



FOUNDATION
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PRELIMINARY ACID SULPHATE SOIL ASSESSMENT
(PASSA)

Property Address

39-41 Fairfax Street, Rutherford NSW

Prepared for

Greentree Projects

Date

July 2023

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TABLE OF CONTENTS

1.0 INTRODUCTION	6
2.0 OBJECTIVES	6
3.0 SCOPE OF WORKS	7
4.0 ASSESSMENT CRITERIA	7
5.0 SITE INFORMATION	10
5.1 SITE IDENTIFICATION	10
5.2 TOPOGRAPHY	10
5.3 LOCAL GEOLOGY & SURFACE WATERS	11
5.4 PROPOSED DEVELOPMENT	11
6.0 SOIL BORING AND SAMPLING	12
6.1 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)	12
7.0 FIELD RESULTS	13
7.1 SOIL OBSERVATIONS	13
7.2 FIELD PH RESULTS	14
8.0 SUSPENDED PEROXIDE OXIDATION COMBINED ACIDITY & SULPHATE (SPOCAS) RESULTS	16
9.0 CHROMIUM REDUCIBLE SULPHUR RESULTS	18
10.0 DISCUSSION & RECOMMENDATION	19

TABLE OF FIGURES

Table 1: Site Identification Review	10
Table 2: Summary of field analysis results	14
Table 3: Laboratory Results - SPOCAS	17
Table 4: Laboratory Results – Chromium Reducible Sulphur	18

LIST OF FIGURES & APPENDICES

Figure 1	Site Locality
Figure 2	Site Features & Borehole Location Plan
Appendix A	Borehole Logs
Appendix B	Proposed Development Plans
Appendix C	NATA Accredited Laboratory Certificate

ABBREVIATIONS

AASS	Actual Acid Sulphate Soils
AHD	Above Height Datum
ANC	Acid Neutralising Capacity
ASS	Acid Sulphate Soils
ASSMAC	Acid Sulphate Soils Management Advisory Committee
ASSMP	Acid Sulphate Soils Management Plan
BGL	Below Ground Level
DNR&M	Department of Natural resources and Mines
DO	Dissolved Oxygen
EC	Electric Conductivity
EIL	Ecological Investigation Level
EPA	Environmental Protection Authority
HIL	Health-based Investigation Level
LOR	Limit of reporting
NV	Neutralising Value
PASS	Potential Acid Sulphate Soils
POCAS	Peroxide Oxidation Combined Acidity and Sulphate
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control
QASSIT	Queensland Acid Sulphate Soils Investigation Team
SPOCAS	Suspended Peroxide Oxidation Combined Acidity and Sulphate
SPOS	Peroxide Oxidisable
TAA	Total Actual Acidity
TCLP	Toxicity Characteristic Leaching Procedure
TPA	Total Potential Acidity
TSA	Total Sulfidic Acidity
TSS	Total Suspended Solids
VENM	Virgin Excavated Natural Material

1.0 INTRODUCTION

Foundation Earth Sciences (FES) was appointed by Greentree Projects to prepare a Preliminary Acid Sulphate Soil Assessment (PASSA) for the property located at 39-41 Fairfax Street, Rutherford NSW (“the site”). The site is in the Maitland LGA.

The site has no existing developments or features, apart from some vegetation and easement along the eastern side of the properties. The proposed development for the site includes the subdivision of the land into numerous residential lots, each with a residential dwelling. The development plans also indicate the construction of a road to connect the properties to Rutherford Street, as well as a carparking area and communal space.

An ASSA assessment is required as disturbances to Potential Acid Sulphate Soil (PASS) or Actual Acid Sulphate Soils, which may occur during construction and excavation works, can result in the formation of acid. The acid, once formed, could then damage infrastructure or harm ecological systems. The results of the field parameters from this assessment should only be used as a preliminary study to determine if further investigations are required. If results exceed the criteria, then further work, including an ASS Management Plan, may be required.

2.0 OBJECTIVES

The purpose of the ASS Assessment is to determine the presence or absence of ASS at the site. In the absence of ASS, it is essential to assess for the presence of Potential Acid Sulphate Soils (PASS). If the results do not meet criteria an Acid Sulphate Soil Management Plan will be required.

This assessment reviewed the presence of ASS / PASS in the portion of the site that may require excavation.

3.0 SCOPE OF WORKS

The scope of works of the PASSA included:

- Review of previous environmental assessments;
- Site walkover;
- Targeted soil boring, sampling and testing for ASS at the site;
- Interpretation of field test analysis and findings;
- Reporting in accordance with relevant assessment guidelines / regulations

4.0 ASSESSMENT CRITERIA

When assessing ASS at sites in NSW, the Acid Sulphate Soils Management Advisory Committee 'Acid Sulphate Soil Manual' apply. The following national guidelines issued in June 2018 are also applicable:

- Australian Government Department of Agriculture and Water Resources (2018), National Acid Sulfate Soils Guidance – National Acid Sulfate Soil Sampling and Identification Methods Manual, June 2018.

The purpose of this report is to determine whether there is a probable risk associated with ASS or PASS and to determine whether these types of soils actually exist on the site.

This report has been prepared in accordance with the Acid Sulphate Soil Manual (1998) & National Acid Sulfate Soil Sampling and identification methods manual (2018).

Risk Map

A review of NSW Department of Land & Water Conservation (DLWC) Acid Sulphate Soil Risk Maps (Edition Two, December 1997, Scale 1:250,000) was undertaken. The risk maps do not detail the severity of the ASS, but only provide an indication that they may be present. The decision to classify certain areas as ASS is based on a number of geomorphic conditions and site criteria. The following points are used to determine if ASS is likely to exist (extracted from ASSMAC (1998) Acid Sulphate Soils Assessment Guidelines):

- Sediments of recent geological age (Holocene) ~ 10 000 yr.
- Soil horizons less than 5m AHD (Australian Height Datum).
- Marine or estuarine sediments and tidal lakes.
- In coastal wetlands or back swamp areas; waterlogged or scalded areas; interdune swales or coastal sand dunes.
- In areas where the dominant vegetation is mangroves, reeds, rushes and other swamp tolerant and marine vegetation.
- In areas identified in geological descriptions or in maps bearing sulphide minerals, coal deposits or former marine shales/sediments.
- Deeper older estuarine sediments >10m below the ground surface, Holocene or Pleistocene age.

