GROUND TECHNOLOGIES

Geotechnical Testing Services

Ground Technologies Pty Ltd
ABN 25 089 213 294
PO Box 1121 Green Valley NSW 2168
Ph: (02) 8783 8200 Fax: (02) 8783 8210
Email: lab@groundtech.com.au

GTE549 - ASS Report
27 October 2015

LOGOS PROPERTY
Suite 1202, Level 12
167 Macquarie Street,
Sydney NSW 2000

Attention: Jeff Lord
E-mail: jlord@dblproperty.com

RE: ACID SULFATE ASSESSMENT for **34 Yarrunga Street, Prestons**

This letter presents a geotechnical report on the inspection and testing services associated with the geotechnical investigation undertaken at the above project.

Should you have any questions related to this report please do not hesitate to contact the undersigned.

For and on behalf of
Ground Technologies Pty Ltd

A. Bennett
Senior Geotechnical Engineer

Reviewed By

J.Harendran
Geotechnical Engineer

Table of Contents

TABLES

1.0 INTRODUCTION

Ground Technologies Pty Ltd has undertaken an Acid Sulfate Soils Assessment for the proposed Prestons Warehouse and Distribution Estate to be constructed at No.34 Yarrunga Street, Prestons. The Acid Sulfate Soils Assessment has been undertaken in response to the Secretary's Environmental Assessment Requirements (SEARs) for the Prestons Industrial Estate SSD 7155 prepared by the Department of Planning and the Environment

2.0 OBJECTIVES AND SCOPE OF WORK

The objectives of the work are outlined below:

- Summarize the relevant environmental characteristics of the site that may impact Actual Acid Sulfate Soils (AASS) and result in the release of acidity and the potential leaching and transport of contaminants.
- Outline potential environmental impacts associated with the proposed works.
- Summarise the presence or the absence, distribution and magnitude of AASS and Potential Acid Sulfate Soils (PASS)

The scope of work includes the following:

- Review of soils and geological maps.
- Available groundwater bore information for the region.
- A Preliminary soil sampling and analysis program to investigate the presence and distribution of AASS and PASS within the site.
- Chemical analysis (SPOCAS suite) by a NATA accredited laboratory.
- Assessment of the results of the chemical analysis against the appropriate guidelines to assess if management is required so as to minimise potential environmental impacts caused by the disturbance of ASS.
- Provide recommendations for the need to undertake a detailed ASS assessment and ASS Management Plan

3.0 PROPOSED WORKS

It is understood that a proposed works will comprise the construction of a five (5) new warehouse buildings within a currently rural / residential parcel of land. Bulk earthworks will be undertaken in order to provide level working platforms for each warehouse, additional shallow excavations will be required for footings and service installations and a deeper excavation will be required for a storm water detention tank. It is anticipated that greater than 1000m^3 of spoil will be generated from excavations the proposed development

4.0 SITE IDENTIFICATION

The following information, presented in Table 1, describes the site.

Table 1: Summary of Site Details

Site Address	34 Yarrunga Street, Prestons
Lot & Plan No.	Lot 33, 34, 35, 43 DP2359 Lot 20 DP 117483
Council Area	Liverpool City Council

The subject property is irregular in shape, measuring approximately 625m wide along the Yarrunga Street frontage, and 305m deep along the Bernera Road frontage. The subject property covers an area of approximately 20.7ha, with the majority of it vacant and grass covered. A high point is located within lot 34, behind the metal shed, with ground slopes falling away from this point in all directions by grades of up to 3° to 7°.

Figure 1 – Location of Site

Lot 33 and 35 are grass covered and vacant. High voltage power lines traverse throughout the site in a north / south alignment. Lot 34 contains a single storey residential house, a metal shed and equipment for loading cattle onto trucks within the northern (front) portion of the lots. Lot 43 contains a metal shed located centrally within the lot. Lot 20 of DP1173483 is predominately vacant. An old drainage line has been re-aligned within this site with a new culvert placed under Kurrajong Road.

