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Report

Acid Sulphate Soils Assessment Report
Proposed Residential Dwellings
Lot 20 Raven Circuit Warriewood NSW

Prepared for:

Aussie Structural Engineers Pty Ltd
31 Cobham Street
Kings Park NSW 2148

Prepared by:

Core Geotech Pty Ltd

23 April 2025

Ref: CG25-0465-B Rev 0

Document Status

Rev No.	Version	Author	Reviewer	Approved for Issue		
				Name	Signature	Date
0	Final	Jeevan Reddy	Raj Singh	Raj Singh		23.04.2025

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Where an electronic only version is provided to the client, a signed hard copy of this document is held on file by CG and a copy will be provided if requested.

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Appendices

1 Introduction

As requested, Core Geotech Pty Ltd (CG) has carried out a acid sulphate soils investigation of a site located at Lot 20 Raven Circuit Warriewood NSW.

According to the provided drawings, the proposed development involves constructing a residential dwelling with an underground On Site Detention (OSD) tank. The average depth of the OSD tank is approximately 0.635 meters.

The aim of this investigation was to assess the presence or absence of acid sulphate soils on site.

2 Fieldwork

Fieldwork was carried out on 8 April 2025 and included drilling one boreholes (BH1) to a termination depth of up to 13.0m using a Ute mounted drilling rig fitted with 110mm diameter solid flight auger attachment. Standard Penetration Tests (SPTs) and Dynamic Cone Penetration (DCP) tests were conducted in BH1 at selected depth intervals to assess the relative density and consistency of the in situ soils.

Soil samples were collected using a stainless-steel trowel from the augers. Sampling tools were decontaminated between each sample collection using water, DECON 90 and a scrubbing brush. All samples were placed in glass jars with plastic caps and Teflon seals with minimum headspace. Each sample was labelled with job number, the sample location and sampling date. All samples were recorded on the Chain of Custody (COC) which is stored in our office files. On completion of fieldwork, the samples were delivered under cold storage conditions to ALS Environmental Smithfield, NSW, a NATA registered laboratory, for analysis under Standard COC procedures.

The field investigation was carried out in the presence of a Geotechnical Engineers from CG who selected borehole location, carried out sampling and prepared borehole log.

A Site investigation Plan (CG25-0465-2) showing the borehole location and borehole log is attached in Appendix B and C respectively. Borehole location was measured from site features to an accuracy of +/- 5m. Elevations were inferred from the survey plan provided.

3 Laboratory Testing

Laboratory testing was carried out generally in accordance with the Australian Standards. All testing was scheduled by CG and carried out by ALS Environmental Smithfield, NSW, a NATA registered laboratory.

The extent of testing carried out to the presence or absence of acid sulphate soils comprised two (2) samples for pHf/pHfox screening test.

4 Site Description

The site is located on the west of Raven Circuit Warriewood NSW. At the time of investigation, the site was vacant. Site photography is shown in Appendix D.

5 Ground Model

5.1 Published Geology

Reference to the NSW surface geology on https://minview.geoscience.nsw.gov.au/ indicates the site is located in an area of Quaternary Alluvial deposits.

5.2 Stratigraphic Units

The subsurface conditions encountered during the field works is considered to be consistent with the geological map indications and can be summarised according to the following subsurface sequence:

Table 1: Summary of Subsurface Profile Encountered in BH1	
Layer Description	**Top to base of layer (m)**
	BH1
Fill – Silty Clayey Sand	0 – 3.3
Alluvial – Silty Sandy Clay/Clay/Silty Clayey Sand	3.3 – 13.0

It should be noted that the depths and layer thickness provided in Table 1 are based on the subsurface conditions as observed at the investigation locations and may not be a representative of the entire site.

Groundwater was encountered at 5m in BH1 at the time of investigation. We note that groundwater levels may not have stabilised over the short observation period. However, it is pointed out that standing groundwater and seepages may fluctuate with variations in rainfall, temperature and other factors. No longer-term groundwater monitoring was carried out.

