Project No: B16097

19 January 2018

NSW Department of Primary Industries
Level 11
323 Castlereagh Street
SYDNEY NSW 2000

Attention: Mitchell Isaacs

Dear Sir

CASUARINA TOWN CENTRE
RESPONSE TO INFORMATION REQUEST DATED 30 MARCH 2016

Please find herein DPI Water's information request items and our responses. Where necessary we have attached supporting information to address the information request.

1. Groundwater

The modification seeks to replace the existing deep swale that traverses the site with a major stormwater pipe network. Modelling has been undertaken to determine the appropriate size of the proposed drainage system in accordance with Council requirements. Whilst DPI Water is not opposed to the piping of the swale, the report does not outline if groundwater will be intercepted as a result of these works. If there is the potential to intercept groundwater the proponent should contact DPI Water immediately. The proponent may be required to obtain a licence to account for any dewatering of groundwater associated with the works.

Please refer to the attached Acid Sulphate Soil Investigation Report prepared by Geotech Investigations PTY LTD on 18 July 2016. Section 4.2 states *"Groundwater seepage was observed in boreholes BH 9 to BH 16 at between approximately 1.4 m and 2.1 m depth."* BH 9 to BH 16 are all taken from the base of the existing swale in question. The base of the proposed culvert generally follows the existing base level of the swale. The downstream invert level of the culvert is RL3.12. Therefore we do not anticipate groundwater interception.

2. Acid Sulphate Soils

The document outlines that the subject site is mapped as containing Class 4 Acid Sulfate Soils. Pursuant to Clause 7.1 of the Tweed Local Environmental Plan an Acid Sulfate Soils Management Plan should be developed if works will disturb 2 metres below the natural ground surface or if works occur where the watertable is likely to be lowered more than 2 metres below the natural ground surface. The site is

proposed to be filled and minor works carried out as part of the development are not expected to exceed below 2 metres of the existing ground level.

Please refer to the attached Acid Sulphate Soil Investigation Report prepared by Geotech Investigations PTY LTD on 18 July 2016 which concludes no actions are required. The current development finished design levels do not exceed a depth of 2m below natural surface levels as shown in the survey model provided to BG&E by Newton Denny Chappelle Surveyors on 09 November 2016.

Yours faithfully
for BG&E Pty Limited

Ben Keith
Senior Civil Engineer

enc.

ABN 81154555478
ACN 154555478

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admin@geotechinvestigations.com

Our Ref: HT:jw: GI 2785-a

18 July 2016

Hutchinson Builders
PO Box 7056
TWEED HEADS SOUTH NSW 2486

REPORT ON ACID SULFATE SOILS INVESTIGATION
"CASUARINA TOWN CENTRE MOD10" CASUARINA WAY, CASUARINA

1. INTRODUCTION

This report details the results of an acid sulfate soils (ASS) investigation for the proposed residential subdivision "Casuarina Town Centre MOD10" at Casuarina Way, Casuarina. The proposed development is understood to comprise 92 residential and larger commercial allotments.

Earthworks for the development comprise the filling of the existing swale drain that traverses along the northern and western extremities of the site, requiring up to 4 m depth of fill, and bulk earthworks over the rest of the allotment to achieve the design levels typically between RL 6.5 m AHD and RL 9 m AHD. Stormwater and sewer pipelines are proposed to be installed along the existing swale, requiring installation excavations of between 1.5 m up to 5.5 m depth.

The scope of the services provided by Geotech Investigations Pty Ltd (GI) was to provide an assessment for the presence and severity of ASS, risk assessment for the disturbance of ASS (if any) and suggested management options.

The assessment for the presence of ASS has been undertake using the Acid Sulfate Soil Manual (Ref 1), *"Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) In Queensland 1998"* (Ref 2) and Laboratory Methods Guidelines (Ref 3).

2. SITE DESCRIPTION

The site is located on the eastern side of Casuarina Way, opposite the intersection with Grand Parade, and covers a plan area of 8.93 ha. The property is bounded to the east by the Pacific Ocean, and to the north and south by residential buildings. A 3 m to 5 m deep swale drain exists along the northern extremity of the site, traversing is general south to south western direction to Casuarina Way.

The site occupied by a stockpile of soil from previous stages of the Casuarina estate development, with approximately 100,00 m3 of soil covering the majority of the site, with a covering of unmaintained greases and shrubs.

3. REGIONAL GEOLOGY AND ACID SULFATE SOILS RISK MAPPING

Reference to geological mapping by the Geological Survey of New South Wales Coastal Quaternary Geology 1:100,000 series for Tweed Heads Area indicates the site is underlain by "Qhbd – Holocene dune *("marine sand*)".

Figure 2: Excerpt from Coastal Quaternary Geology for Tweed Heads Region

Reference to the Acid Sulfate Soils Risk Map, Edition 2, for Cudgen region indicates the site is located within an area of "Disturbed Terrain with an elevation of >4m AHD.

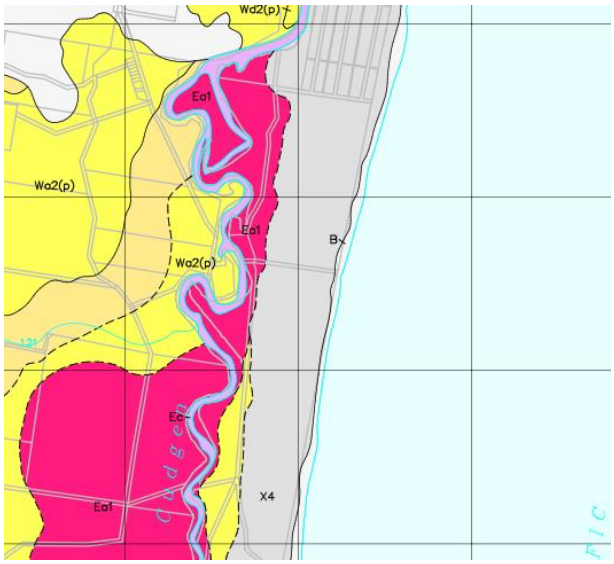


Figure 3: Excerpt from ASS Risk Map Edition 2 'Cudgen'

4. SITE INVESTIGATION

4.1 Field Work Methodology

Fieldwork was undertaken on the 21st to 24th of June 2016, and comprised the drilling and sampling of 21 boreholes, designated BH 1 to BH 21, using a 4wd mounted drill rig to the terminated depths between 3 m and 5.5 m depth.

Sampling locations were selected along the proposed pipeline alignment, being a lineal disturbance, at approximate 100 m intervals, with additional sampling locations on a grillage across the remainder of the site in order to comply with the suggested sampling locations in Acid Sulfate Soils Manual (i.e. 2 BHs/ha). Sampling depths were selected to generally achieve 1 m depth below the proposed excavation depth along the pipeline traverse, and a minimum of 3 m in other areas to account for near surface disturbances. Sampling through the existing stockpile was undertaken as this will be the source of the fill material for bulk earthworks.

Samples were carefully collected directly from the auger flights at approximately 0.5 m intervals of depth, and then sealed into plastic bags and placed on ice, before being delivered to the Tweed Heads South laboratory of Mazlab Pty Ltd for testing and analysis. The approximate location of the boreholes are shown on Site Plan S01 attached in Appendix A.

This investigation has been carried out generally in accordance with AS 1726 – 1993[1] in terms of soil description. The fieldwork was carried out by experienced geotechnical personnel, who positioned and logged the materials encountered in the boreholes, and collected the samples. At the completion of drilling, the boreholes were backfilled loosely with drill spoil.

