

RGS01314.1-AB

11 July 2016

Stanwell Consulting
57 Irvine St
BANKSTOWN NSW 2200

Delivered via email to: stanwellc@gmail.com

Attention: Sam Awad

Dear Sam,

**RE: GEOTECHNICAL ASSESSMENT FOR PROPOSED TOWNHOUSE DEVELOPMENT
19 GREENVIEW CLOSE, FORSTER**

1. INTRODUCTION

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment for a proposed townhouse development at 19 Greenview Close, Forster (Lot 8 DP 806667). The provided drawings indicate that the proposed development involves the construction of five single and triple storey townhouses. The site is currently zoned R2 – Low Density Residential as per MidCoast Council's Local Environment Plan.

The purpose of the assessment was to provide an appraisal of the geotechnical conditions at the site to allow for the design of foundations and to assess for the presence of Acid Sulfate Soils (ASS) in the southern half of the site. It has been assumed that the structure will meet the performance expectations set out in AS2870-2011.

2. METHODOLOGY

Field work involved a general site walkover, observation of the site conditions, and the drilling of five boreholes (BH1 to BH5) within the proposed building footprint and stormwater drainage retention area. The subsurface profile encountered in the boreholes is presented on the attached Engineering Logs. The borehole locations are presented on Figure 1. Two laboratory Shrink-Swell tests were undertaken on representative samples of the clay encountered.



3. SITE CONDITIONS

The property occupies 1,810m², is irregular in shape and bound by Greenview Close to the north, existing residential properties to the east and west and by Tea Tree Road to the south.

The site is located in an area of gently to moderately undulating terrain and is situated toward the top of a north to south trending slope. The front portion of the site slopes toward the south and south west in the order of 1° – 3°. The back (southern) portion of the site slopes to the south and south west in the order of 3° – 5°. The proposed building site is comprised of thick grass and weeds. Pipers Bay is located approximately 180m to the south west of the site.

Drainage of the site is likely to be from a combination of surface infiltration and overland runoff into the Greenview Place street drainage system. At the time of the field work, the proposed building area was vacant.

Images of the site are provided below.



Location of 19 Greenview Cl, Forster



Looking south west over site from Greenview Cl.



Looking north over site from the rear of the property.



Looking south west over site showing the rear property boundary.

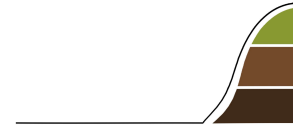


Looking north east over site toward Greenview Cl.

Reference to the 1:100,000 Bulahdelah Geology Map 9333 shows the property to be within an area underlain by the Bundook Beds that contain grey to brown lithic sandstone and siltstone, which is frequently cherty and ribbon banded, interbedded with massive greywackes and minor conglomerate and limestone.

The boreholes drilled within the proposed building area and stormwater drainage retention area encountered up to 0.3m of topsoil/fill, underlain by up to 0.55m of alluvium, underlain by extremely weathered siltstone to at least 1.6m depth.

Groundwater was not encountered in the boreholes. Groundwater levels fluctuate as a result of seasonal variations, temperature, rainfall and other similar factors, the influence of which may not have been apparent at the time of the assessment.



4. SITE CLASSIFICATION

Laboratory testing on two representative samples of alluvial clay from BH2 and BH5 indicated that the natural material at the site has a shrink-swell index of between 3.5% and 4.7%.

On the basis of the conditions encountered in the undisturbed natural ground and the laboratory test results, the site is classified as **Class 'M'** (Moderately Reactive) in accordance with AS2870-2011. Structural footings that are extended to found within the underlying very stiff natural alluvial clay and weathered siltstone can be designed based on a **Class 'M'** classification with a characteristic free surface movement of 40mm and an allowable bearing pressure of 100kPa. Footings and slabs can be designed on the basis of AS2870-2011 recommendations for a Class M site.

Where structures are founded partially within weathered rock and partially on clay soils, differential shrink-swell related movements can be accommodated either by provision of articulation or by placing all foundations within highly weathered rock.