Based on the above information in order to determine whether there is a potential for acid sulphate soils to be present within a site, reference was made to the NSW Department of Land & Water Conservation (DLWC) Acid Sulphate Soil Risk Maps (Edition Two, December 1997, Scale 1:250,000). A review of the "Maitland" map indicated that the site is located in "No Known Occurrences" of acid sulphate soil material within the soil profile. A review of the "Maitland Local Environmental Plan 2011, Acid Sulfate Soils Map – ASS 004A", the site is located in Class 5 area of acid sulphate soil material within the soil profile.

Assessment Criteria

The following soil indicators are used to determine if AASS is actually present on a site:

- field pH ≤ 4 in soils
- presence of shell
- any jarosite horizons or substantial iron oxide mottling in auger holes, in surface encrustations or in any material dredged or excavated and left exposed. Jarosite is not always found, however, in actual acid sulphate soils.

The following soil indicators are used to determine if PASS is actually present on a site:

- waterlogged soils, unripe muds (soft, buttery, blue grey or dark greenish grey) or estuarine silty sands or sands (mid to dark grey) or bottom sediments of estuaries or tidal lakes (dark grey to black)
- presence of shell
- soil pH usually neutral but may be acid -positive Peroxide Test (see section 7.2 Field pH results).

5.0 SITE INFORMATION

5.1 Site Identification

The site is identified as follows:

Table 1: Site Identification Review

Site Identifier	Site Details	
Site Location	39-41 Fairfax Street, Rutherford NSW	
Lot/DP	Lot 10 & Lot 11 in DP809354	
Site Coordinates #	SE Corner: Latitude: -32.71055, Longitude: 151.521105 NE Corner: Latitude: -32.709045, Longitude: 151.521409 NW Corner: Latitude: -32.709336, Longitude: 151.519971	
Site Area	Approximately 9,340m ²	
Local Government Area (LGA)#	Maitland	
Zoning##	R1 – General Residential	
Surrounding Land Uses	<i>North</i>	Residential
	<i>South</i>	Residential
	<i>East</i>	Vacant Land/Residential
	<i>West</i>	Fairfax Street then Residential

Notes: # Six Maps

refer to NSW Planning Portal

<https://www.planningportal.nsw.gov.au/spatialviewer/#!/find-a-property/address>

<https://www.planningportal.nsw.gov.au/find-a-property>

5.2 Topography

The topography viewed on NSW indicated the following for the Bolwarra Heights soil landscape:

rolling low hills on Permian sediments in the centre-west of the sheet in the East Maitland Hills region. Slopes are 5–20%, elevation to 100 m, local relief to 80 m. Cleared tall open-forest.

5.3 Local Geology & Surface Waters

The Geological Map of Newcastle (Geological Series Sheet SI 56-2, Scale 1:250,000, 1966), published by the Department of Mines indicates the site is located in the vicinity of Pd:

Pd indicates the residual soils within the site to be underlain by Permian age sandstone, siltstone, mudstone, shale, conglomerate, tuff, basalt, erratics.

The nearest downgradient waterbody is Hunter River located approximately 1.7km north west of the site. There are many dams within & surrounding of the properties likely connected to the river.

5.4 Proposed Development

The site has no existing developments or features, apart from some vegetation and easement along the eastern side of the properties. The proposed development for the site includes the subdivision of the land into numerous residential lots, each with a residential dwelling. The development plans also indicate the construction of a road to connect the properties to Rutherford Street, as well as a carparking area and communal space.

Refer to **Appendix B** - Proposed Development Plans.

6.0 SOIL BORING AND SAMPLING

A soil sampling and analysis program was used to consolidate the nature and degree of Acid Sulphate Soils present in the surface and subsurface geology. Samples were collected from four (4) boreholes within the site. The borehole locations are presented in **Figure 2 – Site Features and Borehole Location Plan**.

Field analysis was performed on the collected samples for pH_f and pH_{fox} in accordance with the required sampling techniques outlined in the Acid Sulfate Soil Manual (*ASSMAC 1998*). This included the Field pH and peroxide test protocol.

6.1 Quality Assurance/Quality Control (QA/QC)

Standard QA/QC procedures were followed. The decontamination of sampling equipment and the hand auger was achieved by washing with phosphate-free detergent and tap water, followed by final rinsing with distilled water. This was conducted after the collection of samples.

Standard sampling and analysing procedures are in accordance with and set out in the Acid Sulphate Soil Manual (1998) and Australian Government Department of Agriculture and Water Resources (2018), National Acid Sulfate Soils Guidance – National acid sulfate soil sampling and identification methods manual, June 2018.

7.0 FIELD RESULTS

7.1 Soil Observations

Based on information from all boreholes, the surface and sub-surface profile across the site is generalised as follows:

- Fill: Clayey Silt
- Natural: Silty CLAY

No unusual colouring or shells were detected in the soil, other than some mottling observed in the natural material. This suggests the presence of pyrite (iron sulphide) or jarosite was unlikely.

Refer to **Appendix A** – Borehole Logs.

7.2 Field pH Results

The results of the field pH tests are presented in the table below:

Table 2: Summary of field analysis results

Sample	Depth (m)	pH		pH		Change in pH (pH _f – pH _{fox})	Effervescence Reaction Rate
		H ₂ O	Soil pH _f	H ₂ O ₂	Soil pH _{fox}		
ASS1-1	0-0.1	-	5.5	-	3.8	1.7	Low
ASS1-2	0.5-0.6	-	6.0	-	3.9	2.1	Low
ASS1-3	1.0-1.1	-	5.8	-	4.1	1.7	Low
ASS1-4	1.5-1.6	-	5.5	-	4.1	1.4	Medium
ASS1-5	2.0-2.1	-	6	-	4.8	1.2	Low
ASS1-6	2.5-2.6	-	5.7	-	4.5	1.2	Low
ASS1-7	3.0-3.1	-	5.8	-	4.9	0.9	Low
ASS2-1	0-0.1	-	5.7	-	3.8	1.9	Low
ASS2-2	0.4-0.5	-	5.6	-	4.4	1.2	Low
ASS2-3	1.0-1.1	-	4.8	-	4.5	0.3	Low
ASS2-4	1.5-1.6	-	5.0	-	4.1	0.9	Low
ASS2-5	2.0-2.1	-	5.2	-	4.2	1.0	Low
ASS2-6	2.5-2.6	-	5.7	-	4.5	1.2	Low
ASS3-1	0-0.1	-	4.8	-	2.9	1.9	Low
ASS3-2	0.5-0.6	-	4.5	-	3.7	0.8	Low
ASS4-1	0-0.1	-	5.3	-	3.3	2.0	Low
ASS4-2	0.5-0.6	-	5.4	-	3.8	1.6	Low

Notes:

- pH_f refers to pH field (soil and distilled H₂O).
- pH_{fox} refers to pH field oxidised (soil and peroxide).
- Change in pH refers to pH field minus pH field oxidised.
- **Highlighted** refers to detections.

