GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

GEOTECHNICAL INVESTIGATION AND ACID SULFATE SOIL ASSESSMENT

FOR

NSW LAND & HOUSING CORPORATION

C/- SMEC AUSTRALIA PTY LIMITED

25-27 Easton Avenue Sylvania, New South Wales

Report No: 20/3858

Project No: 30617/4135D-G

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1. INTRODUCTION

This report presents the results of a combined Geotechnical Investigation and Acid Sulfate Soil (ASS) assessment carried out by STS Geotechnics Pty Limited (STS) for a proposed new residential development to be constructed at 25 and 27 Easton Avenue Sylvania. At the time of writing this report STS were not provided with architectural drawings for the project, however we understand the development will typically comprise the construction of single and double storey residential buildings. The development will not include basement levels. We understand that the site is located within a Class 5 Acid Sulfate Soils area and therefore Sutherland Council requires an assessment to be undertaken.

The purpose of the investigation was to:

- assess the subsurface conditions over the site,
- provide a Site Classification to AS2870,
- provide recommendations regarding the appropriate foundation system for the site including design parameters,
- comment on soil aggressiveness to buried steel and concrete,
- undertake an ASS assessment, and
- determine if an ASS Management Plan is required.

The investigation was undertaken at the request of SMEC Australia Pty Limited on behalf of NSW Land and Housing Corporation.

Our scope of work did not include a contamination assessment.

2. NATURE OF THE INVESTIGATION

2.1. Fieldwork

The fieldwork consisted of drilling four (4) boreholes numbered BH1 to BH4, inclusive, at the locations shown on Drawing No. 20/3858. Restricted site access dictated the borehole locations. The boreholes were drilled using a Christie track mounted mini drilling rig owned and operated by STS. Soils and weathered rock were drilled using rotary solid flight augers. Soil strengths were determined by undertaking Dynamic Cone Penetrometer (DCP) tests at each borehole location.

Drilling operations were undertaken by one of STS's senior geologists who also logged the subsurface conditions encountered.

The subsurface conditions observed are recorded on the borehole logs given in Appendix A. An explanation of the terms used on the logs is also given in Appendix A. Notes relating to geotechnical reports are also attached.

2.2. Laboratory Testing

In order to assist with determining the site classification, a shrink swell index test was carried out on a representative sample retrieved from the site.

In order to assess the soils for their aggressiveness, a selected representative soil sample was tested to determine the following:

- pH,
- Sulphate content (SO_4),
- Chloride content (CL), and
- Electrical Conductivity (EC)

Based on field observations, four (4) soil samples were also selected for laboratory analysis for the Acid Sulfate Soils assessment. The samples were dispatched to Australian Laboratory Services (ALS) for analysis using the Suspension Peroxide Oxidation Combined Acidity and Sulphate (SPOCAS) method. The method allows both a measure of the existing and potential acidity.

Detailed test reports are given in Appendix B.

3. GEOLOGY AND SITE CONDITIONS

The Wollongong-Port Hacking geological series sheet at a scale of 1:100,000 shows the site is underlain by Triassic Age Hawkesbury Sandstone. Rocks within this formation comprise medium to coarse grained quartz sandstone. Sandstone outcrops are present on both sites.

The site is rectangular in shape with an area of approximately 1,307 m^2. At the time of the fieldwork, fibro houses were present. Single and double storey residential dwellings are present in the nearby properties.

Site vegetation comprised grass, trees and shrubs.

The ground surface falls approximately 3 metres to the north.

4. SUBSURFACE CONDITIONS

When assessing the subsurface conditions across a site from a limited number of boreholes, there is the possibility that variations may occur between test locations. The data derived from the site investigation programme are extrapolated across the site to form a geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour regarding the proposed development. The actual condition at the site may differ from those inferred, since no subsurface exploration programme, no matter how comprehensive, can reveal all subsurface details and anomalies.

The subsurface conditions generally consist of topsoil and fill overlying sandy clays and weathered sandstone. The topsoil was encountered in BH1 and BH3 to a depth of 0.4 metres. In BH2 fill is present to a depth of 1.0 metre. Natural sandy silty clays underlie the topsoil and fill to depths of 0.6 to 1.6 metres. The consistency of these materials varies between firm to stiff and very stiff. Weathered sandstone underlies the natural soils to the depth of auger refusal, 0.7 to 1.7 metres.

Groundwater was not observed during drilling of the boreholes, however, some moist to wet zones were noted in BH2 and BH3.

5. GEOTECHNICAL DISCUSSION

5.1. Site Classification to AS2870

The classification has been prepared in accordance with the guidelines set out in the "Residential Slabs and Footings" Code, AS2870 – 2011.

Undisturbed samples were obtained to determine their shrink swell index.

The results are summarised in Table 5.1

Table 5.1 – Shrink Swell Summary

Location	Depth (m)	Material Description	Shrink/Swell Index (% per ΔpF)
BH2	0.5-0.7	Dark brown with orange brown silty sandy clay	0.7
BH3	0.4-0.8	Light brown with orange brown sandy clay	0.7

Because of the trees and dwellings present, abnormal moisture conditions (AMC) prevail at the site. (Refer to Section 1.3.3 of AS2870).