Fill that is not placed and compacted as Controlled Fill should not be used for the support of high level footings. In such areas, footings should be deepened to extend through the fill to the underlying weathered rock. Footings placed on weathered rock in this manner can be designed on the basis of a maximum allowable end bearing pressure of 300kPa. All footings are to be founded outside or below all zones of influence resulting from existing or future service trenches.

Of particular importance will be the planting of future trees and shrubs that may affect the moisture profile in the vicinity of the footings. Potential surface movements must take into account the potential swelling effects resulting from the removal of the trees which have been calculated in accordance with the methodology outlined in AS2870-2011 (Appendix H).


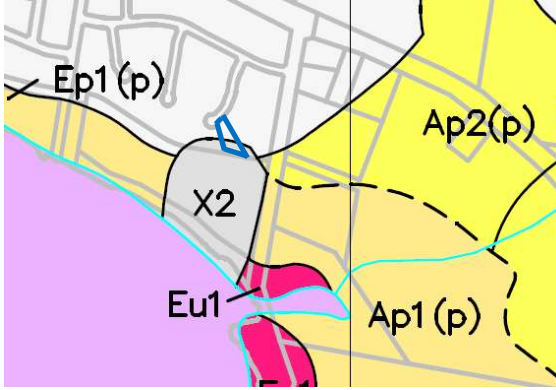
Any foundations located within areas where tree removal has previously been carried out will need to be taken through the disturbed ground to be founded on the undisturbed natural ground beneath. All organic root material should be removed from within the building footprint.

Footings should not be founded within topsoil or within fill.

5. ACID SULFATE SOILS

Reference to the Forster 1:25,000 Acid Sulfate Soil (ASS) Risk Map indicates that the northern half of the site is an area of where there is No Known Occurrence of ASS. The risk map also indicates that the southern half of the site is comprised of Disturbed Terrain. Soil investigations are required to assess areas of disturbed terrain for ASS potential.



	
<p>Location of site in red as indicated by Google Earth image</p>	<p>Extract from Forster 1:25,000 ASS Risk Map indicates the site (shown in blue) to be an area of high probability of occurrence of ASS.</p>

Acid Sulfate Soils (ASS) produce sulphuric acid when exposed to oxygen due to the presence of iron sulphides in the form of pyrite within the soil matrix. These soils form when iron-rich sediments are deposited in saltwater or brackish water environments. Prior to oxidation, these pyritic soils are referred to as Potential ASS. ASS that have produced acid as a result of oxidation are referred to as Actual ASS. They typically occur in natural, low-lying coastal depositional environments below approximately 5m AHD. In the field, ASS are generally identified as saline sediments such as alluvial or estuarine soils or bottom sediments in creeks and estuaries.

Laboratory testing of representative samples collected from boreholes BH1, BH3 and BH4 was undertaken. Test locations are shown on Figure 1.

Three samples obtained were screened for the presence of actual or potential ASS using methods 23Af and 22Bf of the ASSMAC Acid Sulfate Soils Manual. The test results are attached. The results indicated:

- The samples revealed pH_f values of 5.00 to 5.55 in distilled water. In this test, $pH < 4$ is an indicator of Actual ASS;
- The samples revealed pH_{FOX} values of 2.64, 2.98 and 3.26 in hydrogen peroxide. Values of less than 3 can be an indicator of Potential ASS.

To provide a more comprehensive assessment, the samples were submitted for Chromium Reducible Sulphur (CRS) analysis. A summary of the test results are presented in Table 1.



Table 1: Summary of ASS CRS Test Results

Borehole	Depth (m)	Texture	Acid Trail (mol H ⁺ /tonne)		Sulfur Trail (% S Oxidisable)		
			TAA	Action Criteria	S _{kcl}	S _{cr}	Action Criteria
BH1	0.5 – 0.7	Fine	43	18	0.004	0.005	0.03
BH3	0.2 – 0.5	Fine	67	18	0.004	0.010	0.03
BH4	0.3 – 0.5	Fine	104	18	0.003	0.010	0.03

Note: * Testing undertaken on the coarse fraction of material retained on 75µm sieve

A review of the above results indicates the following:

- Each of the samples recorded a Titratable Actual Acidity (TAA) above the adopted action criteria indicating the presence of actual acidity;
- Oxidisable sulfur (S_{cr}) results were below the adopted action criteria in each of the samples which indicates the acidity is not sulphuric in nature.