4.2 Field Work Results

The results of the fieldwork are described in the form of Engineering Logs in Appendix B, along with explanatory notes. In summary, the subsurface conditions encountered in the boreholes can be described as **fill** comprising sand and silty sand over **alluvial** sands. Groundwater seepage was observed in boreholes BH 9 to BH 16 at between approximately 1.4 m and 2.1 m depth. Groundwater is affected by climatic conditions, varying soil permeability, and possibly tidal influences and the depth to groundwater will vary over time.

[1] Australian Standard AS 1726-1993 *'Geotechnical site investigations'*, Standards Australia

5. LABORATORY TESTING

Laboratory screening tests for ASS were carried out in accordance with the Laboratory Methods Guidelines (Ref 3). samples recovered from the boreholes were screened by measurement of pH after the addition of water and then peroxide.

A Field pH test (pH_F) is the pH of a paste of soil mixed with distilled water, which indicates if oxidation of sulfides has occurred in the past. It does not detect any remaining sulphide material that may not have oxidised. Field Peroxide (pH_{FOX}) is used to identify an un-oxidised sulfate or sulfides. To test the oxidation potential of a soil, 30% hydrogen peroxide is added to the soil:water paste and the pH measured after reaction, with the reaction rate also recorded from nil to very high. More rigorous laboratory analysis by the Chromium Suite of tests then completed on selected samples.

Certificates of test results for screening (pH_F & pH_{FOX}) and laboratory testing for the Chromium suite of tests carried out are attached as Appendix B.

6. COMMENTS

6.1 Discussion on Results

In accordance with the ASS Sampling and Analysis Guidelines:-

- pH_F <4 is considered to be an actual acid sulfate soil (AASS). Screening results for the 167 samples tested indicate pH_F ranged from 5.8 to 8.8 pH units, indicating that no previous oxidisation of sulfides had occurred, and the soil is not AASS;
- pH_{FOX} <3, as well as a change in pH between pH_F and pH_{FOX} of greater than 1 pH unit, and a strong reaction with peroxide, strongly indicates the presence of potential acid sulfate soil (PASS). pH_{FOX} values ranged between 3.6 and 7.0 pH units. Reaction rates were recorded as nil. These values indicate that none of the soil samples should be PASS.

The action criterion that triggers a requirement for ASS disturbance to be managed is derived when the existing acidity plus the potential acidity is greater than or equal to 18 mol H+/t or 0.03%S for all disturbances of sand. The analysis of the existing and potential acidity is derived from the results of laboratory analysis. In this case, Chromium suite of tests has been completed on 85 selected samples.

These results indicate the following results:-

- Potential Acidity is assessed as Chromium Reducible Sulfur (S_{CR}), with results on all samples tested were less than the reportable limit, and the action criteria was not exceeded, which indicates there is no oxidisable sulfur; and
- Existing Acidity is assessed from the Total Actual Acidity (TAA), and values ranged up to 0.02%S, with the action criteria not exceeded on any of the samples tested.

6.2 Presence and Likely Disturbance of ASS

The results indicate Acid Sulfate Soils have not been encountered at the locations sampled, in either the stockpile, existing filled soils or natural soils, and no specific management for the disturbance of ASS or acidic soils is required.

7. LIMITS OF INVESTIGATION

Recommendations given in this brief report are provided to assist the client with design decisions, and are based on the limited information supplied regarding the proposed construction in conjunction with the findings of this preliminary investigation. Any change in the construction type or building location may require additional testing and/or make recommendations invalid.

If you should require any further information or clarification, please do not hesitate to contact this office.

Yours faithfully
For and on behalf of
Geotech Investigations Pty Ltd

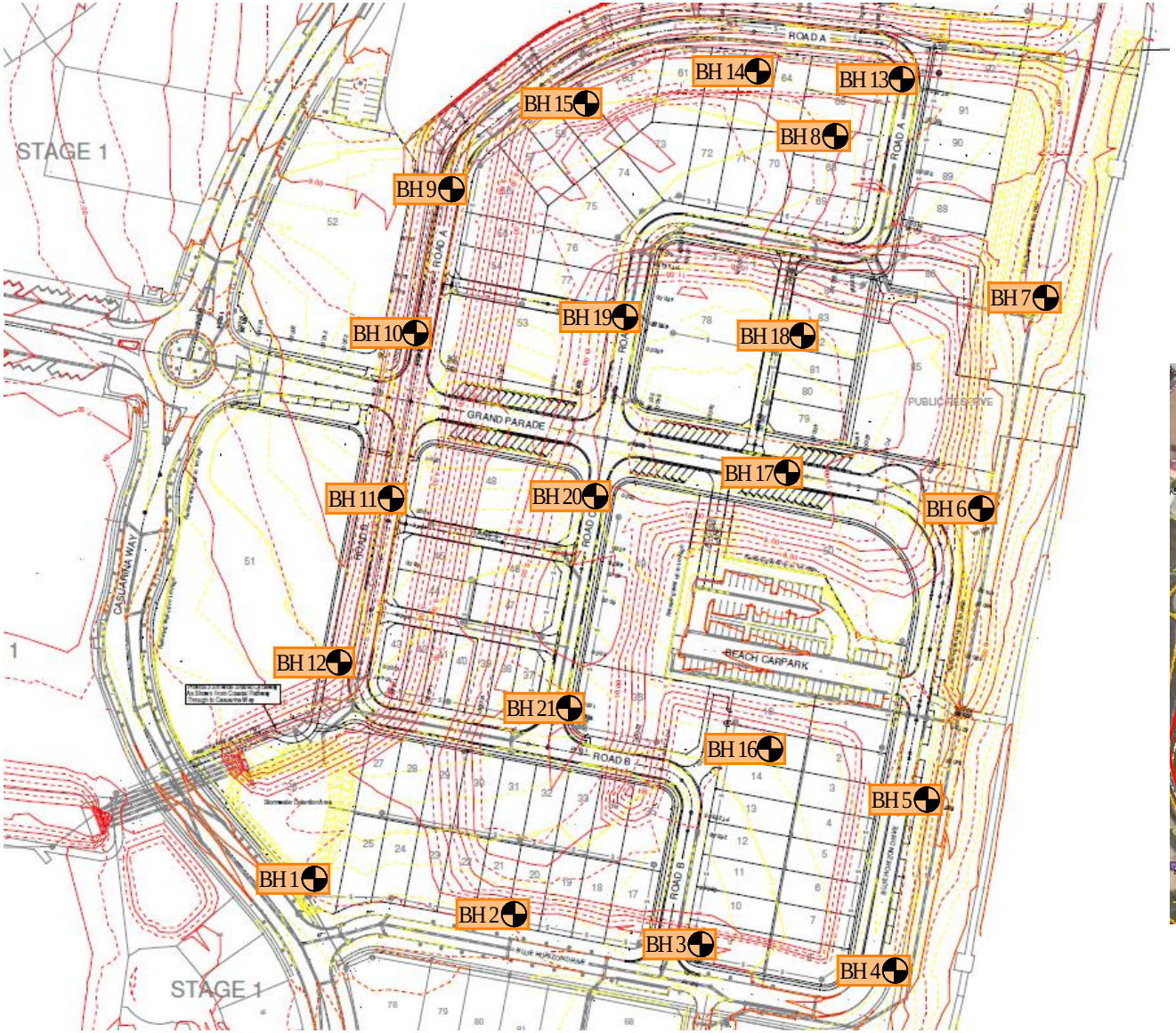
Heath Thomas *AdvDipEng(Civil), AMIEAust*
Geotechnical Engineering Associate