5.0 SITE GEOLOGY, TOPOGRAPHY AND HYDROGEOLOGY

5.1 Geology

The 1:100,000 scale Geological Series Map of the Penrith region indicates that the subject site is underlain by Bringelly Shale of the Wianamatta Group dating back to the Middle Triassic period and generally comprises *shale, carbonaceous claystone, laminate and rare coal / tuff.*

5.2 Topography

The region is situated within the slightly undulating flats to the north-west of the Georges River. The topography of the site is near flat slightly sloping to the south end of the site at a grade of approximately 1˚ to 3°. The site elevation level is estimated to be at approximately 5.7 to 6.2m AHD.

5.3 Borehole Summary and Soil Profile

Fieldwork was undertaken on the 7th of October 2015 and included drilling five boreholes (TS13 –TS17) using a 4WD Toyota Landcruiser Ute mounted drill rig with 100 mm solid flight spiral augers at locations shown on Figure 2. The boreholes were terminated at a depth of 3.0m below existing ground surface levels.

Figure 2 – Borehole Locations

Four (4) distinct geological units were encountered during the field investigation. These units are detailed in table 2 and the approximate depth of each unit is detailed in table 3. Full Borehole logs and field observations are presented in Appendix B.

Table 2 – Summary of Geological Units

UNIT	SOIL TYPE
UNIT A	NATURAL Clayey Silt, brown
UNIT B	NATURAL; Silty Clay, with minor ironstone gravels, grey/brown, mottled red and pale grey/brown, orange/brown, yellow/brown with minor red and pale grey
UNIT C	BEDROCK; Shale, completely weathered, mottled red, pale grey/brown and brown
UNIT D	BEDROCK; Shale, extremely weathered, grey, dark grey, brown, grey, grey/brown

Table 3 – Approximate Depth of each Geological Unit

Borehole	Geological Unit			
	Unit A	Unit B	Unit C	Unit D
	Clayey Silt	Silty Clay	Shale (CW)	Shale (EW)
TS13	0-0.1m	0.1-2.0m	2.0-2.6m	2.6-3.0m
TS14	0-0.3m	0.3-1.9m	1.9-2.2m	2.2-3.0m
TS15	0-0.1m	0.1-2.2m	2.2-3.0m	-
TS16	0-0.3m	0.3-2.2m	2.2-3.0m	-
TS17	0-0.1m	0.1-1.8m	1.8-2.6m	2.6-3.0m

5.4 Hydrogeology

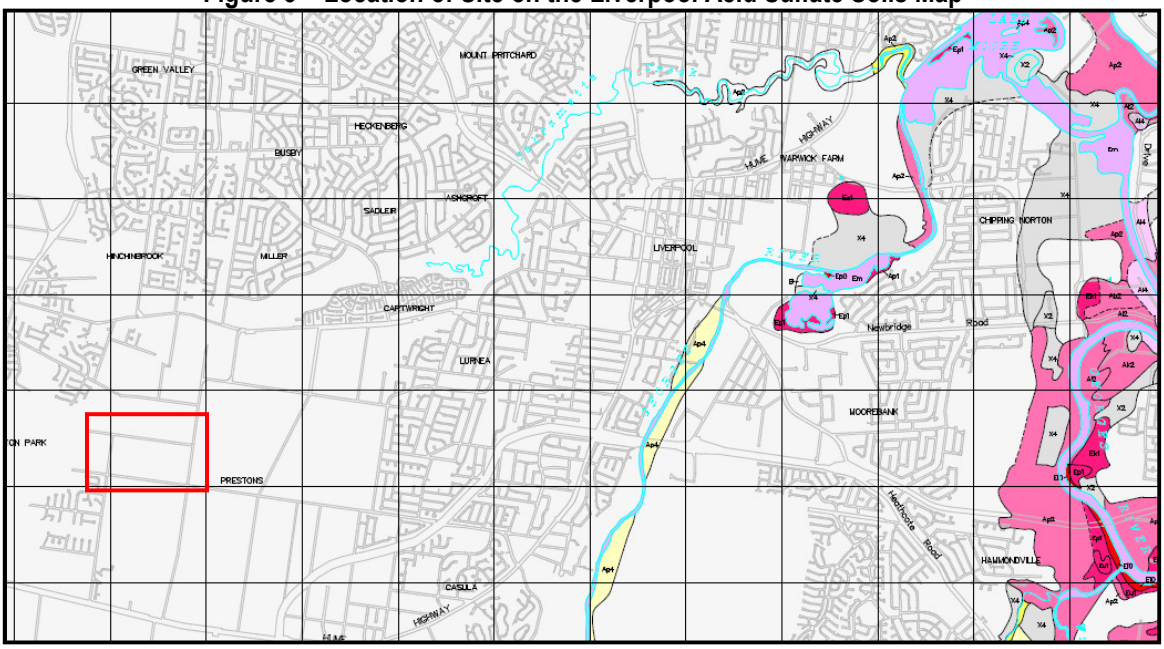
No groundwater was encountered during the excavation of our boreholes, which extended to a depth of 3.0m below existing ground surface levels. A search of the NSW Department of Natural Resources database revealed no registered bores within 1km radius of the site.