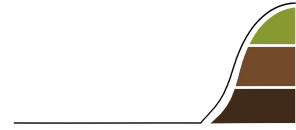
Based on the results, the soils encountered within the assessment are acidic in nature but are not considered to be Acid Sulfate Soils due to the absence of oxidisable sulfur. As such, an Acid Sulfate Soil Management Plan will not be required. However, it would be prudent to apply lime at a rate of 8kg/tonne (dry weight) to excavation spoil that is to be re-used in order to neutralise the acid which is present in the site soils. It is recommended that good quality agricultural lime be used and thoroughly mixed through before re-use.

6. LIMITATIONS

The subsurface information collected is specific to borehole locations only. Although efforts have been made to distribute boreholes to give a good spatial coverage of the site it is unlikely the information is indicative of the full range of conditions which may be encountered during construction. If conditions other than those described in this report are encountered during construction, further advice should be sought without delay. Shrink-swell related movements can be affected by alterations to the soil profile by cutting and filling, and by the suction related effects of trees close to the building area. The effects of any such cutting, filling, tree planting should be taken into account when selecting design values for differential movement across the building. It is recommended that all foundations be founded on similar materials to reduce the potential for differential movement.

This site classification is provided on the basis that the performance expectations set out in AS2870-2011 will be acceptable for the proposed structure.

Please do not hesitate to contact the undersigned if you have any questions regarding this or any other project, or require any additional consultations.



For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Andrew Hills

Environmental Engineer

Attached: Figure 1 – Borehole Location Plan
 Engineering Logs
 Laboratory Test Results



Legend

⊕ Borehole Location

Client	Stanwell Consulting	Job No.	RGS01314.1
Project:	Proposed Townhouse Development 19 Greenview Close, Forster	Drawn By:	APH
		Date:	8-Jul-16
Title:	Borehole Location Plan	Drawing No.	Figure 1



ENGINEERING LOG - BOREHOLE


CLIENT: Stanwell Consulting
PROJECT NAME: Proposed Townhouse Development

LOCATION: Refer to figure 1

BOREHOLE NO: BH1
PAGE: 1 OF 1
JOB NO: RGS01314.1
LOGGED BY: APH
DATE: 22/6/16

DRILL TYPE: Ute Mounted Drill Rig
BOREHOLE DIAMETER:

SURFACE RL: Not Measured m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
TC Bit	Not Encountered	0.50m	D	0.5		CL	FILL: Silty CLAY, low plasticity, brown, trace of Gravel, coarse grained, lots of roots	M < w _p				0.00: TOPSOIL/FILL
		CL				Silty Sandy CLAY: Low to medium plasticity, grey, brown, Sand fine to medium grained, some roots, trace Gravel fine to coarse grained	M < w _p	0.20: ALLUVIUM				
		CL				Silty CLAY: Low to medium plasticity, orange, brown, grey, some Gravel coarse grained, trace Sand fine to medium grained	M < w _p	F				0.75: EXTREMELY WEATHERED SILTSTONE
				1.20m			Hole Terminated at 1.20 m Practical Refusal on Extremely Weathered Siltstone					
				1.5								

LEGEND:		Notes, Samples and Tests		Consistency		UCS (kPa)	Moisture Condition	
Water		U ₅₀ 50mm Diameter tube sample		VS	Very Soft	<25	D	Dry
Water Level (Date and time shown)		CBR Bulk sample for CBR testing		S	Soft	25 - 50	M	Moist
Water Inflow		E Environmental sample (Glass jar, sealed and chilled on site)		F	Firm	50 - 100	W	Wet
Water Outflow		ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)		St	Stiff	100 - 200	W _p	Plastic Limit
Strata Changes		B Bulk Sample		VSt	Very Stiff	200 - 400	W _L	Liquid Limit
Gradational or transitional strata		Field Tests		H	Hard	>400		
Definitive or distinct strata change		PID Photoionisation detector reading (ppm)		Fb	Friable			
		DCP(x-y) Dynamic penetrometer test (test depth interval shown)		Density	V	Very Loose	Density Index <15%	
		HP Hand Penetrometer test (UCS kPa)			L	Loose	Density Index 15 - 35%	
					MD	Medium Dense	Density Index 35 - 65%	
					D	Dense	Density Index 65 - 85%	
					VD	Very Dense	Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE


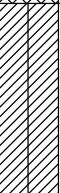

CLIENT: Stanwell Consulting
PROJECT NAME: Proposed Townhouse Development

LOCATION: Refer to figure 1

BOREHOLE NO: **BH2**
PAGE: 1 OF 1
JOB NO: RGS01314.1
LOGGED BY: APH
DATE: 22/6/16

DRILL TYPE: Ute Mounted Drill Rig
BOREHOLE DIAMETER:

SURFACE RL: Not Measured m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
TC Bit	Not Encountered					CL	FILL: Silty CLAY, low plasticity, brown, lots of roots, some Gravel fine to coarse grained	M < w _p	VSt			0.00: TOPSOIL/FILL
		0.25m				CH	Silty CLAY: Medium to high plasticity, brown, grey, trace of Gravel fine to coarse grained, trace roots	M > w _p				0.20: ALLUVIUM
		0.54m		0.5			CL	Silty CLAY: Low to medium plasticity, orange, grey, brown, trace Sand fine to medium grained, trace of Gravel fine to coarse grained	M < w _p			F
				1.5			Hole Terminated at 1.50 m Practical Refusal on Extremely Weathered Siltstone					

LEGEND:
Water
Water Level (Date and time shown)
Water Inflow
Water Outflow
Strata Changes
Gradational or transitional strata
Definitive or distinct strata change

Notes, Samples and Tests
U₅₀ 50mm Diameter tube sample
CBR Bulk sample for CBR testing
E Environmental sample (Glass jar, sealed and chilled on site)
ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B Bulk Sample
Field Tests
PID Photoionisation detector reading (ppm)
DCP(x-y) Dynamic penetrometer test (test depth interval shown)
HP Hand Penetrometer test (UCS kPa)

Consistency	UCS (kPa)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
H Hard	>400	
Fb Friable		
Density		
V Very Loose		Density Index <15%
L Loose		Density Index 15 - 35%
MD Medium Dense		Density Index 35 - 65%
D Dense		Density Index 65 - 85%
VD Very Dense		Density Index 85 - 100%



ENGINEERING LOG - BOREHOLE


CLIENT: Stanwell Consulting
PROJECT NAME: Proposed Townhouse Development

LOCATION: Refer to figure 1

BOREHOLE NO: **BH3**
PAGE: 1 OF 1
JOB NO: RGS01314.1
LOGGED BY: APH
DATE: 22/6/16

DRILL TYPE: Ute Mounted Drill Rig
BOREHOLE DIAMETER:

SURFACE RL: Not Measured m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
TC Bit	Not Encountered	0.20m	D	0.50m		CL	FILL: Silty CLAY, low plasticity, brown, lots of roots, some Gravel fine to coarse grained	M < w _p	St			0.00: TOPSOIL/FILL
		CL				Silty Sandy CLAY: Low to medium grained, Sand fine to medium grained, some roots, trace Gravel fine to coarse grained	M < w _p	0.20: ALLUVIUM				
		CL				Silty CLAY: Low to medium plasticity, orange, grey, brown, trace of Sand fine to medium grained, trace Gravel fine to coarse grained	M < w _p	F	0.50: EXTREMELY WEATHERED SILTSTONE			
				1.0			Hole Terminated at 1.00 m					
				1.5								

