
Acid Sulfate Soil Management Plan

Lot 152 DP 1202468
Raven Street, Kooragang
NSW

NEW20P-0171-AA
8 February 2020



Document control record

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Table of Contents:

1.0	Introduction	2
1.1	Objectives	2
2.0	Physical Setting and Field Works	2
2.1	Site Description	2
2.2	Regional and Site Geology	3
2.3	Hydrogeology	4
3.0	Field Works for ASS	5
2.5	Laboratory Programme	5
4.0	Acid Sulfate Soils	5
4.1	Acid Sulfate Soil Occurrence	5
4.2	Results	6
4.3	Field Screening	6
4.4	Laboratory Results	7
5.0	Management Plan and Procedures for ASS	8
5.1	General	8
5.2	Visual classification	8
5.3	Treatment of ASS via Neutralisation	8
	Excavation Volumes less than 10 cubic metres	8
	Excavation Volumes greater than 10 cubic metres	8
	Treatment Pad and Liming Methodology	8
5.4	Liming Rate	9
6.0	Performance Criteria and Verification Testing	9
6.1	Off-site Disposal	10
7.0	Contingency Plan	10
8.0	Conclusions	11
9.0	Limitations	11
10.0	References	11

Attachments:

- Appendix A: Figures
- Appendix B: Laboratory Reports
- Appendix C: Borehole Logs

1.0 Introduction

Qualtest were engaged by EJE Architecture Pty Ltd (EJE) to prepare an Acid Sulfate Soil Management Plan (ASSMP) for a site located at 70 Raven Street (Lot 152 DP1202468), Kooragang, NSW (the site). The location of the site is shown on Figure 1, Appendix A.

The site is owned by Port of Newcastle (PoN), and PoN engaged EJE to lodge a Development Application (DA) for an industrial development. The site is about 1.05ha, and information provided by EJE indicates the available building area on the site is about 5,800m², located in the eastern portion of the site. Concept plans indicate the development would include an industrial warehouse style building, covering approximately 3,000m².

Qualtest were engaged to carry out preliminary geotechnical, contamination and Acid Sulfate Soils (ASS) assessments, which will comprise components of the supporting documentation for the DA lodgement.

The ASS assessment and ASSMP have been completed in accordance with the ASSMAC (1998) Acid Sulfate Soil Manual and the relevant National ASS Guidance (Sullivan et al 2018). Reference is also made to Dear et al (2014) Queensland Acid Sulfate Soil Technical Manual - Soil Management Guidelines Version 4.1.

1.1 Objectives

The objectives of the ASSMP are to outline the procedures for the management of ASS that may be encountered during excavations, including treatment and verification, to lower the potential environmental impacts associated with the disturbance of ASS.

2.0 Physical Setting and Field Works

2.1 Site Description

The site is located on vacant land used as a carpark at 70 Raven Street in Kooragang located about 840m north of the South Channel of the Hunter River. The site consisted of cleared land with asphalt paved road in the western portion of the site running north-south and an asphalt paved crossing in the northern portion of the site running east-west. The remainder of the site was covered with road base gravel material. Some grass was present along the eastern boundary. Photographs of the site are provided below.

The site is surrounded by heavy industry in each direction, Port Waratah Coal Services to north and east, J Steel to the west and Cargills (oil seed processing plant) to the south.

Reference to the NSW Land and Property Information Spatial Information Exchange website (<https://six.nsw.gov.au/wps/portal/>) indicated the elevation of the site was below 10m AHD.



Photograph 1 – View of site facing south



Photograph 2 – View of site facing north

2.2 Regional and Site Geology

Reference to the 1:100,000 Newcastle-Hunter Coastal Quaternary Geology map indicates that the site is underlain by *“modern fill on Quaternary deposits”*.

The borehole logs from the Qualtest Geotechnical Report are attached in Appendix C.

The typical subsurface conditions observed in the boreholes are summarised in Table 2.6 below.