Because of the AMC and fill present, the site is classified *a problem site (P).* Provided the recommendations given below are adopted and the footings bear in the underlying natural soils, the site may be reclassified *moderately reactive (M).*

5.2. Foundation Design

The existing fill materials should not be relied upon for foundation support. Footings founded in natural soils may be proportioned using an allowable bearing pressure of 100 kPa. The minimum depth of founding must comply with the requirements of AS2870. In order to overcome the presence of trees, the foundations should be designed in accordance with the procedures given in Appendices H and CH of AS2870-2011. Tree information is attached.

Piles founded in weathered sandstone, may be proportioned using an allowable end bearing pressure of 800 kPa. An adhesion value of 80 kPa may used for the portion of the shaft within the weathered rock.

In order to ensure the bearing values given can be achieved, care should be taken to ensure that the base of excavations is free of all loose material prior to concreting. It is recommended that all footing excavations be protected with a layer of blinding concrete as soon as possible, preferably immediately after excavating, cleaning, inspection and approval. The possible presence of groundwater needs to be considered when drilling piers and pouring concrete.

5.3. Soil Aggressiveness

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of soil pH and the types of salts present, generally sulphates and chlorides. In order to determine the degree of aggressiveness, the test values obtained are compared to Tables 6.4.2 (C) and 6.5.2 (C) in AS2159 – 2009 Piling – Design and Installation. The test results are summarised in Table 5.2 below.

Table 5.2– Soil Aggressiveness Summary Table

Sample No.	Location	Depth (m)	pH	Sulfate (mg/kg)	Chloride (mg/kg)	Electrical Conductivity (dS/m)	
						$EC_{1:5}$	EC_e
S1	BH1	0.3	8.0	<10	<10	0.019	0.3
S2	BH3	0.3	7.9	<10	<10	0.026	0.4

The soils on the site are cohesive in nature. Therefore, the soil conditions B are considered appropriate.

A review of the durability aspects indicates that:

- pH : minimum value of 7.9
- SO_4 : maximum value of 10 mg/kg (ppm) > 5000 ppm
- Cl : maximum value of 10 mg/kg (ppm) < 5000 ppm
- EC_e : maximum value of 0.4 dS/m

In accordance with AS2159-2009, the exposure classification for the onsite soils is non-aggressive to both steel and concrete. In accordance with AS2870-2011, the soils are classified as A1.

Reference to DLWC (2002) "Site Investigations for Urban Salinity" indicates that EC_e values of 0.3 and 0.4 dS/m are consistent with the presence of non-saline and slightly saline soils.

6. ACID SULFATE SOIL ASSESSMENT

6.1. Introduction

ASS is the common name given to sediments and soils containing iron sulfides which, when exposed to oxygen generate sulfuric acid. Natural processes formed many acid sulfate sediments when certain conditions existed in the Holocene geological period (the last 10,000 years). Formation conditions require the presence of iron-rich sediments, sulfate (usually from seawater), removal of reaction products such as bicarbonate, the presence of sulfate reducing bacteria and a plentiful supply of organic matter. It should be noted that these conditions exist in mangroves, salt marsh vegetation or tidal areas, and at the bottom of coastal rivers and lakes.

The relatively specific conditions under which acid sulfate soils are formed usually limit their occurrence to low lying parts of coastal floodplains, rivers and creeks. This includes areas with saline or brackish water such as deltas, coastal flats, backswamps and seasonal or permanent freshwater swamps that were formerly brackish. Due to flooding and stormwater erosion, these sulfidic sediments may continue to be re-distributed through the sands and sediments of the estuarine floodplain region. Sulfidic sediment may be found at any depth in suitable coastal sediments – usually beneath the water table.

Any lowering in the water table that covers and protects potential ASS will result in their aeration and the exposure of iron sulfide sediments to oxygen. The lowering in the water table can occur naturally due to seasonal fluctuations and drought or any human intervention, when carrying out any excavations during site development. Potential ASS can also be the exposed to air during physical disturbance with the material at the disturbance face, as well as the extracted material, both potentially being oxidised. The oxidation of iron sulfide sediments in potential ASS results in ASS soils.

Successful management of areas with ASS is possible but must take into account the specific nature of the site and the environmental consequences of development. While it is preferable that sites exhibiting acid sulfate characteristics are not disturbed, management techniques have been devised to minimise and manage impacts in certain circumstances.

When works involving the disturbance of soil or the change of groundwater levels are proposed in coastal areas, a preliminary assessment should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils.

6.2. Presence of ASS

Reference to the Port Hacking ASS Risk Map indicates the property is within an area where ASS is not known to exist. It should be noted that maps are a guide only.