6 Acid Sulphate Soils Assessment (ASSA)

6.1 Definition and Theoretical Background

ASS are naturally occurring sediments and soils containing iron sulphides (principally iron sulphide, iron disulphide or their precursors). Oxidation of these soils through exposure to the atmosphere or through lowering of groundwater levels results in the generation of sulfuric acid. Most ASS are of Holocene age (<10000 years) and their formation requires the presence of iron-rich sediments, sulphate (usually from sea water), removal of reaction products such as bicarbonate, the presence of sulphate-reducing bacteria and an abundant supply of organic matter.

These conditions generally exist in mangroves, salt marshes, inter-tidal areas and on the beds of coastal rivers and lakes. ASS is further sub-divided into Actual Acid Sulfate Soils (AASS) and Potential Acid Sulphate Soil (PASS). AASS and PASS are generally found in the same soil profile with AASS overlying PASS. AASS are soils that contain highly acidic soil horizons or layers resulting from the oxidation of iron sulphides.

The oxidation produces hydrogen ions in excess of the buffering or neutralising capacity of the soil. PASS are soils containing iron sulphides or sulfidic material (usually ferrous iron disulphide or pyrite) which are waterlogged soils, rich in pyrite, that have not been exposed to air and oxidised. Any disturbance that admits oxygen (such as excavation works) will lead to the development of actual acid sulphate soil layers, which may pose an environmental risk.

6.2 Indicators of AASS and PASS

The Indicators of PASS materials are as follows:

- Screening tests: PASS indicators include significant negative pH shifts during screening tests and pH following oxidation (pHFox) below pH 3. Samples with pHF < pH 4.0 indicate that in-situ conditions are already acidic. For pHF approximately equal to 7 the soil is considered neutral.
- Chromium Suite tests: Indicators of PASS materials include significant actual acidity (TAA greater than 18 Mole H+/t) and Chromium Reducible Sulphur percentages SCR greater than 0.03%. Samples with pHKCL < 6.5 indicate that in-situ conditions are already somewhat acidic, but TAA greater than 18 mole H+/t is required for this to be significant (depending on scale of the job and nature of the soil).

6.3 pH Screening Testing

Two (2) samples were collected from BH1 to test for pH screening tests to assess the actual and potential acidity of insitu samples. A summary of pH screening test results is presented in the Table 2 below:

Table 2: Summary of pHf and pHfox Test Results

BH No.	Depth, m	pHf	pHfox	Reaction Rate
BH1	3.3 – 3.5	7.1	2.5	3
BH1	6.5 – 6.7	6.4	2.9	3

Note: Reaction Rate 1 – Slight; 2 – Moderate; 3 – Strong; 4 – Extreme

The laboratory test results are attached in Appendix E.

7 Conclusion

The recorded pHf/pHfox test results show that natural alluvium soils below the fill could contain potential acid sulphate soils if exposed to air during excavation, necessitating treatment before disposal at a waste management facility. However, according to the supplied drawings, the maximum depth of excavation for the proposed OSD is approximately 0.635m. Consequently, it is unlikely that any excavation of alluvial soils will occur. Therefore, acid sulphate soils management is not required.

8 Reference

1. AS1726 – 2017, “Geotechnical Site Investigation”.
2. NSW surface geology on https://minview.geoscience.nsw.gov.au.
3. HB 160 – 2006 Soils testing Reconfirmed 2016 Standards Australia.
4. Acid Sulfate Soil Manual (NSW Acid Sulfate Soil Management Advisory Committee August 1998).

9 Closure

This report has been prepared for Aussie Structural Engineers Pty Ltd in relation to the proposed development in accordance with generally accepted consultancy practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than Aussie Structural Engineers Pty Ltd and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes. This report has been prepared under CG's Terms of Engagement.

This report is not a detailed geotechnical investigation. It complies with the requirements of AS2870-2011 and is limited to the items required under Cl2.2.2(a). Core Geotech Pty Ltd will not accept liability for loss or damage, consequential or otherwise, based on the recommendations of this report, other than for the cost of re-assessment.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. The conclusions drawn in the report are based on interpolation between boreholes. Conditions can vary between test locations that cannot be explicitly defined or inferred by investigation.