6.0 ACID SULFATE SOILS MAPPING

Acid Sulfate Soils (ASS) are naturally occurring and usually form in low lying coastal areas, creeks, rivers and flood plains. The sulfates present in the soil are stable when in the saturated/waterlogged state, but react to form sulphuric acid when disturbed and exposed to oxygen.

With reference to the Acid Sulfate Soils Map produced by the Department of Land and Water Conservation, shown in figure 3, the subject site is in an area of no known acid sulphate soils.

Figure 3 – Location of Site on the Liverpool Acid Sulfate Soils Map



7.0 ACID SULFATE SOILS ASSESSMENT

7.1 Acid Sulfate soil Field Assessment Criteria

In addition to the above criteria, the assessment criteria normally applied to assist in the preliminary identification of Actual Acid Sulfate Soils (AASS) and Potential Acid Sulfate Soils (PASS), in accordance with *Acid Sulfate Soils Planning Guidelines* (AASMAC), are as given below:

- pH_F < 4 indicates an occurrence of oxidation in the past and that AASS are likely to be present.
- pH_{FOX} <3, a pH_{FOX} reading at least one pH unit below the corresponding pH_F , a strong reaction with peroxide, can all indicate the presence of PASS.

7.2 Sampling Methodology and Preliminary Analysis Program

A preliminary soil sampling program was undertaken in accordance with the Acid Sulfate Soil Guidelines. Five (5) boreholes were drilled utilizing a truck mounted solid flight auger drill rig in the area of the proposed development (Refer to Figure 2 – for the borehole locations).

Field pH (pH_F) tests were undertaken from each clay soil strata encountered in each borehole. The field pH of the soil (pH_F) was measured to assess the presence of AASS. Hydrogen Peroxide was added to each soil sample and the pH after oxidation (pH_{FOX}) to assess for the presence of PASS. The vigour of the reaction with peroxide was also recorded.

7.3 Results of Preliminary Analysis Program

The field pH_F and pH_{FOX} results obtained from ALS (Certificate Reference number ES1533169) are as given below in table 4. Full laboratory results are attached in Appendix C.

Table 4 – Results of Preliminary Screening Tests

Sample	Borehole	Depth	Geological Unit	pH_F	pH_{FOX}	Change in pH	Reaction Vigour
SA1	BH1	0.5m	Unit B	5.4	3.6	1.8	Moderate
SA2	BH1	1.5m	Unit B	5.0	3.8	1.2	Moderate
SA5	BH2	0.5m	Unit B	5.1	3.7	1.4	Moderate
SA6	BH2	1.5m	Unit B	4.8	3.6	1.4	Slight
SA8	BH3	0.5m	Unit B	4.9	3.7	1.2	Moderate
SA9	BH3	1.5m	Unit B	4.8	3.9	0.9	Slight
SA11	BH4	0.5m	Unit B	5.0	3.6	1.4	Moderate
SA12	BH4	1.5m	Unit B	5.0	4.2	0.8	Slight
SA14	BH5	0.5m	Unit B	5.1	3.6	1.5	Moderate
SA15	BH5	1.5m	Unit B	4.8	3.7	1.1	Moderate

From the above table, the pH_F results of the soil samples are all above pH 5 and the pH_{FOX} results of the soil samples are all above pH 3. The reaction vigour for the peroxide reaction was predominately moderate to slight. A drop of greater than 1.0pH was documented in all samples bar two samples. This indicates that there is a possibility of AASS and / or PASS in the soil samples found in the above site.

8.0 DETAILED LABORATORY ANALYSIS

Samples SA1, SA2, SA5, SA6, SA8, SA11, SA14 and SA15 were submitted for Suspension Peroxide Combined Acidity and Sulfate (SPOCAS) testing to confirm the presence or absence of AASS and PASS in the soil.

