mins) rox (°C)         temp (°C)         (see note below) road during dispH-pH-px)         Colour during during during during during during during during reaction         pH Change during d</td>	depth (m)         RL (mAHD)         soil description distilled time distilled water (mins)         pH in 1:5 (°C)         pH in 1:5 (see note below)         Effervescence change during change during (ie pH-pH-cx)         Colour change during (ie pH-pH-cx)           1.0-1.1         Sand         6.00         10         3.63         24         A         N         N         2.37           0.55-0.65         Sand         6.76         10         4.51         25         B         Yes         N         1.29           1.1-1.2         Sand         6.36         1         1.45         30         B         Yes         N         4.89           1.0-1.1         Sand         6.35         1         1.36         33         B         Yes         Yes         4.99           1.5-1.6         Sand         5.25         10         2.81         25         b         Yes         Yes         A	depth (m)         RL (mAHD)         soil description distilled time pH (mins)         pH (time pH	depth (m)         RL (mAHD) (mAHD)         soil description distilled water (mins) are mins)         time (m)         pH in 1:5 (mins) are more below)         pH in 1:5 (mins) are more below)         change during during (ie pH-p-Hrox)           1.0-1.1         Sand         6.00         10         3.63         24         A         N         N         2.37           0.55-0.65         Sand         6.76         10         4.51         25         B         Yes         N         2.25           1.1-1.2         Sand         6.36         1.36         3.91         24         S         N         N         4.89           1.0-1.1         Sand         6.35         1.36         33         B         Yes         Yes         4.99           1.5-1.6         Sand         5.25         10         2.81         25         b         Yes         Yes         4.99	depth (m)         RL (mAHD)         soil description distilled water (mins)         time pH (mins)         temp (accordance)         Heave (cc) (see note below)         Colour change (de pH-p-Hcx)           1.0-1.1         Sand         6.00         10         3.63         24         A         N         N         2.37           0.7-0.8         Sand         6.76         10         4.51         25         B         Yes         N         1.29           1.0-1.1         Sand         6.34         10         1.45         30         B         Yes         N         4.89           1.0-1.1         Sand         6.35         1.36         33         B         Yes         N         2.44           1.5-1.6         Sand         5.25         10         2.81         25         b         Yes         N         2.44	depth (m)         RL (mAHD)         soil description distilled (mins)         pH in 1:5 and (mins)         ph in 1:5 and (mins)         temp (ac) (ac) (ac) (ac) (ac) (ac) (ac) (ac)	depth (m)         RL (mAHD)         soil description distilled time (mins)         pH (mins) rox (°C)         temp (°C)         Effervescence during distilled time (mins)         pH (mins) rox (°C)         temp (°C)         (see note below) road during dispH-pH-px)         Colour during during during during during during during during reaction         pH Change during d



LABTSGTE00173AA sheet 1 of 1 job no:

acid sulfate soil screening test

office:

Additional comments Lighter After Reaction c. Vigorous effervescent reaction PH Change (ie PHF-PHFox) PH<sub>FOX</sub> (oxidation in 30% hydrogen peroxide) 0.88 .3 1.3 4.1 1.7 7: change during reaction Colour 22.0 z z Z Z z Newcastle 13/04/07 Newcastle hydrogen peroxide temperature prior to use: HN Odour a. No visible effervescenceb. Slight to moderate effervescence z z z z z date of calibration: > est location: Effervescence (see note below) checked by: tested by: date: 4 ⋖ ⋖ ⋖ ⋖ temp (°C) RIVERSIDE ESTATE PROJECT APPLICATION 28 23 23 22 33 22 meter used/serial Horiba 1.65 3.50 3,25 3.26 **편** 5 3.60 4.06 time (mins) 10 10 9 9 9 9 RL soil description pH in 1:5 distilled water 5.75 4.36 TATTERSAL SURVEYORS 5.20 4.90 4.55 4.94 핌 hydrogen peroxide pH prior to use: 5.49 1. Observed Reaction: 2. Strong Odour: Sand Sand Sand Sand TEA GARDENS Clay Clay date samples recovered; 10-04-07 2.0-2.1 1.0-1.1 0.6-0.7 2.0-2.1 depth (m) 1.1-1.2 1.9-2.0 principal: location: sample location project: TP19 NOTES: client: TP25 TP9 **TP25** *TP6* TP4



LABTSGTE00173AA sheet 1 of 2

acid sulfate soil screening test

client:

21.0 Newcastle 13/04/07 NH/GR Newcastle hydrogen peroxide temperature prior to use: date of calibration: test location: checked by: tested by: office: date: RIVERSIDE ESTATE PROJECT APPLICATION pH meter used/serial Horiba TATTERSAL SURVEYORS hydrogen peroxide pH prior to use: 5.28 TEA GARDENS date samples recovered: principal: project: location:

				ъНф					oxidation	PHFox (oxidation in 30% hydrogen peroxide)	gen peroxide)	
sample location	depth (m)	RL (mAHD)	RL (mAHD) soil description	pH in 1:5 distilled water	time (mins)	<b>pH</b> XOX	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	рН Change (ie рНғ-рНғох)	Additional comments
TP16	0.5-0.6		Sand	4.96	10	4.72	21.5	а	Z	Z	0.24	
TP16	1.7-1.8		Sand	4.93	10	3.83	21.5	а	Z	Z	1.1	
трз	1.7-1.8		Sand	5.65	10	5.42	21.0	а	Z	Z	0.23	
TP5	1.5-1.6		Sand	5.25	10	4.50	21.5	В	Z	Z	0.75	
TP5	0.9-1.0		Sand	5.78	10	4.98	21.5	а	N	Z	0.8	
TP2	1.0-11		Sand	5.53	10	3.36	21.5	a	N	Z	2.17	
TP10	0.5-0.6		Sand	5.25	10	4.60	21	а	Z	Z	0.65	
TP10	1.8-1.9		Sand	5.50	10	4.60	21	а	N	Z	6:0	
TP1	1.0-1.1		Sand	5.60	10	4.79	21	а	Z	Z	0.81	
TP262	0.5-0.6		Sand	4.90	10	4.70	21	a	Z	Z	0.2	
TP26	1.0-1.1		Sand	4.75	10	4.28	21	В	Z	Z	0.47	
NOTES:	F1 201	<ol> <li>Observed Rea</li> <li>Strong Odour:</li> </ol>	ction:	. No visible	efferves	cenceb	. Slight t	a. No visible effervescenceb. Slight to moderate effervescence	scence	c. Vigorous	c. Vigorous effervescent reaction	action



LABTSGTE00173AA sheet 2 of 2

# acid sulfate soil screening test

office:

Newcastle

13/04/07 date: TATTERSAL SURVEYORS

Newcastle test location:

RIVERSIDE ESTATE PROJECT APPLICATION

principal:

project:

NH/GR tested by:

> TEA GARDENS location:

checked by:

date samples recovered:

date of calibration: pH meter used/serial Horiba

hydroger	hydrogen peroxide pH prior to use:	H prior to	use: <b>5.46</b>			hydrog	en perox	hydrogen peroxide temperature prior to use:	or to use:	22.3		
				Ħ					oxidation	PHFox (oxidation in 30% hydrogen peroxide)	gen peroxide)	
sample location	depth (m)	RL (mAHD)	RL soil description pH in 1:5 distilled water	pH in 1:5 distilled water	time (mins)	PH XOT	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	ρΗ Change (le ρΗ⊱-ρΗεοχ)	Additional comments
TP21	1.1-1.2		Sand	5.30	10	5.20	21	а	Z	Z	0.1	
TP10	1.1-1.2		Sand	5.30	10	4.80	22	С	z	Z	0.5	
TP20	0.6-0.7		Sand	5.03	10	4.17	22	В	Z	Z	0.86	
TP20	1.6-1.7		Sand	5.10	10	5.01	22	В	Z	Z	60:0	
TP29	1.1-1.2		Sand	5.20	10	4.03	22	q	Å	Z	1.17	
TP28	1.7-1.8		Sand	5.10	10	4.60	22	В	Z	Z	0.5	
TP19	9.0-2.0		Sand	4.96	10	3.70	22	q	Å	Z	1.26	
TP1	0.5-0.6		Sand	7.28	10	5.32	24	В	z	Z	1.96	
NOTES:	두 이	<ol> <li>Observed Rea</li> <li>Strong Odour:</li> </ol>	ction:	a. No vísible	efferves	cenceb	. Slight t	a. No visible effervescenceb. Slight to moderate effervescence	scence	c. Vigorous	c. Vigorous effervescent reaction	ıction



LABTSGTE00173AA sheet 1 of 1

acid sulfate soil screening test

Newcastle office:

12/04/07 test location: date: TATTERSAL SURVEYORS

principal:

client:

Newcastle

checked by: tested by: RIVERSIDE ESTATE PROJECT APPLICATION project:

HN

pH meter used/serial Horiba TEA GARDENS date samples recovered: 10-04-07 location:

hydrogen peroxide pH prior to use: 5.46

date of calibration:

22.3

hydrogen peroxide temperature prior to use:

_									 	 	_	-
Comments of the Comments of th		Additional comments					Lighter in Peroxide					action
	gen peroxide)	pH Change (ie pHғ-pHғоx)	2.37	2.25	1.29	4.89	4.99	2.44				c. Vigorous effervescent reaction
	PH <sub>FOX</sub> (oxidation in 30% hydrogen peroxide)	Colour change during reaction	Z	Z	Z	Z	<b>\</b>	Z				c. Vigorous
	oxidation	Odour	Z	٨	Z	Y	Å	Å				scence
		Effervescence (see note below)	а	þ	а	b	q	q				a. No visible effervescenceb. Slight to moderate effervescence
		temp (°C)	24	25	24	30	33	25				. Slight
		pH Fox	3.63	4.51	3.91	1.45	1.36	2.81				scence
		time (mins)	10	10	10	10	10	10				e efferve
	4Hq	pH in 1:5 distilled water	00.9	92'9	5.20	6.34	6.35	5.25				a. No visible
		RL soil description distilled water	Sand	Sand	Sand	Sand	Sand	Sand				ction:
		RL (mAHD)										<ol> <li>Observed Rea</li> <li>Strong Odour:</li> </ol>
		depth (m)	1.0-1.1	0.55-0.65	0.7-0.8	1.1-1.2	1.0-1.1	1.5-1.6				-  <i> </i> -
		sample location	TP31	TP34	TP32	TP33	TP34	TP30				NOTES:



LABTSGTE00173AA sheet 1 of 2 on doj

acid sulfate soil screening test

Newcastle office:

13/04/07 date: TATTERSAL SURVEYORS

Newcastle test location:

principal:

client:

project:

ΉN tested by: RIVERSIDE ESTATE PROJECT APPLICATION

date of calibration: checked by: pH meter used/serial Horiba TEA GARDENS date samples recovered: 11/04/07 location:

hydrogen peroxide temperature prior to use: 23.0 hydrogen peroxide pH prior to use: 5.47

980.54	ייל מוספטיו איני איני איני איני איני איני איני אי	2				50.06.1	0	nyaiogen peroxide temperature pirol to use:	2	2		
				书。					oxidation	PH <sub>FOX</sub> (oxidation in 30% hydrogen peroxide)	gen peroxide)	
sample location	depth (m)	RL (mAHD)	RL (mAHD) soil description	주휴 _	time (mins)	pH rox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	PH Change (ie pHr-pHrox)	Additional comments
BH23	0.5-1.0		Sand	5.83	10	5.01	22	ro	z	Z	0.82	
ВНЗ5	2.0-2.5		Sand	6.15	10	4.30	23	q	z	Z	1.85	
ВНЗ5	3.5-4.0		Sand	6.45	10	5.18	22	а	Z	Z	1.27	
ВНЗ6	0.5-1.0		Sand	5.03	10	4.24	23	q	¥	Z	62:0	
ВНЗ6	2.0-2.5		Sand	5.26	10	3.78	22	В	Z	Z	1.4	
ВНЗ6	3.5-4.0		Sand	5.75	10	3.26	22	a	Z	Z	2.49	
ВНЗ6	5.0-5.5		Sand	6.19	10	4.22	23	В	Z	Z	1.97	
BH37	0.5-1.0		Sand	5.85	10	4.67	23	q	Z	Z	1.18	
BH37	2.0-2.5		Sand	5.55	10	3.92	22	B	z	Z	1.63	
BH37	3.5-4.0		Sand	5.80	10	4.25	22	B	Å	Z	1.55	
BH37	5.0-5.5		Sand	5.83	10	3.27	22	q	Z	Z	2.56	
NOTES:	<b>1</b> −1 0/1	<ol> <li>Observed Rea</li> <li>Strong Odour:</li> </ol>	ction:	a. No visible	efferve	scenceb	. Slight 1	a. No visible effervescenceb. Slight to moderate effervescence	cence	c. Vigorous	c. Vigorous effervescent reaction	action



job no: LABTSGTE00173AA

sheet 2 of 2

acid sulfate soil screening test

office: Newcastle

Newcastle 13/04/07 test location: date: TATTERSAL SURVEYORS principal: client:

RIVERSIDE ESTATE PROJECT APPLICATION

project:

tested by: NH/GR

location: TEA GARDENS

date samples recovered:

pH meter used/serial Horiba date of calibration:

checked by:

hydroger	hydrogen peroxide pH prior to use:	H prior to	use: <b>5.46</b>			hydroge	en pero	hydrogen peroxide temperature prior to use:	or to use:	22.3		
				HF.					oxidation	PHFox (oxidation in 30% hydrogen peroxide)	gen peroxide)	
sample location	depth (m)	RL (mAHD)	RL (mAHD) soil description	pH in 1:5 distilled water	time (mins)	pH Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	pH Change (ie pHғ-pHғох)	Additional comments
ВН37	6.5-7.0		Sand	5.73	10	3.07	23	q	Z	Z	2.66	
BH58	0.5-1.0		Sand / Clay	5.19	10	4.20	22	q	z	N	66:0	
ВНЗ8	2.0-2.5		Sand / Clay	5.50	10	4.15	22	а	٨	Z	1.35	
ВНЗ8	3.5-4.0		Sand	5.53	10	4.38	21	a	N	Z	1.15	
BH38	5.0-5.5		Sand	5.93	10	4.55	22	B	Z	N	1.38	
ВНЗ8	6.5-7.0		Sand	5.63	10	4.26	22	В	Υ	N	1.39	
NOTES:	<b>-</b>   2	1. Observed Rea 2. Strong Odour:	ction:	a. No visible	efferves	cenceb.	Slight t	a. No visible effervescenceb. Slight to moderate effervescence	scence	c. Vigorous	c. Vigorous effervescent reaction	action