Table 2.6 – Summary of Site Geology

Unit	Soil Description	Depth Range (m)
Fill	Sandy GRAVEL/Gravelly SAND (road base), fine to medium grained gravel, fine to medium grained sand, pale grey, brown, grey-brown	0.2/0.6 to 1.4/2.0m
	SAND, fine to medium grained, brown, grey, sometimes with shells;	0.20 to 1.40m
	CLAY, medium to high plasticity, grey, dark grey, brown, dark brown	1.0 to 1.3m
	SILT, low plasticity, white to pale grey	0.25 to 0.85m
Estuarine	SAND, fine to medium grained, grey, often with shells	1.5 to 4.10m
	Silty CLAY and Sandy CLAY, medium to high plasticity, grey to dark grey, often with shells.	2.5 to 2.7m
	Clayey SAND, fine to medium grained, grey to dark grey, low to medium plasticity fines.	2.7 to 3.30m
Alluvial	SAND – fine to medium grained, grey with shells	2.90 to 4.10m

2.3 Hydrogeology

Groundwater beneath the site is anticipated to be present in an unconfined aquifer within fill or alluvial/estuarine deposits. As part of drilling works carried out on the site, groundwater was identified between 2.0m and 3.0m bgs.

Groundwater flow direction was anticipated to follow the surface topography and flow to the south south-east and discharge into the Hunter River located approximately 840m south to south-east of the site.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

3.0 Field Works for ASS

Field work was carried out by an Environmental Scientist from Qualtest on 12 January 2021. Four boreholes (BH01-BH04) were drilled within the footprint of the proposed warehouse area as part of the geotechnical investigation. The borehole locations are shown on Figure 1, Appendix A.

The boreholes were drilled using a truck mounted drill rig, to a depth of 4.1m below ground surface (bgs). Soil samples for ASS assessment were collected at intervals of approximately 0.5m and 1.0m intervals down the soil profile. The samples were collected using a split spoon sampler (SPT) and a clean pair of nitrile gloves per sample. The samples were placed into zip-lock bags and immediately stored in an ice filled esky for transport to the laboratory. Disposable nitrile gloves were used during collection of samples.

2.5 Laboratory Programme

Eighteen samples were collected from the boreholes at regular depths and screened at the Qualtest laboratory at Warabrook NSW. The samples were screened in accordance with the procedures outlined in Appendix 1 of the ASSMAC (1998) ASS Manual.

Four samples were dispatched to Eurofins MGT under chain of custody conditions and analysed using the chromium reducible sulfur (Scr) method. The results of the field screening and laboratory analysis are presented in Appendix B.

4.0 Acid Sulfate Soils

4.1 Acid Sulfate Soil Occurrence

The 1:25,000 ASS Risk Map for Lower Hunter Catchment 2008 (which covers Kooragang) indicates that the site lies in a region of “disturbed terrain”.

Acid sulfate soils can form in a number of geologic and geomorphic landscapes provided there is a source of iron, sulfate and soil bacteria. Coastal Acid Sulfate Soils (CASS) have formed along the east coast of Australia, since the last glacial period (19,000 to 18,000 years ago), when sea levels were around 120m to 130m below today's levels.

Sea levels rose rapidly to about 7,000 years ago, reaching a height about 1.0m above the present day mean sea level (0.0m AHD), at which time they stabilised. Since that time there has been a slow accumulation of coastal sediments within the intertidal zone, including saline wetlands, salt marshes and as bottom sediments in embayments, coastal rivers, estuaries and coastal lakes. This accumulation is still occurring today.

CASS are found along most of the coast of mainland Australia, generally found below about 5m AHD where tidal ranges are large, such as northern Queensland. Along coastal areas with smaller tidal ranges, it is rare to find significant accumulations of CASS above about 2m AHD (Simpson et al 2018).

The formation of sulfidic sediments is a natural part of the sulfur cycle where sulfates from sea water, in combination with iron and sulfate reducing bacteria (SRB), combine to produce reduced inorganic sulphides (RIS). RIS can include iron disulfides (FeS₂), pyrite and marcasite, monosulfides (FeS) and elemental sulfur (S₈) (Sullivan et al 2018). Provided these sediments remain in an anoxic state (saturated) they are benign (Dear et al 2014, Sullivan et al 2018).

4.2 Results

In order to assess the presence of ASS, the laboratory results were compared to Action Criteria from ASSMAC (1998) Acid Sulfate Soil Manual.

The ASSMAC (1998) action levels are based on oxidisable sulfur concentrations for three differing soil textures. There are separate action levels depending on the amount of soil disturbed as a result of the proposed works. For this project it has been assumed that less than 1000 tonnes of ASS will be disturbed and that the soil texture category is medium. The applicable action levels are indicated below in Table 4.1.

Table 4.2 – ASSMAC (1998) Action Criteria

Texture Category	Approx. Clay Content (%)	Action Criteria	
		Net Acidity (S_{CR}/S_{POS}) (%)	Net Acidity (mol H ⁺ /tonne)
Coarse	<5%	0.03	18
Medium	5 to 40%	0.06	36
Fine	>40%	0.1	62

4.3 Field Screening

Field screening of the eighteen samples collected was carried out by an experienced Qualitest Environmental Scientist, at our Warabrook laboratory. A summary of the field screening results is provided in Appendix B.