James Walle *RPEQ (15701), RPEng (Civil), B.Eng (Civil)*
Senior Geotechnical Engineer

Appendix A: Site Plan S01
Appendix B: Engineering Logs - Borehole Profile BH 1 to BH 21
Geotechnical Report Standard Notes
Appendix C: Laboratory Test Results – Mazlab Pty Ltd

APPENDIX A

SITE PLAN S01



LOCALITY IMAGE

Locality Image courtesy of
Google Earth & NSW Globe

GeoTech INVESTIGATIONS PTY LTD

Unit 3 / 42 Machinery Drive
PO Box 6885
Tweed Heads South NSW 2486
PH: 0755 233 979
FAX: 0755 233 981
EMAIL: admin@geotechinvestigations.com
WEB: www.geotechinvestigations.com

CLIENT: HUTCHINSON BUILDERS

PROJECT: PROPOSED RESIDENTIAL SUBDIVISION AT CASUARINA TOWN CENTRE MOD 10 - LOT 15 CASUARINA WAY, CASUARINA

DRAWING REF: S01: SITE PLAN

LEGEND:
Borehole and Dynamic Cone Penetrometer Location

Site Plan provided by
Newton Denny Chapelle
Ref No.: 13054

APPROXIMATE NORTH

NORTH

DATE: 21-24.06.2016

OUR REF / JOB No.: GI 2785-a sp

DRAWN BY: DJB

Drawing not to scale.
Printed dimensions only.

APPENDIX B

ENGINEERING LOGS - BOREHOLE PROFILE BH 1 TO BH 21
GEOTECHNICAL REPORT STANDARD NOTES

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 1
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Trace of silt, Moist, Grey/brown		A		FILL
		1.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		
		1.5				A		
		2.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 1 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	21/06/16	Checked By:	HT	Date:	28/06/16

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 2
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 2 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	21/06/16	Checked By:	HT	Date:	28/06/16

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 3
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 3 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	21/06/16	Checked By:	HT	Date:	28/06/16

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 4
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 4 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	21/06/16	Checked By:	HT	Date:	28/06/16

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 5
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 5 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	21/06/16	Checked By:	HT	Date:	28/06/16

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 6
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0				A		
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 6 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	**Date:**	21/06/16	**Checked By:**	HT	**Date:**	28/06/16

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 7
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SM) Silty SAND: Fine to coarse sand, With fine to medium gravel, Moist, Dark grey		A		FILL
		1.0				A		
		1.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		
		2.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 7 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	22/06/16	**Checked By:**	HT	**Date:**	28/06/16

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
Ph: 0755 233 979 Fax: 0755 233 981

ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 8
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SM) Silty SAND: Fine to coarse sand, With fine to medium gravel, Moist, Dark grey		A		FILL
		1.0				A		
		1.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		
		2.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 8 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	22/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 9
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		1.0				A		
		1.5				A		
	▼			(SP) SAND: Fine sand, Wet, Pale orange/brown				
		2.0				A		
		2.5				A		
		3.0				A		
		3.5				A		
		4.0				A		
		4.5				A		

BH 9 TERMINATED AT 4.5m – LIMIT OF INVESTIGATION

METHOD

AD	Auger Drilling
C	Casing
MS	Mud Support
NMLC	Rock Coring
RR	Rock Roller
TC	Tri Cone
WB	Wash Bore

WATER

▼	Water Level
►	Water Seepage

WEATHERING

EW	Extremely
HW	Highly
DW	Distinctly
MW	Moderately
SW	Slightly
F	Fresh

CONSISTENCY / DENSITY / ROCK STRENGTH

VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS

U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	**Date:**	22/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 10
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		1.0				A		
		1.5				A		
	►	2.0		(SP) SAND: Fine sand, Wet, Pale orange/brown		A		
		2.5				A		
		3.0				A		
		3.5				A		
		4.0				A		
		4.5				A		

Continued on Page 2

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	22/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 10
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 2 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		5.0		(SP) SAND: Fine sand, Wet, Pale orange/brown		A		ALLUVIUM
		5.5						
		6.0						
		6.5						
		7.0						
		7.5						
		8.0						
		8.5						
		9.0						

BH 10 TERMINATED AT 5.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	22/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 11
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0		(SP) SAND: Fine sand, Trace of silt, Moist, Grey				FILL
				(SP) SAND: Fine sand, Moist, Pale orange/brown				ALLUVIUM
		0.5				A		
		1.0				A		
	►	1.5				A		
				(SP) SAND: Fine sand, Wet, Pale orange/brown				
		2.0				A		
		2.5				A		
		3.0				A		
		3.5				A		
		4.0				A		
		4.5				A		

BH 11 Continued on Page 2

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By: DAW	**Date:** 22/06/16	**Checked By:** HT	**Date:** 28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 11
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 2 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		5.0		(SP) SAND: Fine sand, Wet, Pale orange/brown		A		ALLUVIUM
		5.5						
		6.0						
		6.5						
		7.0						
		7.5						
		8.0						
		8.5						
		9.0						

BH 11 TERMINATED AT 5.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	22/06/16	Checked By:	HT	Date:	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 12
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD				(SM) Silty SAND: Fine to coarse sand,With fine to medium gravel, Moist, Dark grey				FILL
		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		1.0				A		
	▶	1.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		
		2.0				A		
		2.5				A		
		3.0				A		
		3.5				A		
		4.0				A		
		4.5				A		

BH 12 TERMINATED AT 4.5m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
▶	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By: DAW	**Date:** 23/06/16	**Checked By:** HT	**Date:** 28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 13
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Dark grey		A		FILL
		1.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		1.5				A		
		2.0				A		
	▶	2.5		(SP) SAND: Fine sand, Wet, Pale orange/brown		A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 13 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
▶	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	23/06/16	Checked By:	HT	Date:	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 14
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		1.0				A		
		1.5				A		
	►	2.0		(SP) SAND: Fine sand, Wet, Pale orange/brown		A		
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 14 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	23/06/16	Checked By:	HT	Date:	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 15
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 1

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		ALLUVIUM
		1.0				A		
	►	1.5				A		
		2.0		(SP) SAND: Fine sand, Wet, Pale orange/brown		A		
		2.5				A		
		3.0				A		
		3.5						
		4.0						
		4.5						

BH 15 TERMINATED AT 3.0m – LIMIT OF INVESTIGATION

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By: DAW	**Date:** 23/06/16	**Checked By:** HT	**Date:** 28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 16
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		1.0				A		
	►	1.5				A		
		2.0				A		
		2.5		(SP) SAND: Fine sand, Wet, Orange/brown		A		ALLUVIUM
		3.0				A		
		3.5				A		
		4.0				A		
		4.5		(SP) SAND: Fine sand, Wet, Pale orange/brown		A		

BH 16 Continued on Page 2

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	23/06/16	**Checked By:**	HT	**Date:**	28/06/16

GEOTECH INVESTIGATIONS PTY LTD

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486
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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 16
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 2 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		5.0		(SP) SAND: Fine sand, Wet, Pale orange/brown		A		ALLUVIUM
		5.5				A		
		6.0						
		6.5						
		7.0						
		7.5						
		8.0						
		8.5						
		9.0						