To investigate the pH of the soils (pH_f) water was added to the soil samples. pH_f of all the investigated samples were above the pH of 4. This indicates the soils from which the samples were collected did not contain actual ASS.

To investigate the presence of PASS, 30% peroxide (H_2O_2) was added to soil samples and the resulting pH of the mixture was measured (field test protocols are presented in Appendix D of the ASSMAC (1998) Field pH and peroxide test protocol). The soil peroxide solution (pH_{fox}) results indicated the pH was mostly above 3.5 and only dropped by one to one and a half units on average and all reactions were low excluding ASS1-4A. Based on the field analysis, further limited laboratory investigation was warranted.

8.0 SUSPENDED PEROXIDE OXIDATION COMBINED ACIDITY & SULPHATE (SPOCAS) RESULTS

Following the field tests undertaken by FES (administered Envirolab), four (4) soil samples from FES (collected from 7th March 2023) were submitted to the NATA certified laboratory of Envirolab for the SPOCAS test.

The soils were assessed against the guidelines set out in Acid Sulphate Soils Management Advisory Committee (ASSMAC) (2008) *Acid Sulphate Soils Assessment Guidelines*. The action criteria selected was based on excavation of more than 1,000 tonnes of soils disturbed within the site. The results are assessed against the available criteria, those being:

Coarse Texture Soils

- Sulphur Trail (S_{pos}) = 0.03%
- Acid Trail (TPA) = 18 mol H⁺/tonne

Medium Texture Soils

- Sulphur Trail (S_{pos}) = 0.03%
- Acid Trail (TPA) = 36 mol H⁺/tonne

The laboratory analysis results are presented in the following table:

Table 3: Laboratory Results - SPOCAS

Sample	Profile	Depth (m)	S-POS (%) (sulphur trail)	TAA (mol H ⁺ /tonne)	TPA (mol H ⁺ /tonne) (acid trail)	TSA (mol H ⁺ /tonne) (acid trail)	Lime Calculation (kg CaCO ₃ /t includes 1.5 safety factor).
Sampling dated 23rd February 2023							
ASS1-2	Clayey Silt	0.5-0.6	0.01	24	40	16	2.2
ASS1-4	Silty CLAY	1.5-1.6	0.006	18	39	22	1.6
ASS1-6	Silty CLAY	2.5-2.6	<0.005	24	36	12	1.8
ASS3-1	Clayey Silt	0.0-0.1	0.03	16	30	14	2.7
ASSMAC Guidelines Medium Texture		-	0.03	-	18	18	-
ASSMAC Guidelines Coarse Texture		-	0.03	-	18	18	-

Notes:

- Guidelines follow the ASSMAC “Acid Sulphate Soils Assessment Guidelines 1998”.
- Fine Texture Criteria based upon clay content of > or equal to 40%
- Medium Texture Criteria based upon clay content of 5-40%
- Criteria based upon less than 1000 tonnes disturbed
- **Bold values exceed ASSMAC guidelines**

When comparing the results summarised above in Table 3 to Table 4.4 (ASSMAC) for medium to coarse texture soils it can be determined that the percentage of oxidisable Sulphur (SPOS) in all the samples did not exceed the action criteria. Acid trail (TPA/TSA) in all samples were above the action criteria with the exception of TSA in borehole location ASS1 at 0.5-0.6m and 2.5-2.6m BGL and ASS3 at 0.0-0.1m.

9.0 CHROMIUM REDUCIBLE SULPHUR RESULTS

Chromium Reducible sulphur method calculates the potential acidity from analysis of sulphide content. This method does not include sulphur from organics and sulphates (e.g. gypsum) and detects as low sulphide content and is therefore suitable to determine potential interferences caused by naturally occurring acidity within the soils. The laboratory results are presented in the following table:

Table 4: Laboratory Results – Chromium Reducible Sulphur

Sample	Depth	Chromium Reducible Sulphur (%)
Sampling dated 9th March 2023		
ASS1-2	0.5-0.6	<0.005
ASS1-4	1.5-1.6	<0.005
ASS1-6	2.5-2.6	<0.005
ASS3-1	0.0-0.1	<0.005
SPOS Action Criteria		0.03

The results from the Table 4 indicated the following:

- A lack of oxidisable sulphur compounds was detected within all the borehole locations.

10.0 DISCUSSION & RECOMMENDATION

The assessment of acid sulphate material can be quite complex and can have a lot of interferences associated with the test methods and soil matrix. The following points outline the evidence to support the site is **NOT** impacted to the maximum depth of sampling:

- Analysis using the pH_F & pH_{ox} field test protocol showed the soil indicators to be absent for AASS;
- All effervescence reactions were low/medium;
- No visual indicators of AASS/PASS were noted;
- Analysis via the SPOCAS test indicated the percentage of oxidisable Sulphur (SPOS) did not exceed the relevant action criteria in all samples.
- Analysis using the Chromium reducible suite indicated that no inorganic sulphur sources were present above the relevant action criteria.
- FES has concluded the existing acid trail may have been consistent with organic occurring materials within the natural CLAY.
- Based on a google earth search, the site has an elevation of approx. 28m to 52m AHD. Acid Sulphate Soil horizons are typically located below 5m AHD.

It has been determined that the site is **NOT impacted by Acid Sulphate Soils** within the borehole locations ASSA1 to ASSA4 to a maximum depth of **3.1m BGL**.

We would be pleased to provide further information or discuss any aspect of our report. Please do not hesitate to contact the undersigned should you have any queries.

REFERENCES

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) (2018).
- Australian Government Department of Agriculture and Water Resources (2018), National Acid Sulfate Soils Guidance – National Acid Sulfate Soil Sampling and Identification Methods Manual, June 2018.
- Stone Y, Ahern C.R and Blunden B (1998), 'Acid Sulphate Soil Manual 1998', Acid Sulphate Soils Management Advisory Committee, Wollongbar, NSW, Australia.