The following geomorphic or site criteria are normally used to determine if acid sulfate soils are likely to be present:

- sediments of recent geological age (Holocene)
- soil horizons with an elevation less than 5m AHD
- marine or estuarine sediments and tidal lakes
- in coastal wetlands or back swamp areas

6.3. Assessment

The site has an elevation greater than RL 20m AHD and is underlain by Triassic Age rocks. Therefore, the geomorphic conditions are not consistent with those where ASS are normally found.

In order to assess the significance of the ASS potential, the laboratory results carried out were compared to action criteria contained in ASSM (1998) summarised in Table 6.1. The action criteria trigger the need to prepare an ASSMP and are based on the percentage of oxidisable sulphur (or equivalent TPA and TSA) for broad categories of soil types. Works in soils that exceed these action criteria must prepare a management plan and obtain development consent.

As the soils encountered on the site primarily consisted of clays, the medium texture grade criteria are the most appropriate and have been adopted for this assessment.

Table 6.1 – ASS Action Criteria

Type of material		Action Criteria if 1-1000 tonnes ASS disturbed		Action Criteria if more than 1000 tonnes ASS disturbed	
Texture Range (McDonald et al 1990)	Approx. clay content (%<0.02mm)	Sulphur Trail %S oxidisable (oven dry basis) eg S_{TOS} or S_{POS}	Acid Trail Mol H^+/tonne (oven dry basis) eg TPA or TSA_S	Sulphur Trail %S oxidisable (oven dry basis) eg S_{TOS} or S_{POS}	Acid Trail Mol H^+/tonne (oven dry basis) eg TPA or TSA_S
Coarse Texture (CT) Sands to loamy sands	≥5	0.03	18	0.03	18
Medium Texture (MT) Sandy loams to light clays	5-50	0.06	36	0.03	18
Fine Texture (FT) Medium to heavy clays and silty clays	≥40	0.1	62	0.03	18

The laboratory test results are summarised in relation to the action criteria in Table 6.2.

Table 6.2 – SPOCAS TEST RESULTS SUMMARY

Analysis	Unit	LOR	ASS1 BH2 @ 0.5m	ASS2 BH2 @ 1.5m	ASS3 BH3 @ 0.3m	ASS4 BH3 @ 0.6m	Action Criteria[1] <1000 tonnes disturbed
pH before Oxidation	NA	0.1	7.1	5.9	6.9	5.6	-
pH after Oxidation	NA	0.1	6.2	4.2	5.1	4.8	<3 (high risk)
S (POS)	%	0.02	0.026	<0.02	<0.02	<0.02	0.06
TPA	mole/tonne	2	<2	32	<2	16	36
TSA	mole/tonne	2	<2	28	<2	10	36

[1] = ASSMAC (1998)

Action Criteria Exceeded

The results of the soil sample analyses are compared to the above criteria in Table 6.2, and the analytical laboratory reports for the testing performed are provided in Appendix B.

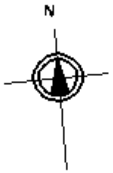
The measured test results are less than the action criteria. Therefore, an ASS Management Plan will not be required.

7. FINAL COMMENTS

During construction, should the subsurface conditions vary from those inferred above, we would be contacted to determine if any changes should be made to our recommendations.

The exposed bearing surfaces for footings should be inspected by a geotechnical engineer to ensure the allowable pressure given has been achieved.

Ian Watts
Geotechnical Engineer
STS Geotechnics Pty Limited



STS Geotechnics Pty. Ltd.	Scale: Unknown	Date: October 2020
Client: NSW LAND & HOUSING CORPORATION C/- SMEC AUSTRALIA		
GEOTECHNICAL INVESTIGATION **25-27 EASTON AVENUE, SYLVANIA** **BOREHOLE AND PENETROMETER LOCATIONS**	Project No. 30617/4135D-G	
	Drawing No: 20/3858	

NOTES RELATING TO GEOTECHNICAL REPORTS

Introduction

These notes have been provided to outline the methodology and limitations inherent in geotechnical reporting. The issues discussed are not relevant to all reports and further advice should be sought if there are any queries regarding any advice or report.

When copies of reports are made, they should be reproduced in full.

Geotechnical Reports

Geotechnical reports are prepared by qualified personnel on the information supplied or obtained and are based on current engineering standards of interpretation and analysis.

Information may be gained from limited subsurface testing, surface observations, previous work and is supplemented by knowledge of the local geology and experience of the range of properties that may be exhibited by the materials present. For this reason, geotechnical reports should be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Where the report has been prepared for a specific purpose (eg. design of a three-storey building), the information and interpretation may not be appropriate if the design is changed (eg. a twenty storey building). In such cases, the report and the sufficiency of the existing work should be reviewed by STS Geotechnics Pty Limited in the light of the new proposal.

Every care is taken with the report content, however, it is not always possible to anticipate or assume responsibility for the following conditions:

- Unexpected variations in ground conditions. The potential for this depends on the amount of investigative work undertaken.
- Changes in policy or interpretation by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, STS Geotechnics Pty Limited would be pleased to resolve the matter through further investigation, analysis or advice.