BH 16 TERMINATED AT 5.5m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	**Date:**	23/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 17
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Orange/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0				A		
		2.5				A		
		3.0				A		
		3.5				A		
		4.0				A		
		4.5				A		

BH 17 Continued on Page 2

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By: DAW	**Date:** 24/06/16	**Checked By:** HT	**Date:** 28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 17
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 2 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		5.0		(SP) SAND: Fine sand, Moist, Orange/brown		A		FILL
		5.5				A		
		6.0						
		6.5						
		7.0						
		7.5						
		8.0						
		8.5						
		9.0						

BH 17 TERMINATED AT 5.5m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	**Date:**	24/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 18
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Orange/brown		A		FILL
		1.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		
		1.5				A		
		2.0				A		
		2.5				A		
		3.0				A		
		3.5				A		
		4.0				A		
		4.5				A		

BH 18 Continued on Page 2

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	24/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 18
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 2 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		5.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		5.5				A		
		6.0						
		6.5						
		7.0						
		7.5						
		8.0						
		8.5						
		9.0						

BH 18 TERMINATED AT 5.5m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	Date:	24/06/16	Checked By:	HT	Date:	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 19
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0				A		
		2.5				A		
		3.0				A		
		3.5				A		
		4.0				A		
		4.5				A		

BH 19 Continued on Page 2

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	24/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 19
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 2 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		5.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		5.5				A		
		6.0						
		6.5						
		7.0						
		7.5						
		8.0						
		8.5						
		9.0						

BH 19 TERMINATED AT 5.5m – LIMIT OF INVESTIGATION

METHOD

AD	Auger Drilling
C	Casing
MS	Mud Support
NMLC	Rock Coring
RR	Rock Roller
TC	Tri Cone
WB	Wash Bore

WATER

▼	Water Level
►	Water Seepage

WEATHERING

EW	Extremely
HW	Highly
DW	Distinctly
MW	Moderately
SW	Slightly
F	Fresh

CONSISTENCY / DENSITY / ROCK STRENGTH

VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS

U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	**Date:**	24/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 20
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0				A		
		2.5				A		
		3.0				A		
		3.5				A		
		4.0				A		
		4.5		(SP) SAND: Fine sand, Moist, Orange/brown		A		

BH 20 Continued on Page 2

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	24/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 20
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 2 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		5.0		(SP) SAND: Fine sand, Moist, Orange/brown		A		FILL
		5.5				A		
		6.0						
		6.5						
		7.0						
		7.5						
		8.0						
		8.5						
		9.0						

BH 20 TERMINATED AT 5.5m – LIMIT OF INVESTIGATION

METHOD		WEATHERING	
AD	Auger Drilling	EW	Extremely
C	Casing	HW	Highly
MS	Mud Support	DW	Distinctly
NMLC	Rock Coring	MW	Moderately
RR	Rock Roller	SW	Slightly
TC	Tri Cone	F	Fresh
WB	Wash Bore		

WATER	
▼	Water Level
►	Water Seepage

CONSISTENCY / DENSITY / ROCK STRENGTH			
VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS	
U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	**Date:**	24/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 21
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 1 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		0.5		(SP) SAND: Fine sand, Moist, Grey/brown		A		FILL
		1.0				A		
		1.5				A		
		2.0				A		
		2.5				A		
		3.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		
		3.5				A		
		4.0				A		
		4.5				A		

BH 21 Continued on Page 2

METHOD		WEATHERING		CONSISTENCY / DENSITY / ROCK STRENGTH				SAMPLES / TESTS	
AD	Auger Drilling	EW	Extremely	VS	Very Soft	D	Dense	U( )	Undisturbed (size in mm)
C	Casing	HW	Highly	S	Soft	VD	Very Dense	D	Disturbed
MS	Mud Support	DW	Distinctly	F	Firm	Fb	Friable	BS	Bulk Sample
NMLC	Rock Coring	MW	Moderately	St	Stiff	ELw	Extremely Low	DCP	Dynamic Cone Penetrometer
RR	Rock Roller	SW	Slightly	VSt	Very Stiff	VLw	Very Low	SPT	Standard Penetrometer Test
TC	Tri Cone	F	Fresh	Hd	Hard	Lw	Low	N	Number of blows for SPT / 300mm
WB	Wash Bore			VL	Very Loose	M	Medium	VS	Vane Shear
WATER				L	Loose	H	High	A	Acid Sulfate Sample
▼	Water Level			MD	Medium Dense	VH	Very High	PP	Pocket Penetrometer (kPa)
►	Water Seepage								

Logged By:	DAW	**Date:**	24/06/16	**Checked By:**	HT	**Date:**	28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

GPS:	N:		E:	

CLIENT: HUTCHINSON BUILDERS	**BOREHOLE I.D. :** BH 21
PROJECT: CASUARINA TOWN CENTRE MOD 10	**JOB No.:** GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 / **HOLE DIAMETER:** 110mm	**PAGE:** 2 of 2

Method	Water	Depth (m)	Graphic Log	Material Description	Consistency / Rel. Density	Sample / Test	DCP Blows / 100mm	Structure and additional observation
AD		5.0		(SP) SAND: Fine sand, Moist, Pale orange/brown		A		FILL
		5.5				A		
		6.0						
		6.5						
		7.0						
		7.5						
		8.0						
		8.5						
		9.0						

BH 21 TERMINATED AT 5.5m – LIMIT OF INVESTIGATION

METHOD

AD	Auger Drilling
C	Casing
MS	Mud Support
NMLC	Rock Coring
RR	Rock Roller
TC	Tri Cone
WB	Wash Bore

WATER

▼	Water Level
►	Water Seepage

WEATHERING

EW	Extremely
HW	Highly
DW	Distinctly
MW	Moderately
SW	Slightly
F	Fresh

CONSISTENCY / DENSITY / ROCK STRENGTH

VS	Very Soft	D	Dense
S	Soft	VD	Very Dense
F	Firm	Fb	Friable
St	Stiff	ELw	Extremely Low
VSt	Very Stiff	VLw	Very Low
Hd	Hard	Lw	Low
VL	Very Loose	M	Medium
L	Loose	H	High
MD	Medium Dense	VH	Very High

SAMPLES / TESTS

U( )	Undisturbed (size in mm)
D	Disturbed
BS	Bulk Sample
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetrometer Test
N	Number of blows for SPT / 300mm
VS	Vane Shear
A	Acid Sulfate Sample
PP	Pocket Penetrometer (kPa)

Logged By:	DAW	**Date:**	24/06/16	**Checked By:**	HT	**Date:**	28/06/16

SCOPE These standard notes may be of assistance when understanding terms and recommendations given in this report. These notes are for general conditions and not all terms given may be of concern to the report attached. The descriptive terms adopted by Geotech Investigations Pty Ltd are given below and are largely consistent with Australian Standards AS1726-1993 'Geotechnical Site Investigations'.

CLIENT can be described and is limited to the financier of this geotechnical investigation.

LEGALITY and privacy of this document is based on communication between Geotech Investigations Pty Ltd and the client. Unless indicated otherwise the report was prepared specifically for the client involved and for the purposes indicated by the client. Use by any other party for any purpose, or by the client for a different purpose, will result in recommendations becoming invalid and Geotech Investigations Pty Ltd will hold no responsibility for problems which may arise.