LEGEND:		Notes, Samples and Tests		Consistency		UCS (kPa)	Moisture Condition	
Water		U ₅₀ 50mm Diameter tube sample		VS	Very Soft	<25	D	Dry
Water Level (Date and time shown)		CBR Bulk sample for CBR testing		S	Soft	25 - 50	M	Moist
Water Inflow		E Environmental sample (Glass jar, sealed and chilled on site)		F	Firm	50 - 100	W	Wet
Water Outflow		ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)		St	Stiff	100 - 200	W _p	Plastic Limit
Strata Changes		B Bulk Sample		VSt	Very Stiff	200 - 400	W _L	Liquid Limit
Gradational or transitional strata		Field Tests		H	Hard	>400		
Definitive or distinct strata change		PID Photoionisation detector reading (ppm)		Fb	Friable			
		DCP(x-y) Dynamic penetrometer test (test depth interval shown)		Density	V	Very Loose	Density Index <15%	
		HP Hand Penetrometer test (UCS kPa)			L	Loose	Density Index 15 - 35%	
					MD	Medium Dense	Density Index 35 - 65%	
					D	Dense	Density Index 65 - 85%	
					VD	Very Dense	Density Index 85 - 100%	



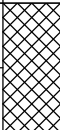



ENGINEERING LOG - BOREHOLE

CLIENT: Stanwell Consulting
PROJECT NAME: Proposed Townhouse Development
LOCATION: Refer to figure 1

BOREHOLE NO: BH4
PAGE: 1 OF 1
JOB NO: RGS01314.1
LOGGED BY: APH
DATE: 22/6/16

DRILL TYPE: Ute Mounted Drill Rig
BOREHOLE DIAMETER:

SURFACE RL: Not Measured m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
TC Bit	Not Encountered					CL	FILL: Silty CLAY, low plasticity, brown, dark brown, some Gravel fine to coarse grained, some roots	M < w _p				0.00: TOPSOIL/FILL
		0.30m				CL	Silty CLAY: Low to medium plasticity, grey, brown, orange, some Gravel fine to coarse grained, some roots		VSt			0.20: ALLUVIUM
		D										
		0.50m		0.5			Becoming pale grey/pale brown/orange Becoming medium to high plasticity					0.60: EXTREMELY WEATHERED SILTSTONE
							Silty CLAY: Low to medium plasticity, pale grey, pale brown, orange, trace Sand fine to medium grained, trace Gravel fine to medium grained.					
				1.0			Becoming friable	M > w _p				
						CL			St - F			
				1.5								
				1.60m								
							Hole Terminated at 1.60 m Practical Refusal on Extremely Weathered Siltstone					

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change		Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample (Glass jar, sealed and chilled on site) ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) B Bulk Sample Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)		Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense		UCS (kPa) Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	
---	--	--	--	--	--	--	--




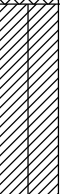

ENGINEERING LOG - BOREHOLE

CLIENT: Stanwell Consulting
PROJECT NAME: Proposed Townhouse Development
LOCATION: Refer to figure 1

BOREHOLE NO: BH5
PAGE: 1 OF 1
JOB NO: RGS01314.1
LOGGED BY: APH
DATE: 22/6/16

DRILL TYPE: Ute Mounted Drill Rig
BOREHOLE DIAMETER:

SURFACE RL: Not Measured m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result		
TC Bit	Not Encountered					CL	FILL: Silty CLAY, low plasticity, brown, dark brown, some Gravel, fine to coarse grained, some roots	M < w _p				0.00: TOPSOIL/FILL	
		0.50m		0.5		CL	Silty CLAY: Low to medium plasticity, brown, grey, orange, trace Gravel fine to coarse grained, trace roots	M > w _p	VSt			0.30: ALLUVIUM	
		0.77m											0.60: EXTREMELY WEATHERED SILTSTONE
						CL	Becoming friable	M < w _p	F				
				1.5			Hole Terminated at 1.40 m Practical Refusal on Extremely Weathered Siltstone						

LEGEND:
Water
Water Level (Date and time shown)
Water Inflow
Water Outflow
Strata Changes
Gradational or transitional strata
Definitive or distinct strata change