Unforeseen Conditions

Should conditions encountered on site differ markedly from those anticipated from the information contained in the report, STS Geotechnics Pty Limited should be notified immediately. Early identification of site anomalies generally results in any problems being more readily resolved and allows re-interpretation and assessment of the implications for future work.

Subsurface Information

Logs of a borehole, recovered core, test pit, excavated face or cone penetration test are an engineering and/or geological interpretation of the subsurface conditions. The reliability of the logged information depends on the drilling/testing method, sampling and/or observation spacings and the ground conditions. It is not always possible or economic to obtain continuous high quality data. It should also be recognised that the volume or material observed or tested is only a fraction of the total subsurface profile.

Interpretation of subsurface information and application to design and construction must take into consideration the spacing of the test locations, the frequency of observations and testing, and the possibility that geological boundaries may vary between observation points.

Groundwater observations and measurements outside of specially designed and constructed piezometers should be treated with care for the following reasons:

- In low permeability soils groundwater may not seep into an excavation or bore in the short time it is left open.
- A localised perched water table may not represent the true water table.
- Groundwater levels vary according to rainfall events or season.
- Some drilling and testing procedures mask or prevent groundwater inflow.

The installation of piezometers and long term monitoring of groundwater levels may be required to adequately identify groundwater conditions.

Supply of Geotechnical Information or Tendering Purposes

It is recommended tenderers are provided with as much geological and geotechnical information that is available and that where there are uncertainties regarding the ground conditions, prospective tenders should be provided with comments discussing the range of likely conditions in addition to the investigation data.

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APPENDIX A – BOREHOLE LOGS AND EXPLANATION SHEETS

STS Geotechnics Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: NSW Land & Housing Corporation C/- SMEC Australia	Project / STS No. 30617/4135D-G	**BOREHOLE NO.:**	**BH 1**
Project: 25-27 Easton Avenue, Sylvania	Date: October 26, 2020		
Location: Refer to Drawing No. 20/3858	Logged: JK Checked By: SS	Sheet 1 of 1	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S1 @ 0.3 m		TOPSOIL: SILTY SANDY CLAY: dark grey, fine gained sand, low plasticity	CL	SOFT TO FIRM	M
		0.5	SANDY CLAY: light grey with orange brown, fine to medium grained sand, low plasticity	CL	VERY STIFF	M
			WEATHERED SANDSTONE: orange brown with light grey, fine to medium grained		EXTREMELY LOW STRENGTH	M-D
			AUGER REFUSAL AT 0.7 M ON WEATHERED SANDSTONE			
		1.0				
		1.5				
		2.0				
		2.5				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Mini Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

STS Geotechnics Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: NSW Land & Housing Corporation C/- SMEC Australia	Project / STS No. 30617/4135D-G	**BOREHOLE NO.:**	**BH 2**
Project: 25-27 Easton Avenue, Sylvania	Date: October 26, 2020		
Location: Refer to Drawing No. 20/3858	Logged: JK Checked By: SS	Sheet 1 of 1	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	ASS1 @ 0.5 m	0.5	FILL: SILTY SANDY CLAY: dark brown with orange brown, fine to medium gained sand, low plasticity, trace of sandstone gravel, pipe	CL	VARIABLE BETWEEN SOFT TO FIRM AND STIFF	M
	U50					
		1.0	SANDY CLAY: orange brown with light grey, fine to medium grained sand, medium plasticity	CL	FIRM TO STIFF	M-W
	ASS2 @ 1.5 m	1.5			STIFF	
			WEATHERED SANDSTONE: light grey with orange brown, fine to medium grained		EXTREMELY LOW STRENGTH	M-D
		2.0	AUGER REFUSAL AT 1.7 M ON WEATHERED SANDSTONE			
		2.5				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Mini Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

STS Geotechnics Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: NSW Land & Housing Corporation C/- SMEC Australia	Project / STS No. 30617/4135D-G	**BOREHOLE NO.:**	**BH 3**
Project: 25-27 Easton Avenue, Sylvania	Date: October 26, 2020		
Location: Refer to Drawing No. 20/3858	Logged: JK Checked By: SS	Sheet 1 of 1	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S2/ASS3 @ 0.3 m		TOPSOIL: CLAYEY SILTY SAND: dark grey, fine to medium grained	SC	SOFT	M
	U50	0.5	SANDY CLAY: light brown with orange brown, fine to medium grained sand, low plasticity	CL	FIRM TO STIFF	M-W
	ASS4 @ 0.6 m	1.0	WEATHERED SANDSTONE: orange brown with light grey, fine to medium grained		EXTREMELY LOW STRENGTH	M-D
			AUGER REFUSAL AT 1.0 M ON WEATHERED SANDSTONE			
		1.5				
		2.0				
		2.5				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Mini Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