GEOTECHNICAL REPORTS are predominantly derived using professional estimates determined from the results of fieldwork, in-situ and laboratory testing and experience from previous investigations in the area, from which geotechnical engineers then formulate an opinion about overall subsurface conditions. The client must be made aware that the investigations are undertaken to ensure minimal site impact using test-pits or small diameter boreholes and soil conditions on-site may vary from those encountered during the investigation.

CLIENTS RESPONSIBILITY to notify this office should there be adjustments in proposed structure/location or inconsistencies with material descriptions given in this report and those encountered on site. Geotech Investigations Pty Ltd is able to provide a range of services from on-site inspections to full project supervision to confirm recommendations given in the report.

CSIRO Publication BTF 18 'Foundation Maintenance and Footing Performance: A Homeowner's Guide' explains how to adequately maintain drainage during and post construction which lies as the responsibility of the client. Suitable drainage ensures recommendations given in this report remain valid.

INVESTIGATION METHODS adopted by Geotech Investigations Pty Ltd are designed to incorporate individual project-specific factors to obtain information on the physical properties of soil and rock around a site to design earthworks and foundations for proposed structures. The following methods of investigation currently adopted by this company are summarised below:-

HAND AUGER – investigations enable field work to be undertaken where access is limited. The materials must have sufficient cohesion to stand unsupported in an unlined borehole and there must be no large cobbles boulders or other obstructions which would prevent rotation of the auger.

TEST-PITS – investigations are carried out with an excavator or backhoe, allowing a visual inspection of sub-surface material in-situ and from samples removed. The limit of investigation is restricted by the reach of the excavator or backhoe.

CONTINUOUS SPIRAL FLIGHT AUGERING TECHNIQUES – investigations are advanced by pushing a 100mm diameter spiral into the sub-surface and withdrawing it at regular intervals to allow sampling or testing as it emerges.

WASH BORING – investigations are advanced by removing the loosened soil from the borehole by a stream of water or drilling mud issuing from the lower end of the wash pipe which is worked up and down or rotated by hand in the borehole. The water or mud carries the soil up the borehole where it overflows at ground level where the soil in suspension is allowed to settle in a pond or tank and the fluid is re-circulated or discharged to waste as required.

NON-CORE ROTARY DRILLING – investigations are advanced using a rotary bit with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from feel and rate of penetration.

ROTARY MUD DRILLING – is carried out as above using mud as support and circulating fluid for the borehole drilling. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling.

CONTINUOUS CORE DRILLING – investigations are carried out in rock material, specimens of rock in the form of cylindrical cores are recovered from the drill holes by the means of core barrel. The core barrel is provided at its lower end with a detachable core bit which carries industrial diamond chips in a matrix of metal. Rotation of the barrel by means of the drill rods causes the core bit to cut an annulus in the rock, the cuttings being washed to the surface by a stream of pumped down the hollow drill rods.

TESTING METHODS adopted by Geotech Investigations Pty Ltd to determine soil properties include but not limited to the following:-

U50 – Undisturbed samples are obtained by inserting a 50mm diameter thin-walled steel tube into the material and withdrawing with a sample of the soil in a moderately undisturbed condition.

PP – Pocket Penetrometer tests are commonly used on thin walled tube samples of cohesive soils to evaluate consistency and approximate unconfined compressive strength of saturated cohesive soils. They may also be used for the same purpose in freshly excavated trenches.

VS – Vane Shear test are commonly used in-situ or on thin walled tube samples of cohesive soils by introducing the vane into the material where the measurement of the undrained shear strength is required. Then the vane is rotated and the torsional force required to cause shearing is calculated.

DCP – Dynamic Cone Penetrometer tests are commonly used in-situ to measure the strength attributes of penetrability and compaction of sub-surface materials.

SPT – Standard Penetration Tests are commonly uses to determine the density of granular deposits but are occasionally used in cohesive material as a means of determining strength and also of obtaining a relatively undisturbed sample. Samples and results are obtained by driving a 50mm diameter split tube through blows from a slide hammer with a weight of 63.5kg falling through a distance of 760mm. Blow counts are recorded for 150mm intervals with the sum of the number of blows required for the second and third 150mm of penetration is termed the "standard penetration resistance" or the "N-value".

GEOLOGICAL ORIGINS of sub-surface material plays a considerable role in the development of engineering parameters and have been summarised as follows:-

FILL – materials are man made deposits, which may be significantly more variable between test locations than naturally occurring soils.

RESIDUAL – soils are present in a region as a result of weathering over the geological time scale.

COLLUVIAL – soils have been deposited recently, on the geological time scale, as soils being transported slowly down slope due to gravitational creep.

ALLUVIAL – soils have been deposited recently, on the geological time scale, as water borne materials.

AEOLIAN – soils have been deposited recently, on the geological time scale, as wind borne materials.

SOIL DESCRIPTION is based on an assessment of disturbed samples, as recovered from boreholes and excavations, and from undisturbed materials. Soil descriptions adopted by Geotech Investigations Pty Ltd are largely consistent with AS 1726-1993 '*Geotechnical Site Investigation'.* Soil types are described according to the predominating particle size, qualified by the grading of other particles present on the following bases detailed in Table 1.

COHESIVE SOILS ability to hold moisture known as its liquid limit is the state of a soil when it goes from a solid state to a liquid state described in Table 2

TABLE 1

Soil Classification	Particle Size
Clay	< 0.002 mm
Silt	0.002 – 0.06 mm
Sand	0.06 – 2.00 mm
Gravel	2.00 – 60.0 mm

TABLE 2

Descriptive Type	Range of Liquid Limit %
Of low plasticity	≤ 35
Of medium plasticity	> 35 ≤ 50
Of high plasticity	> 50

Furthermore to soil description cohesive soils are described on their strength (assessed in conjunction with penetration tests) and liquid limit. Non-cohesive soil strengths are described by their density index. With descriptions for cohesive and non-cohesive soils summarised in Table 3.

TABLE 3

COHESIVE SOILS		NON-COHESIVE SOILS	
Term	**Undrained Shear Strength kPa**	**Term**	**Density Index %**
Very soft	≤ 12	Very Loose	≤15
Soft	> 12 ≤25	Loose	> 15 ≤35
Firm	> 25 ≤50	Medium Dense	> 35 ≤65
Stiff	> 50 ≤100	Dense	> 65 ≤85
Very Stiff	> 100 ≤200	Very Dense	> 85
Hard	> 200		

Description of terms used to describe material portion are summarised in Table 4.

TABLE 4

COARSE GRAINIED SOILS		FINE GRAINED SOILS	
% Fines	**Modifier**	**% Coarse**	**Modifier**
≤ 5	Omit or 'trace'	≤ 15	Omit or 'trace'
> 5 ≤12	Describe as 'with'	> 15 ≤30	Describe as 'with'
> 12	Prefix soil as 'silty/clayey'	> 30	Prefix soil as 'sandy/gravelly'

ROCK DESCRIPTIONS are determined from disturbed samples or specimens collected during field investigations. A rocks presence of defects and the effects of weathering are likely to have a great influence on engineering behaviour.

Rock Material Weathering Classification is summarised in Table 5.

TABLE 5

Term	Symbol	Definition
Residual Soils	-	Soil developed on extremely weathered 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 Rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water
Distinctly Weathered Rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to decomposition of weathering products in pores
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock
Fresh rock	FR	Rock shows no signs of decomposition or staining

Rock Material Strength Classification is summarised in Table 6.