### checked: .....

# RESULTS OF ACID SULFATE SOIL ANALYSIS (Page 1 of 1)

9 samples supplied by Coffey on 14th June, 2007 - Lab. Job No. E7466 Analysis requested by Warabrook. - Your Project: Proposed subdivision

Sample Site	Depth	EAL	Texture	Moisture Content	Lab. Bulk Density	TA'⊢	Acidity (TAA)	Reduced Inorganic Sulfur	Reduced Inorganic Suffar	NET ACIDITY Chromium Suite	LIME CALCULATION Chromium Suite
	€	ep co	(note 6)			A P	mole H7/tonne (to pH 6.5)	(% chromium reducible S)		mole H"/tonne	
Mothod Mo								(2,910() (1)0ce (2)	mole H*/tonne	(based on %Scrs)	(includes 1.5 safety Factor
ow normal						A.S.	231	228	a- 22B	note 5	note 5
TP 39	1.0 - 1.1		Fine	24.9	1.2	4.27	52	0,006	4	95	ம
TP 40	1.5 -1.6	E7466/2	Coarse	15.9	1.3	4.83	თ	<0.005	· c	} σ	· -
TP 41	0.5 - 0.6	E7466/3	Fine	18.0	1.6	4.42	39	<0.005	· C	3.0	- 14
TP 42	1.0 - 1.1	E7466/4	Fine	21.9	1.1	4.63	60	0.007	 > 4	37	) r
TP 43	1.7 - 1.8	£7466/5	Coarse	11.7	4.1	5.13	7	<0.005	. 0	; ~	<b>→</b>
BH 45	5.5 - 5.9	E7466/6	Coarse	16.0	1.6	5.04	9[	0.011	7	22	ď
BH 46	1.0 - 1.1	E7466/7	Coarse	18.5	1.3	5.38	' က	0,028	17	20 25	. ~
BH 46	2.5 - 3.0		Coarse	17.8	4.1	5.23	6	0.016	10	3 6	2 1
BH 46	5.5 - 6.0	E7466/9	Coarse	18.3	1.4	5.91	2	0.013	∞	10	

1 - All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)

2 - Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr - Method 22B)

3 - Methods from Ahern, CR, McEinea AE , Sulivan LA (2004). Acid Sulfate Soils Laboratory Methods Guidelines. QLD DNRME.

4 - Bulk density was determined immediately on arrival to laboratory (insitu bulk density is preferred)

5 - ABA Equation: Net Acidity = Potential Sulfidic Acidity (ie. Scrs or Sox) + Actual Acidity + Retained Acidity - measured ANC/FF 6 - For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays 6 - For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays

- .. Denotes not requested or required

8 - CRS, TAA and ANC are NATA certified but other SPOCAS segments are currently not NATA certification 9- Results at or below detection limits are replaced with '0' for calculation purposes.

10 - Projects that disturb > 1000 tonnes of soli, the ≥0.03% S classification guideline would apply.

(Classification of potential acid sulfate material if: coarse Scr 20.03%S or 19mole H+/t; medium Scr 20.06%S or 37mole H+/t; fine Scr 20.1%S or 62mole H+/t)

Lab, Accred, No.: 14960



job no: GEOTSGTE20248AA

sheet 1 of 5

acid sulfate soil screening test

office: NEWCASTLE

NEWCASTLE 20-90-80 SB test location: checked by: RIVERSIDE ESTATE PROJECT APPLICATION tested by: date: TATTERSALL SURVEYORS PTY LTD REFER TO FIGURE 1 TEA GARDENS principal: project: location: client:

08-06-07 20.4 hydrogen peroxide temperature prior to use: date of calibration: pH meter used/serial HORIBA hydrogen peroxide pH prior to use: 5.45 date samples recovered: 01-04-07