Notes, Samples and Tests
U₅₀ 50mm Diameter tube sample
CBR Bulk sample for CBR testing
E Environmental sample (Glass jar, sealed and chilled on site)
ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B Bulk Sample
Field Tests
PID Photoionisation detector reading (ppm)
DCP(x-y) Dynamic penetrometer test (test depth interval shown)
HP Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)	Moisture Condition
VS	Very Soft	<25	D Dry
S	Soft	25 - 50	M Moist
F	Firm	50 - 100	W Wet
St	Stiff	100 - 200	W _p Plastic Limit
VSt	Very Stiff	200 - 400	W _L Liquid Limit
H	Hard	>400	
Fb	Friable		
Density			
V	Very Loose		Density Index <15%
L	Loose		Density Index 15 - 35%
MD	Medium Dense		Density Index 35 - 65%
D	Dense		Density Index 65 - 85%
VD	Very Dense		Density Index 85 - 100%

Shrink Swell Index Report

Report No: SSI:NEW16W-1654--S01

Issue No: 1

Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street
Wingham NSW 2429

Principal:
Project No.: MNC16P-0001
Project Name: Various Testing



Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or
measurements included in this document are traceable
to Australian/national standards

[Signature]

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 5/07/2016

Sample Details

Sample ID:	NEW16W-1654--S01	Client Sample ID:	-
Test Request No.:	RGS01314.1	Sampling Method:	Sampled by Client
Material:	Clay	Date Sampled:	23/06/2016
Source:	On-Site Insitu	Date Submitted:	24/06/2016
Specification:	No Specification		
Project Location:	19 Greenview Close, Forster, NSW		
Sample Location:	BH2 - (0.25 - 0.54m)		
Borehole Number:	BH2		
Borehole Depth (m):	0.25 - 0.54m		

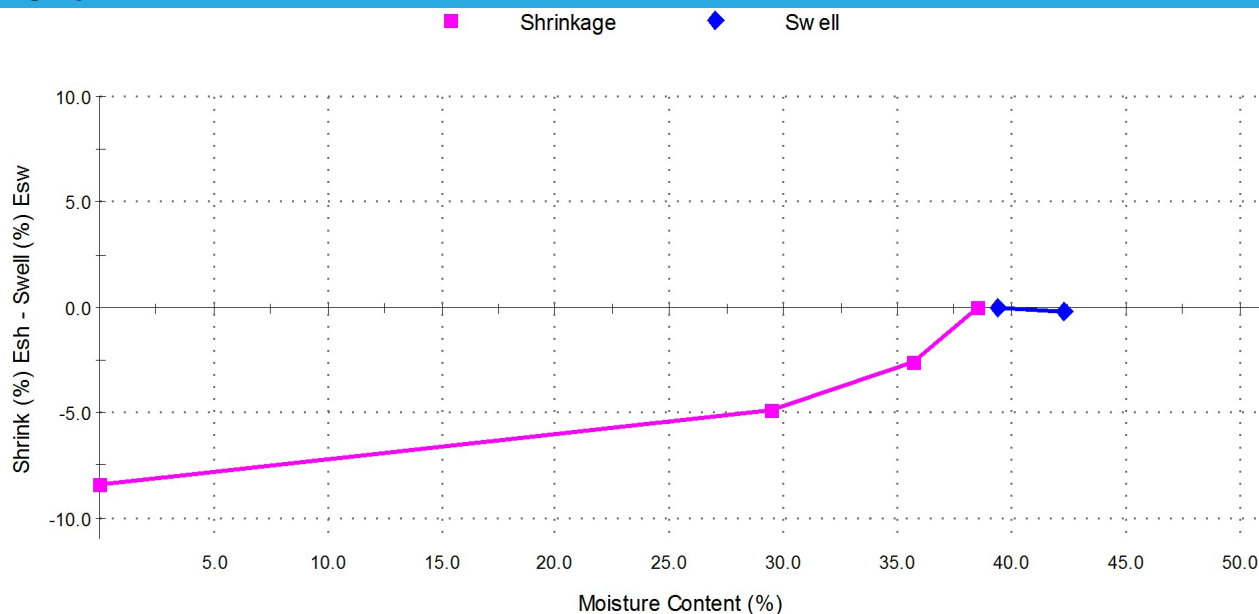
Swell Test AS 1289.7.1.1

Swell on Saturation (%):	-0.2
Moisture Content before (%):	39.4
Moisture Content after (%):	42.3
Est. Unc. Comp. Strength before (kPa):	600
Est. Unc. Comp. Strength after (kPa):	200