8.1 Assessment Criteria for Acid Sulfate Soils Laboratory Testing

The results of analysis for the soils are compared to table 5 below which is a summary of the ASSMAC assessment criteria. It is assumed that greater than 1000 tonnes of material would be disturbed hence the action criteria for greater than 1000 tonnes have been applied. With reference to the ASSMAC Guidelines "*For projects that disturb >1000 tonnes of ASS soils with >0.03% of oxidisable sulfur or equivalent existing acidity, a detailed management plan and development consent will be required*".

Table 5 - NSW ASSMAC Action Criteria

Type of Material Texture	Approx Clay Content (% <0.002mm)	Action Criteria >1000 tonnes Sulfur Trail Spos%
Fine clays/silts	40	0.03

8.2 Laboratory Test Results - SPOCAS

Test results obtained from ALS (Certificate Reference number ES1532036) are summarised in Table 6 with the relevant ASSMAC action criteria. Full laboratory results are attached in Appendix C.

Table 6 – Summary of SPOCAS TEST Results

Sample	Borehole	Depth	Geological Unit	Spos %w/w	Action Criteria >1000 tonnes Sulfur Trail Spos%
SA1	BH1	0.5m	Unit B	0.026	0.03
SA2	BH1	1.5m	Unit B	<0.020	0.03
SA5	BH2	0.5m	Unit B	<0.020	0.03
SA6	BH2	1.5m	Unit B	<0.020	0.03
SA8	BH3	0.5m	Unit B	<0.020	0.03
SA11	BH4	0.5m	Unit B	0.023	0.03
SA14	BH5	0.5m	Unit B	<0.020	0.03
SA15	BH5	1.5m	Unit B	<0.020	0.03

The laboratory results indicate low acid and sulphur trails in the upper soil profiles, indicating the absence of ASS and PASS.

9.0 CONCLUSIONS FROM FIELD WORK AND RECOMMENDATIONS

Ground Technologies Pty Ltd has undertaken a Preliminary Acid Sulfate Soils Assessment for the proposed Prestons Warehouse and Distribution Estate at No.34 Yarrunga Street, Prestons.

Upon completion of our onsite investigation and laboratory analysis the following conclusions/discussions are made:

- Ground water was not encountered during our investigation which concluded at a depth 3.0m.
- Field pH tests conducted on the soil indicated that the potential for AASS and / or PASS soils.
- Laboratory tests (SPOCAS suite) have been analysed and they indicate low sulphur trails in the soil samples. The results confirm the absence of AASS or PASS within these soils.
- An ASS management plan is not required

10.0 LIMITATIONS

This type of investigation (as per our commission) is not designed or capable of locating all ground conditions, (which can vary even over short distances). The advice given in this report is based on the assumption that the test results are representative of the overall ground conditions. However, it should be noted that actual conditions in some parts of the site might differ from those found. If further sampling reveals ground conditions significantly different from those shown in our findings, Ground Tech must be consulted.

The scope and the period of Ground Tech services are described in the report and are subject to restrictions and limitations. Ground Tech did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Ground Tech in regards to it.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Ground Tech for incomplete or inaccurate data supplied by others.

Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

11.0 REFERENCES

- Stone, Y, and Hopkins G (1998). *Acid Sulfate Soils Planning Guidelines.* Published by the Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia.

- Ahern C R, Stone, Y, and Blunden B (1998). *Acid Sulfate Soils Assessment Guidelines* Published by the Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia

- Geology of Sydney 1:100000 Geological Series Sheet 9130, 1st Edition. Geological Survey of NSW Department of Mineral Resources 1983.