STS Geotechnics Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: NSW Land & Housing Corporation C/- SMEC Australia		Project / STS No. 30617/4135D-G	**BOREHOLE NO.: BH 4**
Project: 25-27 Easton Avenue, Sylvania		Date: October 26, 2020	
Location: Refer to Drawing No. 20/3858		Logged: JK Checked By: SS	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			WEATHERED SANDSTONE: light grey with orange brown, fine to medium grained		EXTREMELY LOW STRENGTH	D
			AUGER REFUSAL AT 0.01 M ON WEATHERED SANDSTONE			
		0.5				
		1.0				
		1.5				
		2.0				
		2.5				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Mini Christie

Hole Diameter (mm): 100

Angle from Vertical (°): 0

Drill Bit: Spiral

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Dynamic Cone Penetrometer Test Report

Project: 25-27 EASTON AVENUE, SYLVANIA
Client: NSW LAND & HOUSING CORPORATION C/- SMEC AUSTRALIA
Address: 20 Berry Street, North Sydney
Test Method: AS 1289.6.3.2

Project No.: 30617/4135D
Report No.: 20/3858
Report Date: 30/10/2020
Page: 1 of 1

NATA
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards
NATA Accreditation Number 2750

Site No.	P1	P2	P3	P4		
Location	Refer to Drawing No. 20/3858	Refer to Drawing No. 20/3858	Refer to Drawing No. 20/3858	Refer to Drawing No. 20/3858		
Date Tested	27/10/2020	27/10/2020	27/10/2020	27/10/2020		
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level		
Depth (m)	Penetration Resistance (blows / 150mm)					
0.00 - 0.15	1	1	1	22		
0.15 - 0.30	2	2	1	Refusal		
0.30 - 0.45	2	2	2			
0.45 - 0.60	22	5	3			
0.60 - 0.75	Refusal	6	3			
0.75 - 0.90		4	22			
0.90 - 1.05		3	Refusal			
1.05 - 1.20		3				
1.20 - 1.35		4				
1.35 - 1.50		5				
1.50 - 1.65		18				
1.65 - 1.80		22				
1.80 - 1.95		Refusal				
1.95 - 2.10						
2.10 - 2.25						
2.25 - 2.40						
2.40 - 2.55						
2.55 - 2.70						
2.70 - 2.85						
2.85 - 3.00						
3.00 - 3.15						
3.15 - 3.30						
3.30 - 3.45						
3.45 - 3.60						
3.60 - 3.75						

Remarks: * Pre drilled prior to testing

Approved Signatory..... .....

Technician: JK

Orlando Mendoza - Laboratory Manager

STS Geotechnics Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au

Tree Heights and Type

Project: 25-27 Easton Avenue, Sylvania Project No. / STS No.: 30617/4135D-G

Client: NSW Land & Housing Corporation C/- SMEC Australia Technician: JK

Tree No.	Canopy Radius (m)	Distance from Tree Along Ground (m)	Uphill / Level / Downhill	Height of Tree (m)	Native (Y / N)	Growing / Mature
T1	3		U	18	Y	M

E1. CLASSIFICATION OF SOILS

E1.1 Soil Classification and the Unified System

An assessment of the site conditions usually includes an appraisal of the data available by combining values of engineering properties obtained by the site investigation with descriptions, from visual observation of the materials present on site.

The system used by STS Geotechnics Pty Ltd (STS) in the identification of soil is the Unified Soil Classification system (USC) which was developed by the US Army Corps of Engineers during World War II and has since gained international acceptance and has been adopted in its metricated form by the Standards Association of Australia.

The Australian Site Investigation Code (AS1726-1981, Appendix D) recommends that the description of a soil includes the USC group symbols which are an integral component of the system.

The soil description should contain the following information in order:

Soil composition

- SOIL NAME and USC classification symbol (IN BLOCK LETTERS)
- plasticity or particle characteristics
- colour
- secondary and minor constituents (name estimated proportion, plasticity or particle characteristics, colour

Soil condition

- moisture condition
- consistency or density index

Soil structure

- structure (zoning, defects, cementing)

Soil origin

interpretation based on observation eg FILL, TOPSOIL, RESIDUAL, ALLUVIUM.

E1.2 Soil Composition

(a) Soil Name and Classification Symbol

The USC system is summarised in Figure E1.2.1. The primary division separates soil types on the basis of particle size into:

- Coarse grained soils - more than 50% of the material less than 60 mm is larger than 0.06 mm (60 µm).

- Fine grained soils - more than 50% of the material less than 60 mm is smaller than 0.06 mm (60 µm).

Initial classification is by particle size as shown in Table E1.2.1. Further classification of fine grained soils is based on plasticity.

TABLE E1.2.1 - CLASSIFICATION BY PARTICLE SIZE

NAME	SUB-DIVISION	SIZE
Clay (1)		< 2 µm
Silt (2)		2 µm to 60 µm
Sand	Fine Medium Coarse	60 µm to 200 µm 200 µm to 600 µm 600 µm to 2 mm
Gravel (3)	Fine Medium Coarse	2 mm to 6 mm 6 mm to 20 mm 20 mm to 60 mm
Cobbles (3)		60 mm to 200 mm
Boulders (3)		> 200 mm

Where a soil contains an appropriate amount of secondary material, the name includes each of the secondary components (greater than 12%) in increasing order of significance, eg sandy silty clay.