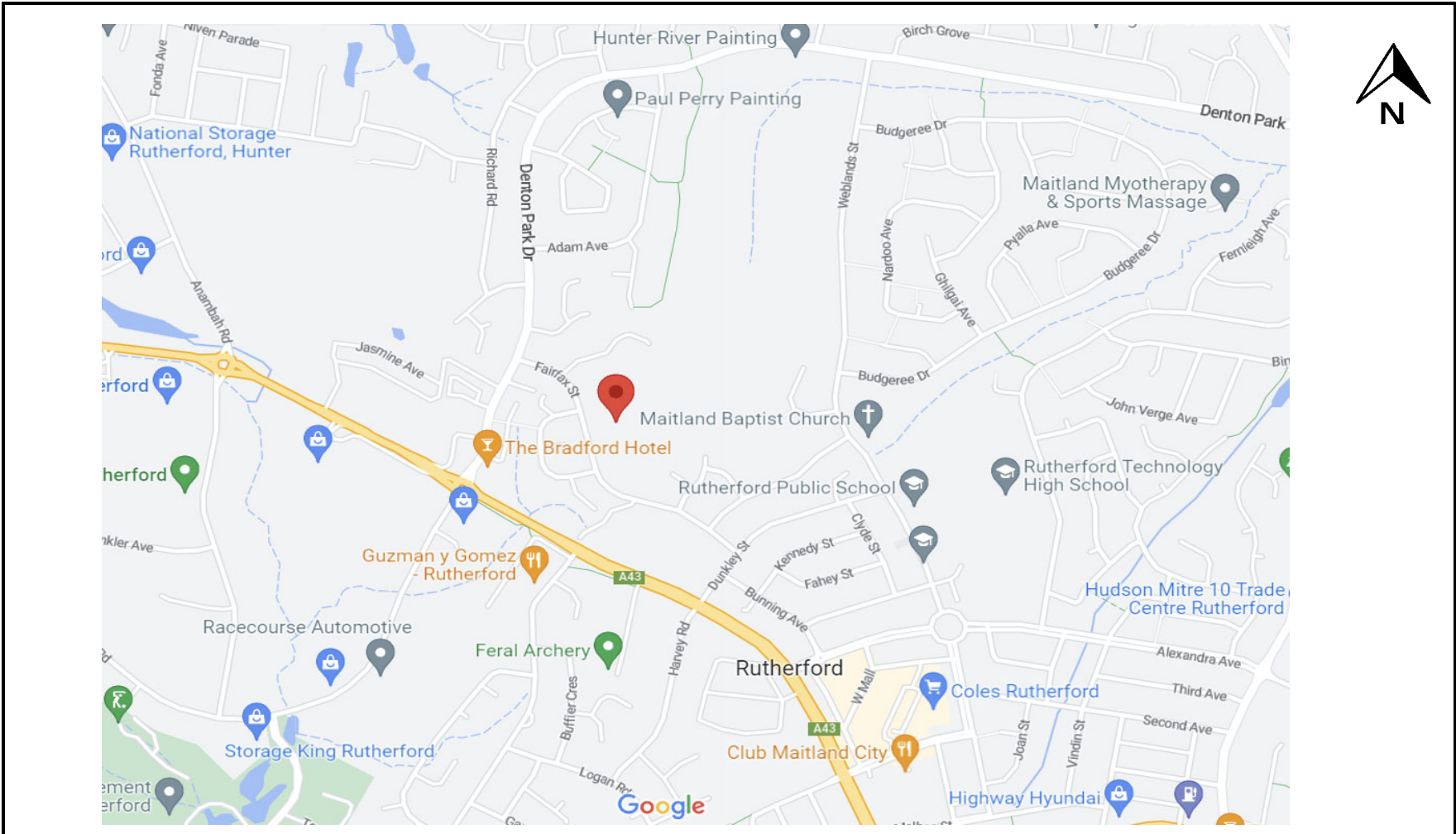
LIMITATIONS

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue, although subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay. There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site.

There is no investigation that is thorough enough to preclude the presence of material that presently or in the future, may be considered hazardous at the site. Since regulatory criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

Opinions are judgements that are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Although the information provided by an Acid Sulphate Soils Assessment and Management Plan can reduce exposure to risks, no assessment, however diligently carried out, can eliminate them. It must be noted that these findings are professional findings and have limitations. Even a rigorous professional assessment may fail to detect all ASS and/or PASS on a site. Sulphates may be present in areas that were not surveyed or sampled.

FIGURE 1: LOCALITY MAP





Key		DRAWN	SITE LOCALITY
Site Location		RW	
		FIGURE	Preliminary Site Investigation
		1	
		Job #	39-41 Fairfax Street, Rutherford NSW
		E3008	

FIGURE 2: SITE FEATURES & BOREHOLE LOCATION PLAN

Feature No	Details
a	Fences
b	Tree
c	Driveway



Key	
Site Location	
Borehole Location	



DRAWN RW
Figure 2
Job # E3008-2

Site Features and Borehole Location Plan	
Greentree Projects	
39-41 Fairfax Street, Rutherford NSW	

APPENDIX A: BOREHOLE LOGS



CLIENT NAME: Greentree Projects Pty Ltd **JOB NUMBER:** E3008-2

SITE ADDRESS: 39-41 Fairfax Street, Rutherford NSW **PROJECT:** Preliminary Acid Sulphate Soil Assessment

Date Started : 7/03/2023 **Completed :** 7/03/2023 **Logged By :** RW **Checked By :** MS/LM

Borehole Location : Refer to Site Plan **Surface RL :** --- **Datum :** m AHD



Equipment : HA/Excavated **Borehole Size :** 500mm **Slope :** -90°

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)	
HA/E	Dry		0.5			FILL - Clayey Silt, brown, low plasticity, with rock fragments	M	[VL]	ASS2-1	No HC smell, No Staining or No fibro fragments observed. Fill	0.5	
			0.60						0.2-0.3			
											ASS2-2	
						CH	Silty CLAY, grey/red/orange, high plasticity	M	St			
					1.0						ASS2-3	
					1.50				VSt-H		ASS2-4	Residual
			2.0					ASS2-5		2.0		
			2.5					ASS2-6		2.5		
			2.70			Borehole BH1 terminated at 2.70m					2.70	
			3.0								3.0	
			3.5								3.5	
			4.0								4.0	

Comments:

D - Dry
M - Moist
W - Wet
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

CLIENT NAME: Greentree Projects Pty Ltd **JOB NUMBER:** E3008-2
SITE ADDRESS: 39-41 Fairfax Street, Rutherford NSW **PROJECT:** Preliminary Acid Sulphate Soil Assessment
Date Started : 7/03/2023 **Completed :** 7/03/2023 **Logged By :** RW **Checked By :** MS/LM
Borehole Location : Refer to Site Plan **Surface RL :** --- **Datum :** m AHD
Equipment : HA/Excavated **Borehole Size :** 100mm **Slope :** -90°