APPENDIX A

BOREHOLE LOGS

GROUND TECHNOLOGIES
Geotechnical Testing Services

Ground Technologies Pty Ltd
ABN 25 089 213 294
PO Box 1121 Green Valley NSW 2168
Ph: (02) 8783 8200
Fax: (02) 8783 8210
Email: lab@groundtech.com.au

SITE LOCATION: 34 Yarunga Street, Prestons

TEST SITE NO. 13

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)	GRAPHIC LOG	SAMPLE	REMARKS
NIL		TOPSOIL	Clayey Silt, brown			
		CI	Silty Clay, with minor ironstone gravel, medium plasticity, mottled red and pale grey/brown moist stiff to very stiff			
	0.5				SA1	
	1					
	1.5				SA2	
	2	BEDROCK	SHALE, completely weathered, very low strength, red, pale grey/brown, brown			
	2.5				SA3	
			SHALE, extremeley weathered, low strength, brown			
	3				SA4	
			Borehole terminated at 3.0m			
	3.5					
	4					
	4.5					

Method: 4WD Mounted Rig/Solid FlightSpiral Augers
Date of Drilling: 7/10/2015
Logged and Drilled by: AB

GROUND TECHNOLOGIES
Geotechnical Testing Services

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Email: lab@groundtech.com.au

SITE LOCATION: 34 Yarunga Street, Prestons

TEST SITE NO. 14

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)	GRAPHIC LOG	SAMPLE	REMARKS
NIL		TOPSOIL	Clayey Silt, brown			
	0.5	CI	Silty Clay, with minor ironstone gravel, medium plasticity, orange/brown, slightly moist, very stiff		SA5	
	1		Silty Clay, with minor ironstone gravel, medium plasticity, mottled red and pale grey/brown moist stiff to very stiff			
	1.5				SA6	
	2	BEDROCK	SHALE, completely weathered, very low strength, red, pale grey/brown, brown			
			SHALE, extremeley weathered, low strength, grey, grey/brown			
	2.5				SA7	
	3		*Borehole terminated at 3.0m*			
	3.5					
	4					
	4.5					

Method: 4WD Mounted Rig/Solid FlightSpiral Augers
Date of Drilling: 7/10/2015
Logged and Drilled by: AB

GROUND TECHNOLOGIES
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Email: lab@groundtech.com.au

SITE LOCATION: 34 Yarunga Street, Prestons

TEST SITE NO. 15

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)	GRAPHIC LOG	SAMPLE	REMARKS
NIL		TOPSOIL	Clayey Silt, brown			
		CI	Silty Clay, medium plasticity, grey/brown, moist, stiff			
	0.5		Silty Clay, with minor ironstone gravel, medium plasticity, mottled red and pale grey/brown moist, very stiff		SA8	
	1					
	1.5				SA9	
	2					
		BEDROCK	SHALE, completely weathered, very low strength, red, pale grey/brown, brown			
	2.5				SA10	
	3		*Borehole terminated at 3.0m*			
	3.5					
	4					
	4.5					

Method: 4WD Mounted Rig/Solid FlightSpiral Augers
Date of Drilling: 7/10/2015
Logged and Drilled by: AB

GROUND TECHNOLOGIES
Geotechnical Testing Services

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Email: lab@groundtech.com.au

SITE LOCATION: 34 Yarunga Street, Prestons

TEST SITE NO. 16

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)	GRAPHIC LOG	SAMPLE	REMARKS
NIL		TOPSOIL	Clayey Silt, brown			
	0.5	CI	Silty Clay, medium plasticity, grey/brown, moist, stiff		SA11	
	1		Silty Clay, with minor ironstone gravel, medium plasticity, mottled red and pale grey/brown moist, very stiff			
	1.5				SA12	
	2					
		BEDROCK	SHALE, completely weathered, very low strength, red, pale grey/brown, brown			
	2.5				SA13	
	3		*Borehole terminated at 3.0m*			
	3.5					
	4					
	4.5					

Method: 4WD Mounted Rig/Solid FlightSpiral Augers
Date of Drilling: 7/10/2015
Logged and Drilled by: AB

GROUND TECHNOLOGIES
Geotechnical Testing Services

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Fax: (02) 8783 8210
Email: lab@groundtech.com.au

SITE LOCATION: 34 Yarunga Street, Prestons

TEST SITE NO. 17

WATER	DEPTH (m)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION (SOIL TYPE, COLOUR, MOISTURE, CONSISTENCY)	GRAPHIC LOG	SAMPLE	REMARKS
NIL		TOPSOIL	Clayey Silt, brown			
		CI	Silty Clay, medium plasticity, grey/brown, moist, stiff			
	0.5				SA14	
	1		Silty Clay, with minor ironstone gravel, medium plasticity, mottled red and pale grey/brown moist, very stiff			
	1.5				SA15	
		BEDROCK	SHALE, completely weathered, very low strength, red, pale grey/brown, brown			
	2					
	2.5				SA16	
			SHALE, extremeley weathered, low strength, brown			
					SA17	
	3		*Borehole terminated at 3.0m*			
	3.5					
	4					
	4.5					