TABLE 6

Term	Symbol	Point load index (MPa) I_s50	Field guide to strength
Extremely Low	EL	≤0.03	Easily remoulded by hand to a material with soil properties
Very Low	VL	>0.03 ≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3cm thick can be broken by finger pressure
Low	L	>0.1 ≤0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling
Medium	M	>0.3 ≤1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty
High	H	>1.0 ≤3.0	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer
Very High	VH	>3.0 ≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer
Extremely High	EH	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer

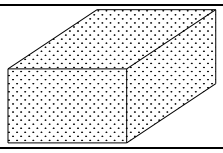
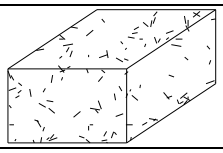
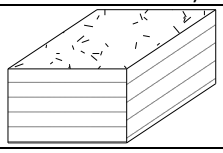
Rock Material Defect Shapes are summarised in Table 7.

TABLE 7

Term	Description
Planar	The defect does not vary in orientation.
Curved	The defect has a gradual change in orientation
Undulating	The defect has a wavy surface
Stepped	The defect has one or more well defined steps.
Irregular	The defect has many sharp changes of orientation
Smooth	The defect has a flat even finish
Rough	The defect has a irregular disoriented finish

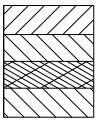
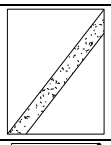
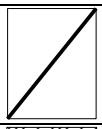
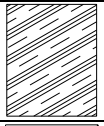
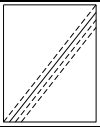
Rock Material Texture and Fabric are summarised in Table 8.

TABLE 8

Geological Description	Massive		Layered (Bedded foliate cleaved)
Diagram			
Fabric Type	Effectively homogenous and isotropic. Bulky or equi-dimensional grains uniformly distributed	Effectively homogeneous and isotropic. Elongated	Effective homogeneous with planar anisotropy. Elongated or tabular grains or pores in a layered arrangement

Rock Material Defect Type is summarised in Table 9

TABLE 9

Term	Definition	Diagram
Bedding	Signifying existence of beds or laminate. Planes dividing sedimentary rocks of the same or different lithology. Structure occurring in granite and similar rocks evident in a tendency to split more or less horizontally to the land surface	
Cross Bedding	Also called cross-lamination or false bedding. The structure commonly present in granular sedimentary rocks, which consists of tabular, irregularly lenticular or wedge-shaped bodies lying essentially parallel to the general stratification and which them selves show pronounced lamination structure in which the laminae are steeply inclined to the general bedding.	
Crushed Seam	A fracture at a more or less acute angle to applied force generally with some pulverized material along its surface	
Joint	A fracture in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.	
Parting	A small joint in rock or a layered rock where the tendency of crystals to separate along certain planes that are not true cleavage planes.	
Sheared Zone	A fracture that results from stresses which tend to shear one part of a specimen past the adjacent part	

APPENDIX C

LABORATORY TEST RESULTS – MAZLAB PTY LTD

MAZLAB Pty Ltd
Environmental Testing, Sampling and Drilling (Vibracore)
ABN 90 151 684 436 ACN 151 684 436

U1/ 33 MACHINERY DR., TWEED HEADS SOUTH, 2486
PO BOX 6879 TWEED HEADS SOUTH, 2486
PHONE: (07) 55239922
EMAIL: mazlab@bigpond.com

Client: Geotech Investigations **Project:** Casaurina Town Centre Mod 10 (GI 2785-a)

Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
38759	BH1-0.50	SAND(SP) grey brown	Nil	Nil	7.0	4.8
38760	BH1-1.00	SAND(SP) pale orange brown	Nil	Nil	6.7	5.0
38761	BH1-1.50	SAND(SP) pale orange brown	Nil	Nil	6.7	4.9
38762	BH1-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.0
38763	BH1-2.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.4
38764	BH1-3.00	SAND(SP) pale orange brown	Nil	Nil	6.7	5.5
38765	BH2-0.50	SAND(SP) pale orange brown	Nil	Nil	6.8	5.3
38766	BH2-1.00	SAND(SP) pale orange brown	Nil	Nil	6.7	5.4
38767	BH2-1.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.1
38768	BH2-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.4
38769	BH2-2.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.7
38770	BH2-3.00	SAND(SP) pale orange brown	Nil	Nil	8.1	6.3
38771	BH3-0.50	SAND(SP) pale orange brown	Nil	Nil	7.3	5.2
38772	BH3-1.00	SAND(SP) pale orange brown	Nil	Nil	6.9	4.3
38773	BH3-1.50	SAND(SP) pale orange brown	Nil	Nil	6.6	4.7
38774	BH3-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	4.9
38775	BH3-2.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.1
38776	BH3-3.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.3

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
38777	BH4-0.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.2
38778	BH4-1.00	SAND(SP) pale orange brown	Nil	Nil	6.6	4.7
38779	BH4-1.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.2
38780	BH4-2.00	SAND(SP) pale orange brown	Nil	Nil	6.7	4.6
38781	BH4-2.50	SAND(SP) pale orange brown	Nil	Nil	6.7	4.7
38782	BH4-3.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.0
38783	BH5-0.50	SAND(SP) pale orange brown	Nil	Nil	6.5	5.3
38784	BH5-1.00	SAND(SP) pale orange brown	Nil	Nil	6.6	4.5
38785	BH5-1.50	SAND(SP) pale orange brown	Nil	Nil	6.5	5.3
38786	BH5-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.5
38787	BH5-2.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.2
38788	BH5-3.00	SAND(SP) pale orange brown	Nil	Nil	6.9	5.8
38789	BH6-0.50	SAND(SP) pale orange brown	Nil	Nil	6.8	4.7
38790	BH6-1.00	SAND(SP) pale orange brown	Nil	Nil	6.6	3.7
38791	BH6-1.50	SAND(SP) pale orange brown	Nil	Nil	6.5	4.7
38792	BH6-2.50	SAND(SP) pale orange brown	Nil	Nil	7.8	6.0
38793	BH6-3.00	SAND(SP) pale orange brown	Nil	Nil	8.6	6.9

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38794	BH7-0.50	Silty SAND(SM) dark grey	Nil	Nil	8.0	5.8
38795	BH7-1.00	Silty SAND(SM) dark grey	Nil	Nil	8.4	6.3
38796	BH7-1.50	SAND(SP) pale orange brown	Nil	Nil	8.6	6.7
38797	BH7-2.00	SAND(SP) pale orange brown	Nil	Nil	8.8	7.0
38798	BH7-2.50	SAND(SP) pale orange brown	Nil	Nil	8.8	6.9
38799	BH7-3.00	SAND(SP) pale orange brown	Nil	Nil	8.7	6.6
38800	BH8-0.50	Silty SAND(SM) dark grey	Nil	Nil	8.5	6.4
38801	BH8-1.00	Silty SAND(SM) dark grey	Nil	Nil	8.4	6.5
38802	BH8-1.50	SAND(SP) pale orange brown	Nil	Nil	8.7	7.0
38803	BH8-2.00	SAND(SP) pale orange brown	Nil	Nil	8.6	6.7
38804	BH8-2.50	SAND(SP) pale orange brown	Nil	Nil	8.4	6.5
38805	BH8-3.00	SAND(SP) pale orange brown	Nil	Nil	8.5	6.5
38806	BH9-0.50	SAND(SP) pale orange brown	Nil	Nil	7.7	5.4
38807	BH9-1.00	SAND(SP) pale orange brown	Nil	Nil	7.4	5.1
38808	BH9-1.50	SAND(SP) pale orange brown	Nil	Nil	7.2	5.1
38809	BH9-2.00	SAND(SP) pale orange brown	Nil	Nil	7.1	5.0
38810	BH9-2.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.1
38811	BH9-3.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.1
38812	BH9-3.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.2
38813	BH9-4.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.2
38814	BH9-4.50	SAND(SP) pale orange brown	Nil	Nil	6.8	5.1

Checked By: Date: 3/7/16.