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
HA/E	Dry		0.30			FILL - Clayey Silt, brown, low plasticity, with rock fragments	M	[VL]	ASS3-1 0.1-0.2	No HC smell, No Staining or No fibro fragments observed. Fill Residual	
			0.5		CH	Silty CLAY, grey/red/orange, high plasticity	D	VSt	Shrink-Swell Index ASS3-2		0.5
			0.70			Borehole BH2/TP2 terminated at 0.70m					
			1.0								1.0
			1.5								1.5
			2.0								2.0
			2.5								2.5
			3.0								3.0
			3.5								3.5
			4.0								4.0

Comments:

D - Dry	VS - Very Soft	VL - Very Loose
M - Moist	S - Soft	L - Loose
W - Wet	F - Firm	MD - Medium Dense
	St - Stiff	D - Dense
	VSt - Very Stiff	VD - Very Dense
	H - Hard	



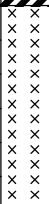
CLIENT NAME: Greentree Projects Pty Ltd JOB NUMBER: E3008-2

SITE ADDRESS: 39-41 Fairfax Street, Rutherford NSW PROJECT: Preliminary Acid Sulphate Soil Assessment

Date Started : 7/03/2023 Completed : 7/03/2023 Logged By : RW Checked By : MS/LM

Borehole Location : Refer to Site Plan Surface RL : --- Datum : m AHD




Equipment : HA/Excavated Borehole Size : 500mm Slope : -90°

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)	
HA/E	Dry		0.5			FILL - Clayey Silt, brown, low plasticity, with gravel and rock fragments	M	[VL]	0.0-0.1 & ASS1-1	No HC smell, No Staining or No fibro fragments observed. Fill	0.5	
									ASS1-2			
			0.80			CH	Silty CLAY, yellow/red/orange, medium to high plasticity, with rock fragments	D-M	H	Atterberg Limits & CBR		1.0
										ASS1-3		
										ASS1-4	Residual	1.5
										ASS1-5		2.0
				2.50				SILTSTONE, extremely weathered, extremely low strength, grey and brown	-		ASS1-6	Rock
								ASS1-7		3.0		
			3.10			Borehole BH3/TP3 terminated at 3.10m					3.10	
			3.5								3.5	
			4.0								4.0	

Comments:

D - Dry M - Moist W - Wet VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense

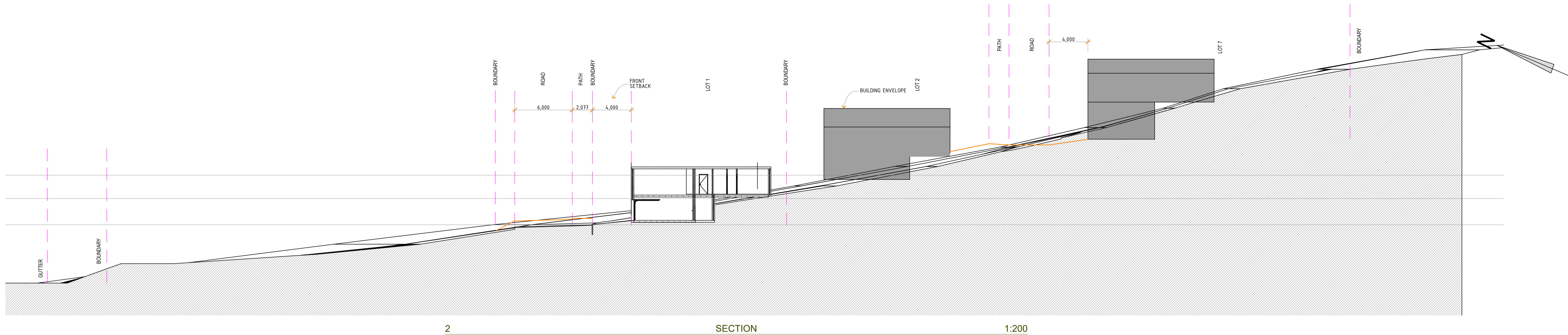
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Borehole Location : Refer to Site Plan **Surface RL :** --- **Datum :** m AHD
Equipment : HA/Excavated **Borehole Size :** 500mm **Slope :** -90°

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)	
HA/E	Dry		0.10			FILL - Clayey Silt, grey, low plasticity, with rocks	M	[VL]	0.0-0.1&ASS4-1	No HC smell, No Staining or No fibro fragments observed. Fill		
			0.50		CH	Silty CLAY, yellow/red/orange, high / medium to high plasticity, with gravel and rock fragments	M	St-VSt	Atterberg Limits & CBR		Residual	
			0.50			SILTSTONE, extremely to highly weathered, extremely low strength, brown	-		ASS4-2		Rock	0.5
			0.60			Borehole BH4/TP4 terminated at 0.60m						
			1.0								1.0	
			1.5								1.5	
			2.0								2.0	
			2.5								2.5	
			3.0								3.0	
			3.5								3.5	
			4.0								4.0	