Method: 4WD Mounted Rig/Solid FlightSpiral Augers
Date of Drilling: 7/10/2015
Logged and Drilled by: AB

APPENDIX B

LABORATORY TEST RESULTS

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5900 E: gladstone@alsglobal.com

☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee mail@alsglobal.com

☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: Ground Technologies	**TURNAROUND REQUIREMENTS :** ☒ Standard TAT (List due date):
OFFICE: 55 Fifteenth Avenue, West Hoxton	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT **(List due date):**
PROJECT: gte549 prestons	**ALS QUOTE NO.:** SY/554/14
ORDER NUMBER:	
PROJECT MANAGER: Anthony Bennett	**CONTACT PH:** 0433284610
SAMPLER: Anthony Bennett	**SAMPLER MOBILE:**
COC emailed to ALS? (YES / NO)	**EDD FORMAT (or default):**
Email Reports to: anthony@groundtech.com.au, moustafa@groundtech.com.au	
Email Invoice to (will default to PM if no other addresses are listed):	

COC SEQUENCE NUMBER (Circle)

COC:	1	2	3	4	5	6	7
OF:	1	2	3	4	5	6	7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comment:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Anthony Bennett	Ram.		
DATE/TIME: 7/10	DATE/TIME: 7/10/15 14:30	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL CONTAINERS	pH	pHfox	eC	Sulphates	Chlorides	resistivity			Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	SA1	7/10/2015	s			x	x	x	x	x	x			
2	SA2	7/10/2015	s			x	x	x	x	x	x			
3	SA3	7/10/2015	s			x	x	x	x	x	x			
4	SA4	7/10/2015	s			x	x	x	x	x	x			
5	SA5	7/10/2015	s			x	x	x	x	x	x			
6	SA6	7/10/2015	s			x	x	x	x	x	x			
7	SA7	7/10/2015	s			x	x	x	x	x	x			
8	SA8	7/10/2015	s			x	x	x	x	x	x			
9	SA9	7/10/2015	s			x	x	x	x	x	x			
10	SA10	7/10/2015	s			x	x	x	x	x	x			
11	SA11	7/10/2015	s			x	x	x	x	x	x			
12	SA12	7/10/2015	s			x	x	x	x	x	x			
13	SA13	7/10/2015	s			x	x	x	x	x	x			
14	SA14	7/10/2015	s			x	x	x	x	x	x			
15	SA15	7/10/2015	s			x	x	x	x	x	x			
16	SA16	7/10/2015	s			x	x	x	x	x	x			
17	SA17	7/10/2015	s			x	x	x	x	x	x			
				TOTAL	17	17	17	17	17	17	17			

Environmental Division
Sydney
Work Order Reference
ES1533169

Telephone : + 61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1533169**	Page	: 1 of 6
Client	: **GROUND TECHNOLOGIES**	Laboratory	: Environmental Division Sydney
Contact	: MR ANTHONY BENNETT	Contact	:
Address	: PO BOX 1121 GREEN VALLEY NSW,AUSTRALIA 2168	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: anthony@groundtech.com.au	E-mail	:
Telephone	: +61 02 8783 8200	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: gte549 prestons	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 07-Oct-2015 15:30
C-O-C number	: ----	Date Analysis Commenced	: 12-Oct-2015
Sampler	: ANTHONY BENNETT	Issue Date	: 19-Oct-2015 14:25
Site	: ----		
		No. of samples received	: 17
Quote number	: ----	No. of samples analysed	: 17

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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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.

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.

- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SA1	SA2	SA3	SA4	SA5
			Client sampling date / time	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]
Compound	CAS Number	LOR	Unit	ES1533169-001	ES1533169-002	ES1533169-003	ES1533169-004	ES1533169-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	5.6	5.0	5.3	5.6	5.3
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	230	680	494	401	107
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.4	5.0	5.2	5.6	5.1
ø pH (Fox)	----	0.1	pH Unit	3.6	3.8	3.8	3.8	3.7
ø Reaction Rate	----	1	-	2	2	1	1	2
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1	%	19.3	16.4	11.0	8.0	16.6
EA080: Resistivity								
^ Resistivity at 25°C	----	1	ohm cm	4350	1470	2020	2490	9340
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	630	440	360	290	170
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	160	820	420	320	20

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SA6	SA7	SA8	SA9	SA10
			Client sampling date / time	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]
Compound	CAS Number	LOR	Unit	ES1533169-006	ES1533169-007	ES1533169-008	ES1533169-009	ES1533169-010
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	4.8	5.0	5.3	4.9	5.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	641	457	178	535	603
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	4.8	4.9	4.9	4.8	5.0
ø pH (Fox)	----	0.1	pH Unit	3.6	2.7	3.7	3.9	3.7
ø Reaction Rate	----	1	-	1	1	2	1	1
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1	%	13.1	9.6	17.9	17.4	14.6
EA080: Resistivity								
^ Resistivity at 25°C	----	1	ohm cm	1560	2190	5620	1870	1660
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	280	230	590	220	370
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	860	440	180	660	710

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SA11	SA12	SA13	SA14	SA15
			Client sampling date / time	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]
Compound	CAS Number	LOR	Unit	ES1533169-011	ES1533169-012	ES1533169-013	ES1533169-014	ES1533169-015
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	5.2	4.8	4.9	5.1	5.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	242	656	712	276	460
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.0	5.0	4.6	5.1	4.8
ø pH (Fox)	----	0.1	pH Unit	3.6	4.2	3.7	3.6	3.7
ø Reaction Rate	----	1	-	2	1	1	2	2
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1	%	19.5	15.6	14.0	17.1	16.0
EA080: Resistivity								
^ Resistivity at 25°C	----	1	ohm cm	4130	1520	1400	3620	2170
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	330	410	480	410	540
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	210	830	860	120	320

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SA16	SA17	----	----	----
			Client sampling date / time	[07-Oct-2015]	[07-Oct-2015]	----	----	----
Compound	CAS Number	LOR	Unit	ES1533169-016	ES1533169-017	--------	--------	--------
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**5.7**	**7.0**	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**262**	**181**	----	----	----
EA037: Ass Field Screening Analysis								
ø **pH (F)**	----	0.1	pH Unit	**5.2**	**6.8**	----	----	----
ø **pH (Fox)**	----	0.1	pH Unit	**3.6**	**7.0**	----	----	----
ø **Reaction Rate**	----	1	-	**2**	**4**	----	----	----
EA055: Moisture Content								
^ **Moisture Content (dried @ 103°C)**	----	1	%	**11.0**	**7.4**	----	----	----
EA080: Resistivity								
^ **Resistivity at 25°C**	----	1	ohm cm	**3820**	**5520**	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**130**	**80**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**230**	**160**	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1532036**	Page	: 1 of 6
Client	: **GROUND TECHNOLOGIES**	Laboratory	: Environmental Division Brisbane
Contact	: MR ANTHONY BENNETT	Contact	: Customer Services EB
Address	: PO BOX 1121 GREEN VALLEY NSW,AUSTRALIA 2168	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: anthony@groundtech.com.au	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 02 8783 8200	Telephone	: +61-7-3243 7222
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: gte549 prestons	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 19-Oct-2015 15:05
C-O-C number	: ----	Date Analysis Commenced	: 26-Oct-2015
Sampler	: ANTHONY BENNETT	Issue Date	: 26-Oct-2015 18:11
Site	: ----		
		No. of samples received	: 8
Quote number	: ----	No. of samples analysed	: 8

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

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Signatories	*Position*	*Accreditation Category*
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