Minor components of a soil are included in the description by means of the terms “some” and “trace” as defined in Table E1.2.2.

TABLE E1.2.2 - MINOR SOIL COMPONENTS

TERM	DESCRIPTION	APPROXIMATE PROPORTION (%)
Trace	presence just detectable, little or no influence on soil properties	0-5
Some	presence easily detectable, little influence on soil properties	5-12

The USC group symbols should be included with each soil description as shown in Table E1.2.3

TABLE E1.2.3 - SOIL GROUP SYMBOLS

SOIL TYPE	PREFIX
Gravel	G
Sand	S
Silt	M
Clay	C
Organic	O
Peat	Pt

The group symbols are combined with qualifiers which indicate grading, plasticity or secondary components as shown on Table E1.2.4

TABLE E1.2.4 - SOIL GROUP QUALIFIERS

SUBGROUP	SUFFIX
Well graded	W
Poorly Graded	P
Silty	M
Clayey	C
Liquid Limit <50% - low to medium plasticity	L
Liquid Limit >50% - medium to high plasticity	H

(b) Grading

"Well graded" Good representation of all particle sizes from the largest to the smallest.

"Poorly graded" One or more intermediate sizes poorly represented

"Gap graded" One or more intermediate sizes absent

"Uniformly graded" Essentially single size material.

(c) Particle shape and texture

The shape and surface texture of the coarse grained particles should be described.

Angularity may be expressed as "rounded", "sub-rounded", "sub-angular" or "angular".

Particle **form** can be "equidimensional", "flat" or elongate".

Surface texture can be "glassy", "smooth", "rough", pitted" or striated".

(d) Colour

The colour of the soil should be described in the moist condition using simple terms such as:

Black White Grey Red
Brown Orange Yellow Green
Blue

These may be modified as necessary by "light" or "dark". Borderline colours may be described as a combination of two colours, eg red-brown.

For soils that contain more than one colour terms such as:

- Speckled Very small (<10 mm dia) patches
- Mottled Irregular
- Blotched Large irregular (>75 mm dia)
- Streaked Randomly oriented streaks

(e) Minor Components

Secondary and minor components should be individually described in a similar manner to the dominant component.

*E1.3 **S**oil Condition*

(a) Moisture

Soil moisture condition is described as "dry", "moist" or "wet".

The moisture categories are defined as:
Dry (D) - Little or no moisture evident. Soils are running.
Moist (M) - Darkened in colour with cool feel. Granular soil particles tend to adhere. No free water evident upon remoulding of cohesive soils.

In addition the moisture content of cohesive soils can be estimated in relation to their liquid or plastic limit.

(b) Consistency

Estimates of the consistency of a clay or silt soil may be made from manual examination, hand penetrometer test, SPT results or from laboratory tests to determine undrained shear or unconfined compressive strengths. The classification of consistency is defined in Table E1.3.1.

TABLE E1.3.1 - CONSISTENCY OF FINE-GRAINED SOILS

TERM	UNCONFINED STRENGTH (kPa)	FIELD IDENTIFICATION
Very Soft	<25	Easily penetrated by fist. Sample exudes between fingers when squeezed in the fist.
Soft	25 - 50	Easily moulded in fingers. Easily penetrated 50 mm by thumb.
Firm	50 - 100	Can be moulded by strong pressure in the fingers. Penetrated only with great effort.
Stiff	100 - 200	Cannot be moulded in fingers. Indented by thumb but penetrated only with great effort.
Very Stiff	200 - 400	Very tough. Difficult to cut with knife. Readily indented with thumb nail.
Hard	>400	Brittle, can just be scratched with thumb nail. Tends to break into fragments.

Unconfined compressive strength as derived by a hand penetrometer can be taken as approximately double the undrained shear strength ($q_u = 2\ c_u$).

(c) Density Index

The insitu density index of granular soils can be assessed from the results of SPT or cone penetrometer tests. Density index should not be estimated visually.

TABLE E1.3.2 - DENSITY OF GRANULAR SOILS

TERM	SPT N VALUE	STATIC CONE VALUE q_c (MPa)	DENSITY INDEX (%)
Very Loose	0 - 3	0 - 2	0 - 15
Loose	3 - 8	2 - 5	15 - 35
Medium Dense	8 - 25	5 - 15	35 - 65
Dense	25 - 42	15 - 20	65 - 85
Very Dense	>42	>20	>85

E1.4 Soil Structure

(a) Zoning

A sample may consist of several zones differing in colour, grain size or other properties. Terms to classify these zones are:

Layer - continuous across exposure or sample
Lens - discontinuous with lenticular shape
Pocket - irregular inclusion
Each zone should be described, their distinguishing features, and the nature of the interzone boundaries.