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Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
38815	BH10-0.50	SAND(SP) pale orange brown	Nil	Nil	6.8	5.2
38816	BH10-1.00	SAND(SP) pale orange brown	Nil	Nil	6.7	5.0
38817	BH10-1.50	SAND(SP) pale orange brown	Nil	Nil	6.6	4.7
38818	BH10-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.4
38819	BH10-2.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.3
38820	BH10-3.00	SAND(SP) pale orange brown	Nil	Nil	7.3	6.1
38821	BH10-3.50	SAND(SP) pale orange brown	Nil	Nil	7.2	5.6
38822	BH10-4.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.4
38823	BH10-4.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.3
38824	BH10-5.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.1
38825	BH11-0.50	SAND(SP) grey	Nil	Nil	6.6	4.7
38826	BH11-1.00	SAND(SP) pale orange brown	Nil	Nil	6.5	4.6
38827	BH11-1.50	SAND(SP) pale orange brown	Nil	Nil	6.5	5.1
38828	BH11-2.00	SAND(SP) pale orange brown	Nil	Nil	6.4	5.0
38829	BH11-2.50	SAND(SP) pale orange brown	Nil	Nil	6.5	5.0
38830	BH11-3.00	SAND(SP) pale orange brown	Nil	Nil	7.5	6.1
38831	BH11-3.50	SAND(SP) pale orange brown	Nil	Nil	7.4	5.8
38832	BH11-4.00	SAND(SP) pale orange brown	Nil	Nil	7.2	5.7
38833	BH11-4.50	SAND(SP) pale orange brown	Nil	Nil	7.2	5.5
38834	BH11-5.00	SAND(SP) pale orange brown	Nil	Nil	7.2	5.7

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
38835	BH12-0.50	Silty SAND(SM) dark grey	Nil	Nil	7.8	6.1
38836	BH12-1.00	SAND(SP) pale orange brown	Nil	Nil	8.2	6.2
38837	BH12-1.50	SAND(SP) pale orange brown	Nil	Nil	7.5	5.8
38838	BH12-2.00	SAND(SP) pale orange brown	Nil	Nil	7.2	5.8
38839	BH12-2.50	SAND(SP) pale orange brown	Nil	Nil	7.1	5.5
38840	BH12-3.00	SAND(SP) pale orange brown	Nil	Nil	7.0	5.7
38841	BH12-3.50	SAND(SP) pale orange brown	Nil	Nil	7.1	5.5
38842	BH12-4.00	SAND(SP) pale orange brown	Nil	Nil	7.2	5.8
38843	BH12-4.50	SAND(SP) pale orange brown	Nil	Nil	7.1	5.1
38444	BH13-0.50	Silty SAND(SM) dark grey	Nil	Nil	7.0	5.4
38845	BH13-1.00	SAND(SP) pale orange brown	Nil	Nil	6.9	5.3
38846	BH13-1.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.1
38847	BH13-2.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.3
38848	BH13-2.50	SAND(SP) pale orange brown	Nil	Nil	7.0	5.7
38849	BH13-3.00	SAND(SP) pale orange brown	Nil	Nil	6.9	5.6
38850	BH14-0.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.0
38851	BH14-1.00	SAND(SP) pale orange brown	Nil	Nil	6.5	4.9
38852	BH14-1.50	SAND(SP) pale orange brown	Nil	Nil	6.5	4.6
38853	BH14-2.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.7
38854	BH14-2.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.9
38855	BH14-3.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.7

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Client: Geotech Investigations **Project:** Casaurina Town Centre Mod 10 (GI 2785-a)

Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
38856	BH15-0.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.8
38857	BH15-1.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.8
38858	BH15-1.50	SAND(SP) pale orange brown	Nil	Nil	6.4	4.9
38859	BH15-2.00	SAND(SP) pale orange brown	Nil	Nil	6.4	5.1
38860	BH15-2.50	SAND(SP) pale orange brown	Nil	Nil	6.3	5.1
38861	BH15-3.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.9
38908	BH16-0.50	SAND(SP) pale orange brown	Nil	Nil	6.3	7.2
38909	BH16-1.00	SAND(SP) pale orange brown	Nil	Nil	7.5	6.4
38910	BH16-1.50	SAND(SP) pale orange brown	Nil	Nil	7.9	6.4
38911	BH16-2.00	SAND(SP) pale orange brown	Nil	Nil	7.8	6.4
38912	BH16-2.50	SAND(SP) pale orange brown	Nil	Nil	7.7	6.1
38913	BH16-3.00	SAND(SP) orange brown	Nil	Nil	7.4	5.9
38914	BH16-3.50	SAND(SP) orange brown	Nil	Nil	7.3	5.5
38915	BH16-4.00	SAND(SP) orange brown	Nil	Nil	7.4	5.4
38916	BH16-4.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.6
38917	BH16-5.00	SAND(SP) pale orange brown	Nil	Nil	7.0	5.4
38918	BH16-5.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.2

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Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
38919	BH17-0.50	SAND(SP) orange brown	Nil	Nil	6.5	4.8
38920	BH17-1.00	SAND(SP) orange brown	Nil	Nil	6.7	5.2
38921	BH17-1.50	SAND(SP) orange brown	Nil	Nil	6.6	5.3
38922	BH17-2.00	SAND(SP) orange brown	Nil	Nil	6.6	5.3
38923	BH17-2.50	SAND(SP) orange brown	Nil	Nil	6.6	4.9
38924	BH17-3.00	SAND(SP) orange brown	Nil	Nil	6.6	5.0
38925	BH17-3.50	SAND(SP) orange brown	Nil	Nil	6.5	3.9
38926	BH17-4.00	SAND(SP) orange brown	Nil	Nil	6.3	3.7
38927	BH17-4.50	SAND(SP) orange brown	Nil	Nil	6.3	3.7
38928	BH17-5.00	SAND(SP) orange brown	Nil	Nil	6.3	5.5
38929	BH17-5.50	SAND(SP) orange brown	Nil	Nil	6.0	3.7
38930	BH18-0.50	SAND(SP) orange brown	Nil	Nil	6.1	4.3
38931	BH18-1.00	SAND(SP) pale orange brown	Nil	Nil	6.2	4.3
38932	BH18-1.50	SAND(SP) pale orange brown	Nil	Nil	6.2	4.6
38933	BH18-2.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.6
38934	BH18-2.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.5
38935	BH18-3.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.2
38936	BH18-3.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.2
38937	BH18-4.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.3
38938	BH18-4.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.4
38939	BH18-5.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.2
38940	BH18-5.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.3