	1 1 12 1		_	1		T		T		[		 <del></del>
		Additional comments										action
	gen peroxide)	PH Change (ie pHF-pHFox)	3.09	2.89	1.83	4.29	2:32	3.01	2.35	1.48		c. Vigorous effervescent reaction
	PHFox (oxidation in 30% hydrogen peroxide)	Colour change during reaction										c. Vigorous
	oxidation	Odour	A	¥	A	В	A	A	A	А	•	cence
		Effervescence (see note below)	8	В	∢	В	В	А	А	А		fervescenceb. Slight to moderate effervescence
-		temp (°C)	20.6	20.7	20.3	20.3	20.2	20.2	20.0	19.9		Slight
,		pH FOX	4.38	3.86	5.46	2.28	4.38	4.66	5.33	5.77		cenceb.
		time (mins)	20	25	15	22	21	20	19	18	·	efferves
	₩d	pH in 1:5 distilled water	7,47	6.75	7.29	6.57	6.70	7.67	7.68	7.25		a. No visible ef
		soil description	Clay	Clay	Sand	Sand	Sand	Sand	Sand	Sand		ction:
		RL (mAHD)										<ol> <li>Observed Real</li> <li>Strong Odour:</li> </ol>
	. 12	depth (m)	0.5-0.6	1.0-1.1	1.5-1.6	1.0-1.5	2.5-3.0	4.0-4.5	5.5-6.0	7.0-7.5		-   ci
		sample location	TP39	TP39	TP39	ВН46	BH46	BH46	BH46	BH46		NOTES:

coffey geotechnics SPECIALISTS MANAGING THE EARTH

job no: GEOTSGTE20248AA

sheet 2 of 5

acid sulfate soil screening test

NEWCASTLE office:

70-90-80 NEWCASTLE 20.2 08-06-07 hydrogen peroxide temperature prior to use: SB date of calibration: test location: checked by: RIVERSIDE ESTATE PROJECT APPLICATION tested by: date: pH meter used/serial HORIBA TATTERSALL SURVEYORS PTY LTD REFER TO FIGURE 1 hydrogen peroxide pH prior to use: 5.15 TEA GARDENS date samples recovered: 01-04-07 principal: project: location:

Sample depth		RL. Soil description	PHF PH in 1:5				1	oxidation	Oxidation in 30% hydrogen peroxide	gen peroxide)	
			distilled water	time (mins)	F X	(°C)	Effervescence (see note below)	Odour	change during reaction	pH Change (ie pHr-pHrox)	Additional comments
0.5-0.6		Clay	5.20	42	3.86	20.8	В	В		1.34	
1.0-1.1		Sandy Clay	5.18	43	4.06	20.8	89	₹		1.12	
1.5-1.6		Clayey Sand	5.02	44	4.35	21.0	A	A		29.0	
2.4-2.5		Sand	6.02	46	4.67	20.7	A	₹		1.35	
0.5-0.6		Clay	6.17	55	4.64	20.4	B	A		1.53	
1.0-1.1		Clay	5.65	56	4.50	20.4	Ą	₹		1.15	
1.5-1.6		Sand	5.90	22	4.73	20.3	Ą	₹		1.17	The state of the s
											Addition in the control of the contr
#I (NI	<ol> <li>Observed Rea</li> <li>Strong Odour:</li> </ol>	ction:	. No visible	effervesc	senceb.	Slight t	a. No visible effervescenceb. Slight to moderate effervescence	cence	c. Vigorous	c. Vigorous effervescent reaction	ction



job no: GEOTSGTE20248AA

sheet 3 of 5

acid sulfate soil screening test

08-06-07 NEWCASTLE 20.6 20-90-80 NEWCASTLE hydrogen peroxide temperature prior to use: SB date of calibration: test location: checked by: RIVERSIDE ESTATE PROJECT APPLICATION tested by: office: date: pH meter used/serial HORIBA TATTERSALL SURVEYORS PTY LTD REFER TO FIGURE 1 hydrogen peroxide pH prior to use: 5.55 TEA GARDENS date samples recovered: 01-04-07 principal:

project:

location:

		ā		Hq Hr.					oxidation	eHFox (oxidation in 30% hydrogen peroxide)	gen peroxide)	
	£	(mAHD)	(mAHD) soil description primits distilled water	pn m i.o distilled water	time (mins)	PH Lox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	PH Change (ie pHr-pHeox)	Additional comments
0	0.5-0.6		Sand	4.09	15	4.94	21.2	8	А			
7	1.0-1.1		Sand	5.26	16	4.90	20.9	4	Ą		0.36	
1	1.7-1.8		Sand	5.83	18	5.18	20.7	Ą	Æ		0.65	
0	0.5-0.6		Clay	5.71	30	4.24	20.7	В	4		1.47	
1	1.0-1.1		Sandy Clay	5.25	30	4.19		A	A		1.06	
4	1.5-1.6		Sand	5.44		4.15	20.8	В	Ą		1.29	
.												
				****								
	<b>₩</b>	<ol> <li>Observed Rea</li> <li>Strong Odour:</li> </ol>	ction:	a. No visible	efferves	cenceb.	Slight t	a. No visible effervescenceb. Slight to moderate effervescence	scence	c. Vigorous	c. Vigorous effervescent reaction	action



job no: GEOTSGTE20248AA

sheet 4 of 5

## acid sulfate soil screening test

TATTERSALL SURVEYORS PTY LTD date: 08-06-07

NEWCASTLE

test location:

NEWCASTLE

office:

project: RIVERSIDE ESTATE PROJECT APPLICATION tested by: SB

TEA GARDENS

principal:

client:

location: REFER TO FIGURE 1

date samples recovered: 01-04-07 pH meter used/serial HORIBA

IORIBA date of calibration:

checked by:

07-06-07

hydrogen peroxide pH prior to use; 5.44

hydrogen peroxide temperature prior to use: 20.9

	Additional comments								
									eaction
oxidation in 30% hydrogen peroxide)	pH Change (le pHr-pHrox)	0.13	0.20						c. Vigorous effervescent reaction
PHFOX n in 30% hydro	Colour change during reaction			-					c. Vigorou
oxidatio	Odour	В	A	4					cence
	Effervescence (see note below)	В	В	A					a. No visible effervescenceb. Slight to moderate effervescence
	temp (°C)	20.4	20.4	20.5					. Slight t
	Ha Yo	4.57	4.75	5.07					scenceb
	time (mins)	28	30	31					efferve
ŧ	pH in 1:5 distilled water	4.70	4.95	5.04					a. No visible
	RL mAHD) soil description pH in 1:5 distilled water	Sand	Silty Sand	Sand	**************************************			:	tion:
	RL (mAHD)								1. Observed Read
	(m)	0.5-0.6	1.0-1.1	1.5-1.6					-
	sample location	TP44	TP44	TP44					NOTES:

COFFEY geotechnics SPECIALISTS MANAGING THE EARTH

job no: GEOTSGTE20248AA

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sheet 5 of

acid sulfate soil screening test

GST office: NEWCASTLE

Additional comments c. Vigorous effervescent reaction PH Change (ie pHr-pHEox) PH<sub>FOX</sub> (oxidation in 30% hydrogen peroxide) 1.14 1.44 1.44 1.65 1.15 1.37 1.48 1.85 20-90-80 change during reaction NEWCASTLE Colour 20.3 20-90-80 hydrogen peroxide temperature prior to use: SB Odour ۷ ¥ No visible effervescenceb. Slight to moderate effervescence date of calibration: ₹ ◂ 4 ₹ ⋖ ⋖ test location: Effervescence (see note below) checked by: RIVERSIDE ESTATE PROJECT APPLICATION tested by: date: ₹ ⋖ ⋖ ⋖ ⋖ ⋖ ⋖ ⋖ c) (°C) 20.3 19.9 19.9 19.5 20.0 20.1 20.0 20.0 pH meter used/serial HORIBA 5.09 5.21 5.40 4.72 5.34 5.45 4.80 5.20 F S TATTERSALL SURVEYORS PTY LTD time (mins) 5 16 17 18 20 21 21 22 RL soil description pH in 1:5 distilled water 6.35 6.84 6.16 7.10 6.17 6.49 6.68 6.95 REFER TO FIGURE 1 ю 5.46 Sand Sand Sand Sand Sand 1. Observed Reaction: 2. Strong Odour: TEA GARDENS Sand Sand Sand date samples recovered: 01-04-07 hydrogen peroxide pH prior to use: 10.0-10.5 2.5-3.0 5.5-5.9 depth (m) 1.0-1.5 4.0-4.5 4.0-4.5\* 7.0-7.4 8.5-9.0 principal: location: sample focation project: BH45 client: BH45 BH45 BH45 BH45 BH45 BH45 BH45 NOTES:

### Appendix C

Acid Sulfate Soils Management Plan



4 June 2007

Tattersall Surveyors Pty Ltd PO Box 54 RAYMOND TERRACE NSW 2324

**Attention: Bob Lander** 

Dear Bob

**RE: PROPOSED SUBDIVISION** 

RIVERSIDE ESTATE PROJECT APPLICATION AND SUBSEQUENT STAGES, TEA GARDENS

**GENERAL ACID SULFATE SOILS MANAGEMENT PLAN** 

Please find enclosed a generic Acid Sulfate Soils (ASS) Management Plan for all future developments within the proposed Riverside Estate Project Application and subsequent stages, Tea Gardens. The plan is aimed at being useable by all future service installers, builders or property owners. It presents an overview of acid sulfate conditions at the site, the potential for exposure to ASS and then provides recommendations and procedures for management and monitoring of ASS conditions.

If you have any questions regarding this management plan, please do not hesitate to contact Robert Pearce or the undersigned.

For and on behalf of Coffey Geotechnics Pty Ltd

author land

**Arthur Love** 

Principal Geotechnical Engineer

### **CONTENTS**

1	INTRODUCTION	1
2	SITE CONDITIONS AND PROPOSED DEVELOPMENT	1
3	WHAT ARE ACID SULFATE SOILS (ASS)?	1
3.1	Background Information	1
3.2	Significance of ASS	2
4	ASS AND THE DEVELOPMENT OF RIVERSIDE ESTATE	2
5	POTENTIAL FOR OXIDATION OF ACID SULFATE SOILS	2
6	MANAGEMENT OF EXPOSED ACID SULFATE SOILS	3
6.1	Neutralisation	3
6.2	Dewatering	4
7	MONITORING	4
7.1	pH Monitoring	4
7.2	Water Monitoring	4
8	CONTINGENCY PLAN	5
9	CONCLUSIONS	5

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### 1 INTRODUCTION

Coffey Geotechnics Pty Ltd (Coffey) has prepared a generic Acid Sulfate Soils Management Plan for future developments within the proposed Riverside Estate Project Application, Tea Gardens. The work was commissioned by Bob Lander of Tattersall Surveyors, on behalf of Crighton Properties, the developers of the Riverside Estate.