(b) Defects

Defects which are present in the sample can include:

- fissures
- roots (containing organic matter)
- tubes (hollow)
- casts (infilled)

Defects should be described giving details of dimensions and frequency. Fissure orientation, planarity, surface condition and infilling should be noted. If there is a tendency to break into blocks, block dimensions should be recorded

E1.5 Soil Origin

Information which may be interpretative but which may contribute to the usefulness of the material description should be included. The most common interpreted feature is the origin of the soil. The assessment of the probable origin is based on the soil material description, soil structure and its relationship to other soil and rock materials.

Common terms used are:

“Residual Soil” - Material which appears to have been derived by weathering from the underlying rock. There is no evidence of transport.

“Colluvium” - Material which appears to have been transported from its original location. The method of movement is usually the combination of gravity and erosion.

“Landslide Debris” - An extreme form of colluvium where the soil has been transported by mass movement. The material is obviously distributed and contains distinct defects related to the slope failure.

“Alluvium” - Material which has been transported essentially by water. usually associated with former stream activity.

“Fill” - Material which has been transported and placed by man. This can range from natural soils which have been placed in a controlled manner in engineering construction to dumped waste material. A description of the constituents should include an assessment of the method of placement.

E1.6 Fine Grained Soils

The physical properties of fine grained soils are dominated by silts and clays.

The definition of clay and silt soils is governed by their Atterberg Limits. Clay soils are characterised by the properties of cohesion and plasticity with cohesion defines as the ability to deform without rupture. Silts exhibit cohesion but have low plasticity or are non-plastic.

The field characteristics of clay soils include:

- dry lumps have appreciable dry strength and cannot be powdered
- volume changes occur with moisture content variation
- feels smooth when moist with a greasy appearance when cut.

The field characteristics of silt soils include:

- dry lumps have negligible dry strength and can be powdered easily
- dilatancy - an increase in volume due to shearing - is indicted by the presence of a shiny film of water after a hand sample is shaken. The water disappears upon remoulding. Very fine grained sands may also exhibit dilatancy.
- low plasticity index
- feels gritty to the teeth

E1.7 Organic Soils

Organic soils are distinguished from other soils by their appreciable content of vegetable matter, usually derived from plant remains.

The soil usually has a distinctive smell and low bulk density.

The USC system uses the symbol Pt for partly decomposed organic material. The O symbol is combined with suffixes “O” or “H” depending on plasticity.

Where roots or root fibres are present their frequency and the depth to which they are encountered should be recorded. The presence of roots or root fibres does not necessarily mean the material is an “organic material” by classification.

Coal and lignite should be described as such and not simply as organic matter.

GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

APPENDIX B – LABORATORY TEST RESULTS

STS Geotechnics Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au

GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

Shrink Swell Index Report

Project: 25-27 EASTON AVENUE, SYLVANIA
Client: NSW LAND & HOUSING CORPORATION C/- SMEC AUSTRALIA
Address: 20 Berry Street, North Sydney
Test Method: AS1289.7.1.1

Project No.: 30617/4135D
Report No.: 20/3872
Report Date: 2/11/2020
Page: 1 OF 1

Sampling Procedure: AS 1289.1.3.1 Clause 3.1.3.2 - Thin Walled Sampler

STS / Sample No.		4135D-L/1	4135D-L/2				
Sample Location		Borehole 2 Refer to Drawing	Borehole 3 Refer to Drawing				
Material Description		Gravelly Sandy Clay: Yellow grey brown	Sandy Ckay: Yellow grey				
Depth (m)		0.5-0.7	0.4-0.8				
Sample Date		27/10/2020	27/10/2020				
Shrink	Moisture Content (%)	27.4	16.4				
	Soil Crumbling	Nil	Nil				
	Extent of Cracking	Nil	Nil				
	Strain (%)	1.2	1.3				
Swell	Moisture Content Initial (%)	13.1	16.9				
	Moisture Content Final (%)	16.2	17.4				
	Strain (%)	0.0	0.0				
Inert Inclusions (%)		<25	<5				
Shrink Swell Index (%)		**0.7**	**0.7**				

Remarks:

NATA
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards
NATA Accreditation Number 2750

Approved Signatory.....