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- **This work order has been created to REBATCH samples from Previous ALS workorder ES1533169**
- 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	SA1	SA2	SA5	SA6	SA8
			Client sampling date / time	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]
Compound	CAS Number	LOR	Unit	EB1532036-001	EB1532036-002	EB1532036-003	EB1532036-004	EB1532036-005
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	**4.3**	**4.4**	**4.0**	**4.1**	**4.2**
pH OX (23B)	----	0.1	pH Unit	**4.6**	**4.9**	**4.1**	**4.5**	**4.5**
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**57**	**39**	**105**	**77**	**80**
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	**74**	**42**	**127**	**85**	**94**
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	**17**	**3**	**22**	**8**	**14**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.092**	**0.063**	**0.168**	**0.124**	**0.128**
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	**0.119**	**0.068**	**0.203**	**0.136**	**0.151**
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	**0.027**	<0.020	**0.035**	<0.020	**0.023**
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	**0.027**	**0.027**	**0.037**	<0.020
Peroxide Sulfur (23De)	----	0.02	% S	**0.026**	**0.034**	**0.031**	**0.044**	<0.020
Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	**0.026**	<0.020	<0.020	<0.020	<0.020
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	**16**	<10	<10	<10	<10
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	<0.020	**0.025**	<0.020	<0.020
Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	<0.020	**0.025**	<0.020	<0.020
Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	<0.020	<0.020	<0.020	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	**0.170**	**0.125**	**0.094**	**0.075**	**0.133**
Peroxide Magnesium (23Tm)	----	0.02	% Mg	**0.172**	**0.130**	**0.101**	**0.076**	**0.133**
Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-G: Retained Acidity								
HCl Extractable Sulfur (20Be)	----	0.02	% S	**0.028**	**0.038**	**0.040**	**0.052**	**0.023**
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	**0.028**	<0.020	<0.020	<0.020	**0.023**
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	**13**	<10	<10	<10	**11**
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	**0.021**	<0.020	<0.020	<0.020	<0.020

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SA1	SA2	SA5	SA6	SA8
				Client sampling date / time	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]
Compound	CAS Number	LOR	Unit		EB1532036-001	EB1532036-002	EB1532036-003	EB1532036-004	EB1532036-005
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		**0.14**	**0.08**	**0.18**	**0.14**	**0.14**
Net Acidity (acidity units)	----	10	mole H+ / t		**87**	**48**	**114**	**89**	**91**
Liming Rate	----	1	kg CaCO3/t		**6**	**4**	**8**	**7**	**7**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SA11	SA14	SA15	----	----
			Client sampling date / time	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	----	----
Compound	CAS Number	LOR	Unit	EB1532036-006	EB1532036-007	EB1532036-008	--------	--------
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	**4.1**	**4.2**	**4.3**	----	----
pH OX (23B)	----	0.1	pH Unit	**4.4**	**4.3**	**4.6**	----	----
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**70**	**72**	**46**	----	----
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	**79**	**82**	**50**	----	----
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	**9**	**11**	**4**	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.113**	**0.115**	**0.074**	----	----
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	**0.127**	**0.132**	**0.081**	----	----
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	<0.020	<0.020	----	----
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	**0.027**	**0.057**	----	----
Peroxide Sulfur (23De)	----	0.02	% S	**0.023**	**0.034**	**0.066**	----	----
Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	**0.023**	<0.020	<0.020	----	----
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	**14**	<10	<10	----	----
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	**0.027**	<0.020	----	----
Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	**0.027**	<0.020	----	----
Acid Reacted Calcium (23X)	----	0.02	% 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)	----	0.02	% S	<0.020	<0.020	<0.020	----	----
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	**0.172**	**0.156**	**0.114**	----	----
Peroxide Magnesium (23Tm)	----	0.02	% Mg	**0.171**	**0.160**	**0.115**	----	----
Acid Reacted Magnesium (23U)	----	0.02	% 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)	----	0.02	% S	<0.020	<0.020	<0.020	----	----
EA029-G: Retained Acidity								
HCl Extractable Sulfur (20Be)	----	0.02	% S	**0.024**	**0.036**	**0.077**	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	**0.024**	<0.020	**0.020**	----	----
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	**11**	<10	<10	----	----
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	<0.020	<0.020	<0.020	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SA11	SA14	SA15	----	----
				Client sampling date / time	[07-Oct-2015]	[07-Oct-2015]	[07-Oct-2015]	----	----
Compound	CAS Number	LOR	Unit		EB1532036-006	EB1532036-007	EB1532036-008	--------	--------
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**----**	**----**
Net Acidity (sulfur units)	----	0.02	% S		**0.15**	**0.13**	**0.10**	**----**	**----**
Net Acidity (acidity units)	----	10	mole H+ / t		**96**	**81**	**61**	**----**	**----**
Liming Rate	----	1	kg CaCO3/t		**7**	**6**	**5**	**----**	**----**