The Riverside Estate area has been subject to numerous previous acid sulfate soil (ASS) assessments and management plans. Previous development of the adjoining Myall Quays estate has been undertaken in accordance with ASS Management Plans prepared specifically for the development earthworks programs.

The purpose of the plan provided in this document was to provide a generic plan for management of ASS in future earthworks that occur within the Riverside Estate. It is understood the plan is to be provided as a reference to all lot purchasers and contractors required to work on the site. It has therefore been formatted in a way that will be useable to individual land owners to assist in obtaining DA approvals and in controlling and managing ASS during the development of each lot.

### 2 SITE CONDITIONS AND PROPOSED DEVELOPMENT

Topographically, the proposed development area is located within low lying coastal sand plains, with elevations typically of the order of 0.75m to between about 2.5m to 3m AHD. Vegetation generally comprises of tall grasses and scattered medium sized eucalypts.

Geologically the site is located within a region of windblown sand deposits probably of Pleistocene age (ie. greater than 20,000 years old) overlain by alluvial clays and the subsurface profiles encountered during our current investigation at the site and numerous previous investigations at the adjoining Myall Quays site revealed four main natural materials:

- TOPSOIL: Silty Clayey SAND, fine to medium grained, dark brown and dark grey;
- ALLUVIAL CLAY: Sandy CLAY and CLAY, medium to high plasticity and Clayey SAND, fine to medium grained;
- AEOLIAN SAND: fine to medium grained, pale grey / white and pale grey / brown;
- INDURATED SAND: fine to medium grained, dark brown, pale brown and orange / brown.

Groundwater depths generally vary from 0.3m to 2.0m below the surface.

### 3 WHAT ARE ACID SULFATE SOILS (ASS)?

### 3.1 Background Information

Acid Sulfate Soils (ASS) are soils which contain significant concentrations of iron sulphide or 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 <u>potential</u> ASS. When the soils are exposed, the oxidation of pyrite occurs and sulphuric acids are generated, the soils are said to be <u>actual</u> 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 1m 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.

### 3.2 Significance of ASS

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 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 into aquatic ecosystems can have a detrimental effect on aquatic ecosystems.

### 4 ASS AND THE DEVELOPMENT OF RIVERSIDE ESTATE

Prior to development, the area was occupied by low lying sand plains with elevations typically of the order of 0.75m to about 3m AHD.

The development of the adjoining Myall Quays residential estate involved raising the level of the land to achieve a minimum surface level of 2.1m AHD. Fill used to raise land levels was won onsite and from a sand pit located to the west of the site. All fill used in the development was tested in accordance with relevant guidelines and if necessary treated in accordance with the Acid Sulfate Soils Management Plan for the site. Similar fill materials will also be used to raise site levels across part of Riverside Estate Project Application.

### 5 POTENTIAL FOR OXIDATION OF ACID SULFATE SOILS

Installation of services involves placement of sewer mains to varying depths of up to 8m below final ground surface level. Risers are installed on each lot so the connection to sewer will not be required to extend to a depth of more than 1m. However, there is a requirement to pier structures in the vicinity of the sewer main to below the zone of influence. As this will be below the water table in most cases driven or screw piles are likely to be used and therefore extensive exposure of ASS is not likely.

As the majority of residential developments do not involve excavation below 1m depth, the following scenarios for exposure of ASS are envisaged:

Swimming pool excavations exceeding 1m deep;

- Bored piers exceeding 1m deep;
- Other excavations that exceed 1m deep or involve dewatering by lowering the water table to depths
  of more than 1m.

It is assumed that excavations for roads will not be below 1m deep and therefore it is not envisaged that road excavation will encounter ASS or Potential ASS.

For any such proposed excavations, or dewatering projects, an acid sulfate soils assessment should be undertaken, involving sampling and analysis of soils to the proposed depth of excavation.

### 6 MANAGEMENT OF EXPOSED ACID SULFATE SOILS

### 6.1 Neutralisation

The preferred method for managing the relatively small quantities of acid sulfate soil likely to be excavated is neutralisation by lime. The required dosing rate should be derived from testing of representative samples of the soil prior to excavation. Soil samples should be obtained at a rate of 1 per 50m³ of soil disturbed. Samples should be taken by a suitably qualified soils technician, engineer, or soil scientist and submitted to a NATA registered laboratory for analysis by POCAS or Chromium Reducible Sulfur methods.