Technician: DH

Orlando Mendoza - Laboratory Manager

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2037881**	Page	: 1 of 7
Client	: **STS Geotechnics**	Laboratory	: Environmental Division Sydney
Contact	: ENQUIRES STS	Contact	: Customer Services ES
Address	: Unit 14/1 Cowpasture Place Wetherill Park 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 30060/30617/30644/30852	Date Samples Received	: 28-Oct-2020 14:15
Order number	: E-2020-0428	Date Analysis Commenced	: 02-Nov-2020
C-O-C number	: ----	Issue Date	: 05-Nov-2020 08:20
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 13		
No. of samples analysed	: 13		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA029 (SPOCAS): Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA029 (SPOCAS): Excess ANC not required because pH OX less than 6.5.
- ASS: EA029 (SPOCAS): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime ($CaCO_3$) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from kg/t dry weight to kg/m3 in-situ soil, multiply reported results x wet bulk density of soil in t/m3.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	30060/1319	30060/1322	30617/S1	30617/S2	30617/ASS1
			Client sampling date / time	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00
Compound	CAS Number	LOR	Unit	ES2037881-001	ES2037881-002	ES2037881-003	ES2037881-004	ES2037881-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**8.3**	**7.8**	**8.0**	**7.9**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**555**	**176**	**19**	**26**	**----**
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	**----**	**----**	**----**	**----**	**7.1**
pH OX (23B)	----	0.1	pH Unit	**----**	**----**	**----**	**----**	**6.2**
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**----**	**----**	**----**	**----**	<2
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	**----**	**----**	**----**	**----**	<2
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	**----**	**----**	**----**	**----**	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	**----**	**----**	**----**	**----**	<0.020
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	**----**	**----**	**----**	**----**	<0.020
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	**----**	**----**	**----**	**----**	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	**----**	**----**	**----**	**----**	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	**----**	**----**	**----**	**----**	**0.026**
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	**----**	**----**	**----**	**----**	**0.026**
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	**----**	**----**	**----**	**----**	**16**
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	**----**	**----**	**----**	**----**	**0.248**
Peroxide Calcium (23Wh)	----	0.020	% Ca	**----**	**----**	**----**	**----**	**0.202**
Acid Reacted Calcium (23X)	----	0.020	% Ca	**----**	**----**	**----**	**----**	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	**----**	**----**	**----**	**----**	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	**----**	**----**	**----**	**----**	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	**----**	**----**	**----**	**----**	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	**----**	**----**	**----**	**----**	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	**----**	**----**	**----**	**----**	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	**----**	**----**	**----**	**----**	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	**----**	**----**	**----**	**----**	<0.020
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	30060/1319	30060/1322	30617/S1	30617/S2	30617/ASS1
				Client sampling date / time	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00
Compound	CAS Number	LOR	Unit		ES2037881-001	ES2037881-002	ES2037881-003	ES2037881-004	ES2037881-005
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		----	----	----	----	1.5
Net Acidity (sulfur units)	----	0.02	% S		----	----	----	----	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		----	----	----	----	<10
Liming Rate	----	1	kg CaCO3/t		----	----	----	----	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		----	----	----	----	0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		----	----	----	----	16
Liming Rate excluding ANC	----	1	kg CaCO3/t		----	----	----	----	1
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		19.5	32.1	25.4	28.7	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		540	210	<10	<10	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		----	----	<10	<10	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	30617/ASS2	30617/ASS3	30617/ASS4	30644/S1	30644/S2
			Client sampling date / time	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00
Compound	CAS Number	LOR	Unit	ES2037881-006	ES2037881-007	ES2037881-008	ES2037881-009	ES2037881-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**----**	**----**	**----**	**8.0**	**7.8**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**----**	**----**	**----**	**14**	**11**
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	**5.9**	**6.9**	**5.6**	**----**	**----**
pH OX (23B)	----	0.1	pH Unit	**4.2**	**5.1**	**4.8**	**----**	**----**
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**4**	<2	**6**	**----**	**----**
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	**32**	<2	**16**	**----**	**----**
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	**28**	<2	**10**	**----**	**----**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	**----**	**----**
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	**0.051**	<0.020	**0.025**	**----**	**----**
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	**0.046**	<0.020	<0.020	**----**	**----**
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	**----**	**----**
Peroxide Sulfur (23De)	----	0.020	% S	<0.020	<0.020	<0.020	**----**	**----**
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	<0.020	<0.020	<0.020	**----**	**----**
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	<10	**----**	**----**
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	**0.046**	**0.171**	**0.058**	**----**	**----**
Peroxide Calcium (23Wh)	----	0.020	% Ca	**0.048**	**0.177**	**0.060**	**----**	**----**
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	<0.020	<0.020	**----**	**----**
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	**----**	**----**
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	**----**	**----**
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	**----**	**----**
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	**----**	**----**
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	**----**	**----**
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	**----**	**----**
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	**----**	**----**
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	30617/ASS2	30617/ASS3	30617/ASS4	30644/S1	30644/S2
				Client sampling date / time	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00
Compound	CAS Number	LOR	Unit		ES2037881-006	ES2037881-007	ES2037881-008	ES2037881-009	ES2037881-010
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	----	----
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	----	----
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	<10	----	----
Liming Rate	----	1	kg CaCO3/t		<1	<1	<1	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	<10	<10	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	<1	<1	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		----	----	----	24.3	8.8
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		----	----	----	<10	<10
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		----	----	----	10	20

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	30644/S3	30852/S1	30852/S2	----	----
			Client sampling date / time	27-Oct-2020 00:00	27-Oct-2020 00:00	27-Oct-2020 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2037881-011	ES2037881-012	ES2037881-013	--------	--------
				Result	Result	Result	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**7.7**	**5.7**	**5.2**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**13**	**248**	**477**	**----**	**----**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**10.0**	**20.1**	**19.1**	**----**	**----**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	**200**	**170**	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**10**	**210**	**480**	**----**	**----**