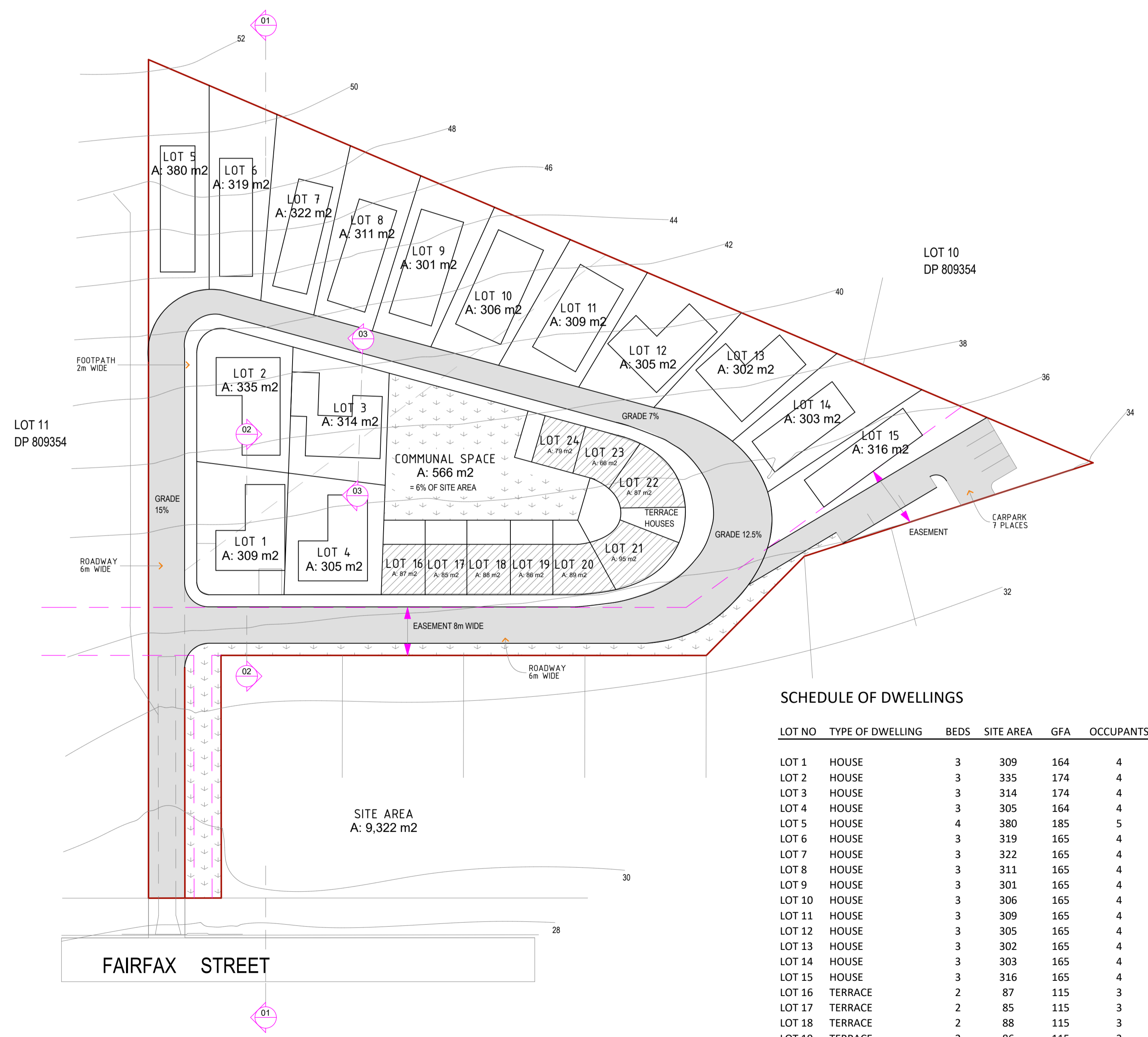
Comments:

D - Dry	VS - Very Soft	VL - Very Loose
M - Moist	S - Soft	L - Loose
W - Wet	F - Firm	MD - Medium Dense
	St - Stiff	D - Dense
	VSt - Very Stiff	VD - Very Dense
	H - Hard	

APPENDIX B: PROPOSED DEVELOPMENT PLANS



2 SECTION 1:200



1 SITE PLAN 1:500

SCHEDULE OF DWELLINGS

LOT NO	TYPE OF DWELLING	BEDS	SITE AREA	GFA	OCCUPANTS
LOT 1	HOUSE	3	309	164	4
LOT 2	HOUSE	3	335	174	4
LOT 3	HOUSE	3	314	174	4
LOT 4	HOUSE	3	305	164	4
LOT 5	HOUSE	4	380	185	5
LOT 6	HOUSE	3	319	165	4
LOT 7	HOUSE	3	322	165	4
LOT 8	HOUSE	3	311	165	4
LOT 9	HOUSE	3	301	165	4
LOT 10	HOUSE	3	306	165	4
LOT 11	HOUSE	3	309	165	4
LOT 12	HOUSE	3	305	165	4
LOT 13	HOUSE	3	302	165	4
LOT 14	HOUSE	3	303	165	4
LOT 15	HOUSE	3	316	165	4
LOT 16	TERRACE	2	87	115	3
LOT 17	TERRACE	2	85	115	3
LOT 18	TERRACE	2	88	115	3
LOT 19	TERRACE	2	86	115	3
LOT 20	TERRACE	2	89	115	3
LOT 21	TERRACE	2	95	115	3
LOT 22	TERRACE	2	87	115	3
LOT 23	TERRACE	1	66	95	2
LOT 24	TERRACE	2	79	115	3
TOTALS			5499	3526	87



3 AERIAL VIEW 1 1:142.86

Issue Amendment Date
 Project: **MULTI DWELLING HOUSING**
 39-41 FAIRFAX STREET
 RUTHERFORD 2320
 LOTS 10 & 11 DP 809354
 Client: TBA

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Drawing: **SITE PLAN & SECTION**

Scale: AS SHOWN Date: 13 SEP 2022

Status: CONCEPT Drawn by: MMA

Project No. Drawing No. Amend.

14222 01

Plot Date: 25/11/2022

APPENDIX C: NATA ACCREDITED LABORATORY CERTIFICATES



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CERTIFICATE OF ANALYSIS 318279

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Michael Silk
Address	PO Box 4405, East Gosford, NSW, 2250

Sample Details

Your Reference	<u>E3008-2 Rutherford</u>
Number of Samples	17 Soil
Date samples received	09/03/2023
Date completed instructions received	09/03/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by 16/03/2023

Date of Issue 16/03/2023

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Results Approved By

Diego Bigolin, Inorganics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Client Reference: E3008-2 Rutherford

sPOCAS field test						
Our Reference		318279-1	318279-2	318279-3	318279-4	318279-5
Your Reference	UNITS	ASS1-1	ASS1-2	ASS1-3	ASS1-4	ASS1-5
Depth		0.0-0.1	0.5-0.6	1.0-1.1	1.5-1.6	2.0-2.1
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/03/2023	15/03/2023	15/03/2023	15/03/2023	15/03/2023
Date analysed	-	15/03/2023	15/03/2023	15/03/2023	15/03/2023	15/03/2023
pH _F (field pH test)	pH Units	5.5	6.0	5.8	5.5	6.0
pH _{FOX} (field peroxide test)	pH Units	3.8	3.9	4.1	4.1	4.8
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Medium reaction	Low reaction