The recommended liming agent is fine agricultural lime with an Effective Neutralising Value (ENV) of 98% or more. Using lime of this type, the required dosing rate can be calculated from the results of the laboratory testing using the following formula:

Lime required (kg lime/tonne soil) = 1.5 x Total Potential Acidity (kg H<sub>2</sub> SO<sub>4</sub>/tonne soil)

The lime and soil should be thoroughly mixed, preferably in a bunded area as close as possible to the source, with provision for runoff water to be collected and treated prior to release. Exposed soils in the walls and floors of the excavations should be treated by spreading of lime on the exposed surfaces.

For excavations disturbing less than 1,000 tonnes of soil, liming will be required unless analysis results fall below the following criteria:

SOIL TYPE	ACTION CRITERIA
Sand to loamy sand	0.03% oxidisable sulfur  18 mol H <sup>+</sup> /tonne
Sandy loam to light clay	0.06% oxidisable sulfur  36 mol H <sup>+</sup> /tonne
Medium to heavy clay or silty clay	0.1% oxidisable sulfur 62 mol H <sup>+</sup> /tonne

Where more than 1,000 tonnes of soil is to be disturbed, all soils should be treated unless test results fall below 0.03% oxidisable sulfur or 18 mol H<sup>+</sup>/tonne.

Neutralised soils can be used elsewhere on site provided test results on the neutralised soil meet the above criteria.

### 6.2 Dewatering

To minimise the impacts of dewatering for installation of services or other excavations, the following recommendations apply:

- Where possible, undertake excavations in the wet (ie without dewatering);
- Minimise the depth and extent of dewatering by staging the works and maintaining the groundwater level as close as possible to the working surface or pipe inverts;
- Minimise the time of exposure of potential ASS by staging excavations, immediately installing services or pipes and backfilling excavation as soon as services are installed;
- Excavated groundwater should be pumped to a holding tank, pond or bunded area. The pH of the
  water should be measured and the water released only if a pH of 6.5 to 9.0 is achieved. If water pH
  is less than 6.5, lime should be added as a slurry to the water until pH meets the required values.
  The preferred method of water disposal is by overland discharge at a rate that allows infiltration into
  the sand subsoils. Direct runoff to surface drainage or waterways should be avoided;
- Larger exposures, such as those on the batters of detention basins should be further limed and the
  lower parts of the batter should have a lime buffer placed in the form of limed sand bags (10% lime
  in sand) to allow neutralisation of acid leachate generated from the excavation walls. If required, (as
  indicated by pH monitoring) additional neutralisation of water should be undertaken.

### 7 MONITORING

### 7.1 pH Monitoring

The following monitoring is recommended to gauge neutralisation of excavated potential ASS:

- Daily measurement of soil pH in distilled water and hydrogen peroxide. Additional lime should be added if soil pH <4 (in distilled water) or pH<3 (in hydrogen peroxide) is encountered;</li>
- Laboratory testing by POCAS or CRS methods at a rate of one per 50m³ (or part thereof) of neutralised soil;
- Monitoring and liming should continue until required levels have been achieved.

### 7.2 Water Monitoring

Monitoring of pH in water discharged from dewatering operation should be as discussed in Section 7.1.

Surface waters, such as drainage lines, ponds or creeks in the vicinity of excavations or dewatering operation should also be monitored. Discharge to surface water should be avoided if practical, but where necessary, background water quality testing should be undertaken. Discharges should comply with ANZECC 2000 guidelines.

The following criteria are presented for discharge to surface water:

pH INDICATOR	FRESH WATER	MARINE ECOSYSTEM
рН	6.5 – 8.5	<0.2 unit change
Fe (Total)	500μg/L	N/A
Total Dissolved Solids	0-1500mg/L	>1500 mg/L
Aluminium (Total)	5μg/L for pH <6.5 100μg/L for pH >6.5	-

### 8 CONTINGENCY PLAN

Contingency plans have been discussed in the preceding section but are summarised below. Sufficient lime should be stored on site to allow implementation of the plans.

### Soil

Where tests indicate lime neutralisation has not achieved acceptable results, additional lime shall be mixed through the soil until an acceptable result is achieved.

### Water

Water not meeting the criteria outlined above should be treated by addition of lime in the form of a slurry. Mixing rates should be judged by monitoring pH during the process and be confirmed by laboratory testing prior to release. Care should be taken to add lime gradually, as 'over-shooting' can occur rapidly in such operations.

### 9 CONCLUSIONS

All personnel on sites involved with excavation or dewatering should be made fully aware of the issues associated with exposure of ASS and the requirements of this plan.

The site management procedures should be constantly reviewed to ensure that opportunities for exposure and oxidation of ASS are minimised.

For and on behalf of Coffey Geotechnics Pty Ltd

author land

**Arthur Love** 

Principal Geotechnical Engineer