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
38941	BH19-0.50	SAND(SP) pale orange brown	Nil	Nil	6.1	4.1
38942	BH19-1.00	SAND(SP) pale orange brown	Nil	Nil	6.1	4.6
38943	BH19-1.50	SAND(SP) pale orange brown	Nil	Nil	5.8	3.6
38944	BH19-2.00	SAND(SP) pale orange brown	Nil	Nil	6.0	4.0
38945	BH19-2.50	SAND(SP) pale orange brown	Nil	Nil	6.2	4.3
38946	BH19-3.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.4
38947	BH19-3.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.6
38948	BH19-4.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.8
38949	BH19-4.50	SAND(SP) pale orange brown	Nil	Nil	6.4	4.8
38950	BH19-5.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.1
38951	BH19-5.50	SAND(SP) pale orange brown	Nil	Nil	6.3	3.6
38952	BH20-0.50	SAND(SP) pale orange brown	Nil	Nil	6.4	5.6
38953	BH20-1.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.2
38954	BH20-1.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.3
38955	BH20-2.00	SAND(SP) pale orange brown	Nil	Nil	7.0	5.0
38956	BH20-2.50	SAND(SP) pale orange brown	Nil	Nil	6.8	4.9
38957	BH20-3.00	SAND(SP) pale orange brown	Nil	Nil	6.3	5.0
38958	BH20-3.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.7
38959	BH20-4.00	SAND(SP) pale orange brown	Nil	Nil	6.2	3.6
38960	BH20-4.50	SAND(SP) orange brown	Nil	Nil	6.1	3.9
38961	BH20-5.00	SAND(SP) orange brown	Nil	Nil	6.3	4.4
38962	BH20-5.50	SAND(SP) orange brown	Nil	Nil	5.9	3.8

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
38963	BH21-0.50	SAND(SP) grey brown	Nil	Nil	6.6	4.7
38964	BH21-1.00	SAND(SP) grey brown	Nil	Nil	7.8	5.2
38965	BH21-1.50	SAND(SP) grey brown	Nil	Nil	8.1	5.1
38966	BH21-2.00	SAND(SP) grey brown	Nil	Nil	8.5	6.1
38967	BH21-2.50	SAND(SP) grey brown	Nil	Nil	8.1	5.4
38968	BH21-3.00	SAND(SP) pale orange brown	Nil	Nil	8.1	5.2
38969	BH21-3.50	SAND(SP) pale orange brown	Nil	Nil	7.9	5.4
38970	BH21-4.00	SAND(SP) pale orange brown	Nil	Nil	7.5	5.4
38971	BH21-4.50	SAND(SP) pale orange brown	Nil	Nil	7.5	5.5
38972	BH21-5.00	SAND(SP) pale orange brown	Nil	Nil	7.3	5.3
38973	BH21-5.50	SAND(SP) pale orange brown	Nil	Nil	7.3	6.0

Checked By: Date: 3/7/16

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Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	ANC mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/ t)
38759	BH1-0.50	SAND(SP) grey brown	5.8	<2 <0.01%	13	-	-	13	Nil
38761	BH1-1.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38763	BH1-2.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38765	BH2-0.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38767	BH2-1.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38769	BH2-2.50	SAND(SP) pale orange brown	6.7	<2 <0.01%	-	-	NA	<2	Nil
38771	BH3-0.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38773	BH3-1.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38775	BH3-2.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38777	BH4-0.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38779	BH4-1.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38781	BH4-2.50	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil
38783	BH5-0.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38785	BH5-1.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38787	BH5-2.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38789	BH6-0.50	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Client: Geotech Investigations **Project:** Casaurina Town Centre Mod 10 (GI 2785-a)

Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results – Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	ANC mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/ t)
38791	BH6-1.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38793	BH6-3.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38795	BH7-1.00	Silty SAND(SM) dark grey	7.8	<2 <0.01%	-	-	NA	<2	Nil
38797	BH7-2.00	SAND(SP) pale orange brown	8.4	<2 <0.01%	-	-	NA	<2	Nil
38799	BH7-3.00	SAND(SP) pale orange brown	7.0	<2 <0.01%	-	-	NA	<2	Nil
38801	BH8-1.00	Silty SAND(SM) dark grey	8.6	<2 <0.01%	-	-	NA	<2	Nil
38803	BH8-2.00	SAND(SP) pale orange brown	7.4	<2 <0.01%	-	-	NA	<2	Nil
38805	BH8-3.00	SAND(SP) pale orange brown	7.2	<2 <0.01%	-	-	NA	<2	Nil
38807	BH9-1.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38809	BH9-2.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38811	BH9-3.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38813	BH9-4.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38815	BH10-0.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38817	BH10-1.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38819	BH10-2.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38821	BH10-3.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Client: Geotech Investigations **Project:** Casaurina Town Centre Mod 10 (GI 2785-a)

Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results – Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	ANC mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/ t)
38823	BH10-4.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38825	BH11-0.50	SAND(SP) grey	6.4	<2 <0.01%	3	-	-	3	Nil
38827	BH11-1.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38829	BH11-2.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38831	BH11-3.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38833	BH11-4.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38835	BH12-0.50	Silty SAND(SM) dark grey	6.6	<2 <0.01%	-	-	NA	<2	Nil
38837	BH12-1.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38839	BH12-2.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38841	BH12-3.50	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil
38843	BH12-4.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38845	BH13-1.00	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil
38847	BH13-2.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38849	BH13-3.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38851	BH14-1.00	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38853	BH14-2.00	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS
Certificate of Test Results – Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	ANC mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/ t)
38855	BH14-3.00	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil
38857	BH15-1.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38859	BH15-2.00	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38861	BH15-3.00	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil
38908	BH16-0.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38910	BH16-1.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38912	BH16-2.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38914	BH16-3.50	SAND(SP) orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38916	BH16-4.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38918	BH16-5.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38920	BH17-1.00	SAND(SP) orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38922	BH17-2.00	SAND(SP) orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38924	BH17-3.00	SAND(SP) orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38926	BH17-4.00	SAND(SP) orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38928	BH17-5.00	SAND(SP) orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38930	BH18-0.50	SAND(SP) orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results – Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	ANC mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/ t)
38932	BH18-1.50	SAND(SP) pale orange brown	8.8	<2 <0.01%	-	-	NA	<2	Nil
38934	BH18-2.50	SAND(SP) pale orange brown	7.6	<2 <0.01%	-	-	NA	<2	Nil
38936	BH18-3.50	SAND(SP) pale orange brown	7.0	<2 <0.01%	-	-	NA	<2	Nil
38938	BH18-4.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38940	BH18-5.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38942	BH19-1.00	SAND(SP) pale orange brown	6.7	<2 <0.01%	-	-	NA	<2	Nil
38944	BH19-2.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38946	BH19-3.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38948	BH19-4.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38950	BH19-5.00	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38952	BH20-0.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38954	BH20-1.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38956	BH20-2.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38958	BH20-3.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38960	BH20-4.50	SAND(SP) orange brown	6.3	<2 <0.01%	3	-	-	3	Nil
38962	BH20-5.50	SAND(SP) orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil

Checked By: Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Client: Geotech Investigations **Project:** Casaurina Town Centre Mod 10 (GI 2785-a)

Mazlab Job No: GTI 2686 **Date:** 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results – Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	ANC mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/ t)
38964	BH21-1.00	SAND(SP) grey brown	6.9	<2 <0.01%	-	-	NA	<2	Nil
38966	BH21-2.00	SAND(SP) grey brown	7.9	<2 <0.01%	-	-	NA	<2	Nil
38968	BH21-3.00	SAND(SP) pale orange brown	7.2	<2 <0.01%	-	-	NA	<2	Nil
38970	BH21-4.00	SAND(SP) pale orange brown	7.0	<2 <0.01%	-	-	NA	<2	Nil
38972	BH21-5.00	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil

Checked By: Date: 3/7/16

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