sPOCAS field test						
Our Reference		318279-6	318279-7	318279-8	318279-9	318279-10
Your Reference	UNITS	ASS1-6	ASS1-7	ASS2-1	ASS2-2	ASS2-3
Depth		2.5-2.6	3.0-3.1	0.0-0.1	0.4-0.5	1.0-1.1
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/03/2023	15/03/2023	15/03/2023	15/03/2023	15/03/2023
Date analysed	-	15/03/2023	15/03/2023	15/03/2023	15/03/2023	15/03/2023
pH _F (field pH test)	pH Units	5.7	5.8	5.7	5.6	4.8
pH _{FOX} (field peroxide test)	pH Units	4.5	4.9	3.8	4.4	4.5
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		318279-11	318279-12	318279-13	318279-14	318279-15
Your Reference	UNITS	ASS2-4	ASS2-5	ASS2-6	ASS3-1	ASS3-2
Depth		1.5-1.6	2.0-2.1	2.5-2.6	0.0-0.1	0.5-0.6
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/03/2023	15/03/2023	15/03/2023	15/03/2023	15/03/2023
Date analysed	-	15/03/2023	15/03/2023	15/03/2023	15/03/2023	15/03/2023
pH _F (field pH test)	pH Units	5.0	5.2	5.7	4.8	4.5
pH _{FOX} (field peroxide test)	pH Units	4.1	4.2	4.5	2.9	3.7
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test			
Our Reference		318279-16	318279-17
Your Reference	UNITS	ASS4-1	ASS4-2
Depth		0.0-0.1	0.5-0.6
Type of sample		Soil	Soil
Date prepared	-	15/03/2023	15/03/2023
Date analysed	-	15/03/2023	15/03/2023
pH _F (field pH test)	pH Units	5.3	5.4
pH _{FOX} (field peroxide test)	pH Units	3.3	3.8
Reaction Rate*	-	Low reaction	Low reaction

Method ID	Methodology Summary
Inorg-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.

Client Reference: E3008-2 Rutherford

QUALITY CONTROL: sPOCAS field test					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			15/03/2023	[NT]	[NT]	[NT]	[NT]	15/03/2023	[NT]
Date analysed	-			15/03/2023	[NT]	[NT]	[NT]	[NT]	15/03/2023	[NT]
pH _F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
pH _{Fox} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.



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CERTIFICATE OF ANALYSIS 318279-A

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Ray Liu
Address	PO Box 4405, East Gosford, NSW, 2250

Sample Details

Your Reference	<u>E3008-2 Rutherford</u>
Number of Samples	Additional Testing on 4 Soils
Date samples received	09/03/2023
Date completed instructions received	17/03/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by 24/03/2023

Date of Issue 24/03/2023

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Results Approved By

Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Client Reference: E3008-2 Rutherford

sPOCAS + %S w/w					
Our Reference		318279-A-2	318279-A-4	318279-A-6	318279-A-14
Your Reference	UNITS	ASS1-2	ASS1-4	ASS1-6	ASS3-1
Depth		0.5-0.6	1.5-1.6	2.5-2.6	0.0-0.1
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	24/03/2023	24/03/2023	24/03/2023	24/03/2023
Date analysed	-	24/03/2023	24/03/2023	24/03/2023	24/03/2023
pH _{KCl}	pH units	4.5	4.5	4.3	4.5
TAA pH 6.5	moles H ⁺ / t	24	18	24	16
s-TAA pH 6.5	%w/w S	0.04	0.03	0.04	0.03
pH _{Ox}	pH units	3.6	3.4	4.2	3.9
TPA pH 6.5	moles H ⁺ / t	40	39	36	30
s-TPA pH 6.5	%w/w S	0.06	0.06	0.06	0.05
TSA pH 6.5	moles H ⁺ / t	16	22	12	14
s-TSA pH 6.5	%w/w S	0.03	0.03	0.02	0.02
ANC _E	% CaCO ₃	[NT]	[NT]	[NT]	[NT]
a-ANC _E	moles H ⁺ / t	[NT]	[NT]	[NT]	[NT]
s-ANC _E	%w/w S	[NT]	[NT]	[NT]	[NT]
S _{KCl}	%w/w S	<0.005	<0.005	0.007	0.005
S _P	%w/w	0.01	0.007	0.008	0.04
S _{POS}	%w/w	0.01	0.006	<0.005	0.03
a-S _{POS}	moles H ⁺ / t	6	<5	<5	19
Ca _{KCl}	%w/w	0.02	0.008	0.005	0.05
Ca _P	%w/w	0.03	0.01	0.007	0.04
Ca _A	%w/w	0.007	<0.005	<0.005	<0.005
Mg _{KCl}	%w/w	0.011	0.012	0.019	0.032
Mg _P	%w/w	0.015	0.016	0.028	0.027
Mg _A	%w/w	<0.005	<0.005	0.009	<0.005
S _{HCl}	%w/w S	0.006	<0.005	0.007	0.011
S _{NAS}	%w/w S	<0.005	<0.005	<0.005	0.007
a-S _{NAS}	moles H ⁺ / t	<5	<5	<5	<5
s-S _{NAS}	%w/w S	<0.01	<0.01	<0.01	<0.01
Fineness Factor	-	1.5	1.5	1.5	1.5
a-Net Acidity	moles H ⁺ / t	30	21	24	35
s-Net Acidity	%w/w S	0.05	0.03	0.04	0.06
Liming rate	kg CaCO ₃ / t	2.2	1.6	1.8	2.7
s-Net Acidity without -ANCE	%w/w S	0.05	0.03	0.04	0.06
a-Net Acidity without ANCE	moles H ⁺ / t	30	21	24	35
Liming rate without ANCE	kg CaCO ₃ / t	2.2	1.6	1.8	2.7

SCr					
Our Reference		318279-A-2	318279-A-4	318279-A-6	318279-A-14
Your Reference	UNITS	ASS1-2	ASS1-4	ASS1-6	ASS3-1
Depth		0.5-0.6	1.5-1.6	2.5-2.6	0.0-0.1
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	24/03/2023	24/03/2023	24/03/2023	24/03/2023
Date analysed	-	24/03/2023	24/03/2023	24/03/2023	24/03/2023
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H ⁺ / t	<3	<3	<3	<3

Method ID	Methodology Summary
Inorg-064	<p>sPOCAS determined using titrimetric and ICP-AES techniques. Based on National acid sulfate soils identification and laboratory methods manual June 2018. Ideally samples should be received in the laboratory at <40C. Please refer to SRA for sample temperature on receipt. Net acidity including ANC has a safety factor of 1.5 applied. Neutralising value (NV) of 100% is assumed for liming rate The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL results reported.</p>
Inorg-068	<p>Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Net acidity including ANC has a safety factor of 1.5 applied. Neutralising value (NV) of 100% is assumed for liming rate. Based on National acid sulfate soils identification and laboratory methods manual June 2018. The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL results reported.</p>