The report, or sections of the report, should not be used as part of a specification for a project, without review and agreement by CG, as the report has been written as advice and opinion rather than instructions for construction.

The report must be read in conjunction with the attached Information Sheets and any other explanatory notes and should be kept in its entirety without separation of individual pages or sections. CG cannot be held responsible for interpretations or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report. In preparing the report CG has necessarily relied upon information provided by the client and/or their agents.

This report must be read in conjunction with the attached Information Sheets and any other explanatory notes.

We trust these comments are sufficient to meet your present requirements. Please do not hesitate to contact CG should you have any queries.

Appendix A
Information About this Report

Information About This Report

Limitations

Scope of Services: The report has been prepared in accordance with the scope of services set out in CG's Proposal under CG's Terms of Engagement, or as otherwise agreed with the client. The scope of services may have been limited and/or amended by a range of factors including time, budget, access and site constraints.

Specific Purpose: The report is provided for the specific development and purpose as described in the report. The report may not contain sufficient information for developments or purposes other than that described in the report.

Currency of Information: The information in this report is considered accurate at the date of issue with regard to the current conditions of the site.

Reliance on Information: In preparing the report CG has necessarily relied upon information provided by the Client and/or their Agents. Such data may include surveys, analyses, designs, maps and plans. CG has not verified the accuracy or completeness of the data except as stated in this report.

Copyright and Reproductions: The contents of this documents are and remain the intellectual property of CG. This document should only be used for the purpose for which it was commissioned and should not be used for other projects or by a third party. This report shall not be reproduced either totally or in part without the permission of CG. Where information from this report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimise the likelihood of misinterpretation.

Construction Specifications: Unless otherwise stated, the report, or sections of the report, should not be used as part of a specification for a project, without review and agreement by CG.

Report Should Not be Separated: The report must be read in conjunction with the attached information Sheets and any other explanatory notes and should be kept in its entirely without separation of individual pages or sections.

Review by Others: CG cannot be held responsible for interpretation or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

GENERAL NOTES

Geotechnical Reporting: Geotechnical reporting relies on the interpretation of factual information based on judgment and opinion and is far less exact than other engineering or design disciplines. Geotechnical reports are for a specific purpose, development and site as described in the report and may not contain sufficient information for other purposes, developments or sites (including adjacent sites) other than that described in the report.

Subsurface Conditions: Subsurface conditions can change with time and can vary between test locations. For example, the actual interface between the materials may be far more gradual or abrupt than indicated and contaminant presence may be affected by spatial and temporal patterns. Therefore, actual conditions in areas not sampled may differ from those predicted since no subsurface investigation, no matter how comprehensive, can reveal all subsurface details and anomalies. Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions and thus the continuing adequacy of a geotechnical report. CG should be kept informed of any such events and should be retained to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Groundwater: Groundwater levels indicated on borehole and test pit logs are recorded at specific times. Depending on ground permeability, measured levels may or may not reflect actual levels if measured over a longer time period. Also, groundwater levels and seepage inflows may fluctuate with seasonal and environmental variations and construction activities.