Shrink Test AS 1289.7.1.1

Shrink on drying (%):	8.4
Shrinkage Moisture Content (%):	38.5
Est. inert material (%):	3
Crumbling during shrinkage:	-
Cracking during shrinkage:	Major

Shrink Swell



Shrink Swell Index - Iss (%): 4.7

Comments

Shrink Swell Index Report

Report No: SSI:NEW16W-1654--S02

Issue No: 1

Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street
Wingham NSW 2429

Principal:
Project No.: MNC16P-0001
Project Name: Various Testing



Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or
measurements included in this document are traceable
to Australian/national standards



Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 5/07/2016

Sample Details

Sample ID:	NEW16W-1654--S02	Client Sample ID:	-
Test Request No.:	RGS01314.1	Sampling Method:	Sampled by Client
Material:	Clay	Date Sampled:	23/06/2016
Source:	On-Site Insitu	Date Submitted:	24/06/2016
Specification:	No Specification		
Project Location:	19 Greenview Close, Forster, NSW		
Sample Location:	BH5 - (0.50 - 0.77m)		
Borehole Number:	BH5		
Borehole Depth (m):	0.5 - 0.77m		

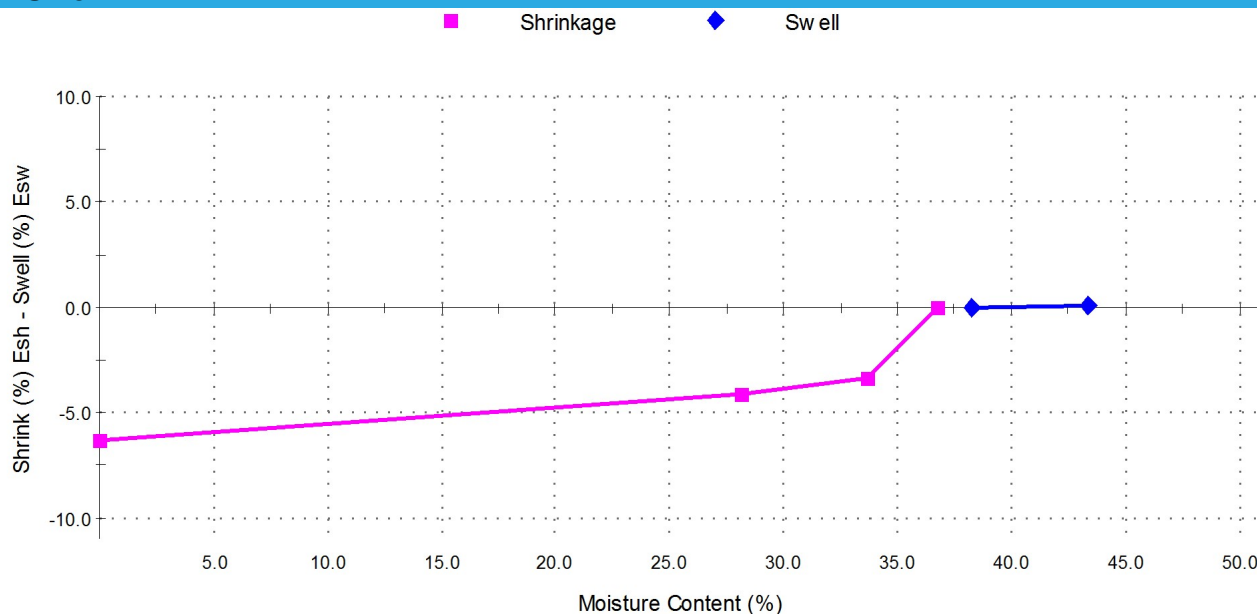
Swell Test AS 1289.7.1.1

Swell on Saturation (%):	0.1
Moisture Content before (%):	38.2
Moisture Content after (%):	43.3
Est. Unc. Comp. Strength before (kPa):	600
Est. Unc. Comp. Strength after (kPa):	200

Shrink Test AS 1289.7.1.1

Shrink on drying (%):	6.3
Shrinkage Moisture Content (%):	36.7
Est. inert material (%):	6
Crumbling during shrinkage:	-
Cracking during shrinkage:	Major