Client Reference: E3008-2 Rutherford

QUALITY CONTROL: sPOCAS + %S w/w				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			24/03/2023	[NT]	[NT]	[NT]	[NT]	24/03/2023	[NT]
Date analysed	-			24/03/2023	[NT]	[NT]	[NT]	[NT]	24/03/2023	[NT]
pH _{KCl}	pH units		Inorg-064	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
TAA pH 6.5	moles H ⁺ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	112	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pH _{Ox}	pH units		Inorg-064	[NT]	[NT]	[NT]	[NT]	[NT]	103	[NT]
TPA pH 6.5	moles H ⁺ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	127	[NT]
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
TSA pH 6.5	moles H ⁺ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
ANC _E	% CaCO ₃	0.05	Inorg-064	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-ANC _E	moles H ⁺ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC _E	%w/w S	0.05	Inorg-064	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S _{KCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S _P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S _{POS}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-S _{POS}	moles H ⁺ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ca _{KCl}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ca _P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ca _A	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Mg _{KCl}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Mg _P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Mg _A	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S _{HCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S _{NAS}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-S _{NAS}	moles H ⁺ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-S _{NAS}	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fineness Factor	-	1.5	Inorg-064	<1.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Net Acidity	moles H ⁺ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate	kg CaCO ₃ /t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity without -ANCE	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Client Reference: E3008-2 Rutherford

QUALITY CONTROL: sPOCAS + %S w/w					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
a-Net Acidity without ANCE	moles H ⁺ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate without ANCE	kg CaCO ₃ /t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Client Reference: E3008-2 Rutherford

QUALITY CONTROL: SCr				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			24/03/2023	[NT]	[NT]	[NT]	[NT]	24/03/2023	[NT]
Date analysed	-			24/03/2023	[NT]	[NT]	[NT]	[NT]	24/03/2023	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	96	[NT]
a-Chromium Reducible Sulfur	moles H ⁺ /t	3	Inorg-068	<3	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

SAMPLE RECEIPT ADVICE

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Ray Liu

Sample Login Details

Your reference	E3008-2 Rutherford
Envirolab Reference	318279-A
Date Sample Received	09/03/2023
Date Instructions Received	17/03/2023
Date Results Expected to be Reported	24/03/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 4 Soils
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	8
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: ahie@envirolab.com.au

Jacinta Hurst

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	sPOCAS + %S w/w	SCr	On Hold
ASS1-1-0.0-0.1			✓
ASS1-2-0.5-0.6	✓	✓	
ASS1-3-1.0-1.1			✓
ASS1-4-1.5-1.6	✓	✓	
ASS1-5-2.0-2.1			✓
ASS1-6-2.5-2.6	✓	✓	
ASS1-7-3.0-3.1			✓
ASS2-1-0.0-0.1			✓
ASS2-2-0.4-0.5			✓
ASS2-3-1.0-1.1			✓
ASS2-4-1.5-1.6			✓
ASS2-5-2.0-2.1			✓
ASS2-6-2.5-2.6			✓
ASS3-1-0.0-0.1	✓	✓	
ASS3-2-0.5-0.6			✓
ASS4-1-0.0-0.1			✓
ASS4-2-0.5-0.6			✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.


TAT for Micro is dependent on incubation. This varies from 3 to 6 days.



Chain of Custody Record

Client Details:	Foundation Earth Sciences PO Box 4405, East Gosford NSW 2250 email: ben@foundations.com.au michael@foundations.com.au; reece@foundations.com.au ph: +61466 385 221	Project Manager: Michael Silk Sampled By: RW Purchase Order #: N/A Page #: 1 of 1	Project #: E3008-2 Project Name: Rutherford Quote #: Turnaround: Standard
Delivery Details:	Envirolab Pty Ltd 12 Ashley Street, Chatswood NSW 2067 email: ahie@envirolab.com.au ph: +612 9910 6200		

#	Sample ID	Depth	Date Sampled	Matrix	Analytes												Sample Comments			
1	ASS1-1	0.0-0.1																		Keep
2	ASS1-2	0.5-0.6																		Keep
3	ASS1-3	1.0-1.1																		Keep
4	ASS1-4	1.5-1.6																		Keep
5	ASS1-5	2.0-2.1																		Keep
6	ASS1-6	2.5-2.6																		Keep
7	ASS1-7	3.0-3.1																		Keep
8	ASS2-1	0.0-0.1																		Keep
9	ASS2-2	0.4-0.5																		Keep
10	ASS2-3	1.0-1.1																		Keep
11	ASS2-4	1.5-1.6																		Keep
12	ASS2-5	2.0-2.1																		Keep
13	ASS2-6	2.5-2.6																		Keep
14	ASS3-1	0.0-0.1																		Keep
15	ASS3-2	0.5-0.6																		Keep
16	ASS4-1	0.0-0.1																		Keep
17	ASS4-2	0.5-0.6																		Keep


Envirolab Services
 12 Ashley St
 Chatswood NSW 2067
 Ph: (02) 9910 6200
 Job No: 318279
 Date Received: 9/3/23
 Time Received: 1605
 Received By: RW
 Temp: Cold Ambient
 Cooling: Ice/CePack
 Security: Intact/Broken/None

Special Directions and Comments:			
Relinquished by	RW	Received By	Katy Wayne ELS SYD
Signature	RW	Signature	<i>[Signature]</i>
Date	09.03.2023	Date	9/3/23 1605

SAMPLE RECEIPT ADVICE

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Michael Silk

Sample Login Details

Your reference	E3008-2 Rutherford
Envirolab Reference	318279
Date Sample Received	09/03/2023
Date Instructions Received	09/03/2023
Date Results Expected to be Reported	16/03/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	17 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	8
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: ahie@envirolab.com.au

Jacinta Hurst

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	sPOCAs field test
ASS1-1-0.0-0.1	✓
ASS1-2-0.5-0.6	✓
ASS1-3-1.0-1.1	✓
ASS1-4-1.5-1.6	✓
ASS1-5-2.0-2.1	✓
ASS1-6-2.5-2.6	✓
ASS1-7-3.0-3.1	✓
ASS2-1-0.0-0.1	✓
ASS2-2-0.4-0.5	✓
ASS2-3-1.0-1.1	✓
ASS2-4-1.5-1.6	✓
ASS2-5-2.0-2.1	✓
ASS2-6-2.5-2.6	✓
ASS3-1-0.0-0.1	✓
ASS3-2-0.5-0.6	✓
ASS4-1-0.0-0.1	✓
ASS4-2-0.5-0.6	✓

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