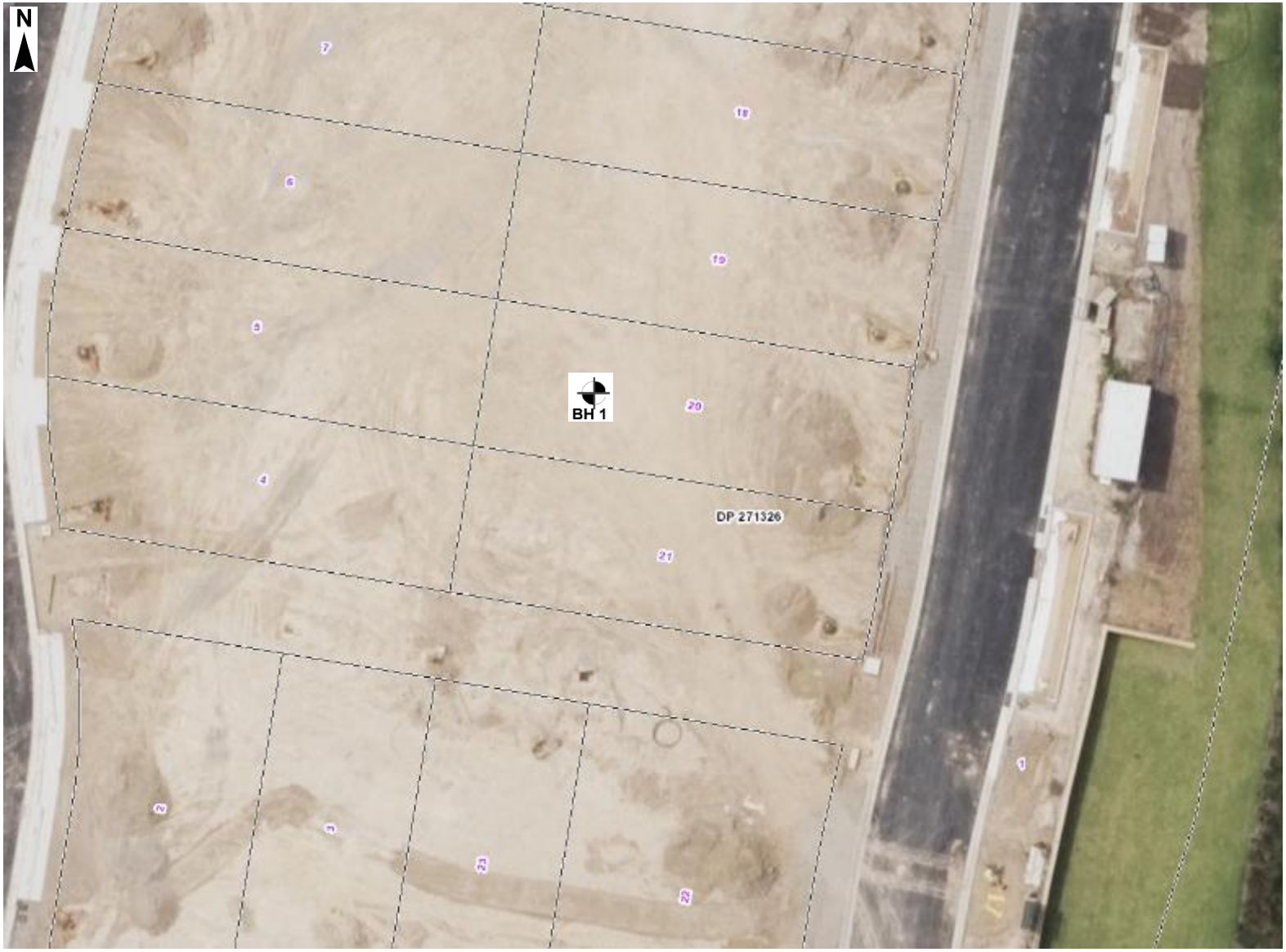
Interpretation of Data: Data obtained from nominated discrete locations, subsequent laboratory testing and empirical or external sources are interpreted by trained professionals in order to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions in accordance with any relevant industry standards, guidelines or procedures.

Soil and Rock Descriptions: Soil and rock descriptions are based on AS 1726 – 2017, using visual and tactile assessment except at discrete locations where field and / or laboratory tests have been carried out. Refer to the accompanying soil and rock terms sheet for further information.

Further Advice: CG would be pleased to further discuss how any of the above issues could affect a specific project. We would also be pleased to provide further advice or assistance including:

- Assessment of suitability of designs and construction techniques;
- Contract documentation and specification;
- Construction control testing (earthworks, pavement materials, concrete);
- Construction advice (foundation assessments, excavation support).