Shrink Swell



Shrink Swell Index - Iss (%): 3.5

Comments

RESULTS OF ACID SULFATE SOIL ANALYSIS

3 samples supplied by Regional Geotechnical Solutions Pty Ltd on 24th June, 2016 - Lab. Job No. F1279

Analysis requested by Andrew Hills. **Your Project: RGS01314.1**

(44 Bent Street WINGHAM NSW 2429)

Required if pH_{ACL} <4.5

Sample Site	EAL lab code	TEXTURE (note 7)	MOISTURE CONTENT		FIELD/ LAB PEROXIDE SCREENING TECHNIQUE				TITRATABLE ACTUAL ACIDITY (TAA) (To pH 6.5)		Extractable sulfate sulfur %S _{KCL}	Extractable sulfate sulfur (equivalent mole H ⁺ /tonne)	REDUCED INORGANIC SULFUR (% chromium reducible S)		RETAINED ACIDITY (HCL extract) (as %S _{HCL} - %S _{KCL})		NET ACIDITY Chromium Suite mole H ⁺ /tonne (based on %Scrs)	LIME CALCULATION Chromium Suite kg CaCO ₃ /tonne DW (includes 1.5 safety Factor when liming rate is *ve)
			(% moisture of total wet weight)	(g moisture / g of oven dry soil)	Initial pH _F	pH _{FOX}	pH change	Reaction	pH _{KCL}	(mole H ⁺ /tonne)			(%Scr)	(mole H ⁺ /tonne)	(%S _{NAS})	(mole H ⁺ /tonne)		
<i>Method Info.</i>		**	**						<i>(ACTUAL ACIDITY-Method 23)</i>				<i>(POTENTIAL ACIDITY-Method 22B)</i>		<i>(RETAINED ACIDITY)</i>		** & note 5	** & note 4 and 6
BH1 0.5-0.7	F1279/1	Fine	16.9	0.20	5.55	2.98	-2.57	Medium	4.43	43	0.004	2	0.005	3	0.005	2	49	4
BH3 0.2-0.5	F1279/2	Fine	20.0	0.25	5.29	2.64	-2.65	High	4.18	67	0.004	2	0.010	6	0.008	4	76	6
BH4 0.3-0.5	F1279/3	Fine	26.6	0.36	5.00	3.26	-1.74	Medium	4.16	104	0.003	2	0.010	6	0.006	3	113	8

NOTE:

- 1 - All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)
- 2 - Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr - Method 22B)
- 3 - Methods from Ahern, CR, McElnea AE, Sullivan LA (2004). **Acid Sulfate Soils Laboratory Methods Guidelines**. QLD DNRME.
- 4 - Bulk Density is required for liming rate calculations per soil volume. Lab. Bulk Density is no longer applicable - field bulk density rings can be used and dried/ weighed in the laboratory.
- 5 - **ABA Equation: Net Acidity = Potential Sulfidic Acidity (ie. Scrs or Sox) + Actual Acidity + Retained Acidity - measured ANC/FF (with FF currently defaulted to 1.5)**
- 6 - The neutralising requirement, lime calculation, includes a 1.5 safety margin for acid neutralisation (an increased safety factor may be required in some cases)
- 7 - For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
- 8 - .. denotes not requested or required. '0' is used for ANC and Snag calcs if TAA pH <6.5 or >4.5
- 9 - SCREENING, CRS, TAA and ANC are NATA accredited but other SPOCAS segments are currently not NATA accredited
- 10- Results at or below detection limits are replaced with '0' for calculation purposes.
- 11 - **Projects that disturb >1000 tonnes of soil, the ≥0.03% S classification guideline would apply (refer to acid sulfate management guidelines).**
- 12 - Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
- 13 ** denotes these test procedure or calculation are as yet not NATA accredited but quality control data is available



(Classification of potential acid sulfate material if: coarse Scr≥0.03%S or 19mole H⁺/t; medium Scr≥0.06%S or 37mole H⁺/t; fine Scr≥0.1%S or 62mole H⁺/t) - as per QUASSIT Guidelines