Appendix B
Site Investigation Plan



	LEGEND:	Core Geotech	Scale: A4 - NOT TO SCALE	Client: AUSSIE STRUCTURAL ENGINEERS PTY LTD	
⌖	APPROXIMATE BOREHOLE LOCATION		Date: 23/04/2025	Project: PROPOSED RESIDENTIAL DWELLING	
			Drawing: RS	Location: LOT 20 RAVEN CIRCUIT WARRIEWOOD NSW	
			Drawing No: CG25/0465-2	Sheet: 1 of 1	**SITE PLAN**

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Appendix C
Borehole Log

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BOREHOLE NUMBER BH01

CLIENT Aussie Structural Engineers Pty Ltd
PROJECT NAME Proposed Residential Dwellings
PROJECT NUMBER CG25-0465
PROJECT LOCATION Lot 20 Raven Circuit Warriewood NSW

DATE STARTED 8/4/25 **COMPLETED** 8/4/25 **R.L. SURFACE** 5.45 **DATUM** m
DRILLING CONTRACTOR Pace Drilling Services **SLOPE** 90° **BEARING** ---
EQUIPMENT Track Mounted Drilling Rig (Comacchio Geo 205) **HOLE LOCATION** Refer to Drawing No. CG25-0465-1
HOLE SIZE 120mm **LOGGED BY** GN **CHECKED BY** RS
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
ADT		4	2		SC	Silty Clayey SAND, fine to medium grained, pale brown, grey, low plasticity clay, fine to medium gravel, moisture condition = moist	DCP = 11 8 18 +25	FILL
		2	4		CL	Silty Sandy CLAY, low plasticity, dark grey mottled brown, fine to medium grained sand, trace fine gravel and shell fragments, moisture condition >= plastic limit, very soft		ALLUVIUM
					CL	Silty Sandy CLAY, low plasticity, dark grey, red, fine to medium grained sand, trace fine gravel, moisture condition >= plastic limit, very soft	SPT 1, 1, 1 N=2	
	▼	0	6		CH	CLAY, high plasticity, dark grey with silt, moisture condition > plastic limit, wet, very soft		
					CL/CI	Silty CLAY, low to medium plasticity, dark grey, trace fine grained sand and gravel, moisture condition > plastic limit, wet, very soft		
		-2	8		CL	Silty Sandy CLAY, low plasticity, dark grey, fine to medium grained, trace gravel, moisture condition > plastic limit, wet, very soft		
					SP	Silty SAND, fine to medium grained sand, pale grey with low plasticity fines, moisture condition = wet, medium dense	SPT 2, 1, 2 N=3	
		-4	10		CH	Silty Sandy CLAY, high plasticity, dark grey becoming pale grey, yellow, trace fine grained sand, moisture condition > plastic limit, wet, very stiff		
							SPT 4, 8, 11 N=19	
		-6	12					
		-8	14			Borehole BH01 terminated at 13m		

Appendix D
Laboratory Test Results

CERTIFICATE OF ANALYSIS

Work Order	: **ES2510462**	Page	: 1 of 2
Client	: **Core Geotech Pty Ltd**	Laboratory	: Environmental Division Sydney
Contact	: Mr Raj Singh	Contact	: Customer Services ES
Address	: Suite 314 Level 3/33 Lexington Bella Vista 2153	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: CG25-0465, Proposed Residential Dwelling	Date Samples Received	: 10-Apr-2025 14:30
Order number	: ----	Date Analysis Commenced	: 17-Apr-2025
C-O-C number	: ----	Issue Date	: 17-Apr-2025 15:27
Sampler	: Raj Singh		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH01, 3.3 - 3.5m	BH01, 6.5 - 6.7m	BH02, 5.0 - 5.3m	BH02, 5.5 - 5.7m	----
			Sampling date / time	10-Apr-2025 00:00	10-Apr-2025 00:00	10-Apr-2025 00:00	10-Apr-2025 00:00	----
Compound	CAS Number	LOR	Unit	ES2510462-001	ES2510462-002	ES2510462-003	ES2510462-004	--------
				Result	Result	Result	Result	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	7.1	6.4	7.1	4.9	----
pH (Fox)	----	0.1	pH Unit	2.5	2.9	2.9	2.2	----
Reaction Rate	----	1	Reaction Unit	3	3	3	4	----

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry / Biology).

(SOIL) EA003 :pH (field/fox)