Table 4.3 – Results of Field Screening Tests

Sample ID	pH _f	pH _{fox}	Reaction
BH01 1.0-1.1	7.41	6.15	Vigorous
BH01 2.0-2.1	7.56	4.49	Vigorous
BH01 2.5-2.6	7.17	4.45	Vigorous
BH01 3.5-3.6	7.22	2.13	Vigorous
BH01 4.0-4.1	7.11	2.30	Vigorous
BH02 1.0-1.1	6.91	5.38	Slight
BH02 1.5-1.6	6.66	5.19	Slight
BH02 2.0-2.1	7.03	5.07	Slight
BH03 1.5-1.6	7.50	6.23	Slight
BH03 2.5-2.6	7.85	5.81	None Observed
BH03 3.0-3.1	7.76	5.63	None Observed
BH03 3.5-3.6	7.61	5.53	None Observed

Sample ID	pH _F	pH _{FOX}	Reaction
BH03 4.0-4.1	7.58	4.61	Slight
BH04 0.5-0.6	7.66	6.07	None Observed
BH04 1.5-1.6	8.49	5.83	None Observed
BH04 2.5-2.6	8.44	6.05	Vigorous
BH04 3.5-3.6	7.83	5.12	Slight
BH04 4.0-4.1	7.89	6.02	Moderate

Two samples, BH01 3.5-3.6 and BH04 4.0-4.1 recorded pH_{FOX} of 2.13 to 2.30 following the addition of hydrogen peroxide. A pH_{FOX} below or 3.5 or lower, can sometimes indicate a potential for reduced inorganic sulphides (RIS) to be present within the soils. The remaining samples recorded a pH_{FOX} between 4.45 and 6.23.

4.4 Laboratory Results

Four samples were dispatched to NATA accredited laboratory Eurofins MGT for Chromium Reducible Sulfur (CRS) testing. The laboratory reports are included in Appendix B.

Table 4.4: Laboratory Results

Sample ID	Description	pH _{KCL}	TAA (mol H ⁺ /t)	Scr (%S)	S _{NAS} Sulfur (molH ⁺ /t)	Net Acidity (%S)
BH01 1.0-1.1	FILL - SAND – fine to medium grained, brown, with shells.	9.1	< 2	<0.005	N/A	< 0.02
BH01 4.0-4.1	SAND – fine to medium grained, grey, with shells.	7.5	<2	0.12	N/A	0.12
BH04 0.5-0.6	FILL - SAND – fine to medium grained, brown and pale brown, with shells.	9.1	<2	0.01	N/A	0.01
BH04-2.5-2.6	Clay – medium to high plasticity grey and dark grey	6.7	<2	0.021	N/A	0.021
Action Criteria*		-	18	0.03	-	0.03

Note: Shaded area indicates results above the Action criteria

Based on the field observations, and the laboratory results, the estuarine/alluvial sands and clays below fill material (from about 1.5m bgs) are assessed to comprise Acid Sulfate Soils and treatment is required should these soils be encountered during foundation works.

5.0 Management Plan and Procedures for ASS

5.1 General

The monitoring and management of ASS will be the responsibility of the Contractor, or their delegated sub-contractor.

The following general management procedures are considered applicable for the proposed works:

- i. Appointment of a person to be responsible for managing acid sulfate soil issues during the earthwork activities;
- ii. Manage the materials that are assessed to be acid sulfate soils through stockpiling and lime neutralisation.

These procedures are further discussed in the following sections.

5.2 Visual classification

ASS soils are suspected from about 1.5m below the ground surface. Information on visual ASS classification for the site soils is provided below:

- The preliminary visual checking of potential ASS will be based on material type, colour and consistency;
- Estuarine/Alluvial soils consisting of dark grey and grey sands and clays at depths greater than about 1.5m bgs will be classified as ASS.

5.3 Treatment of ASS via Neutralisation

Excavation Volumes less than 10 cubic metres

Where excavation volumes are less than 10m³, then excavated ASS can either:

- be stored in a skip bin onsite and lime applied and mixed by hand followed by offsite disposal; or
- temporarily stockpiled on site, followed by treatment with lime and verification testing. Once successfully treated the material can be re-used on site as general fill.

Excavation Volumes greater than 10 cubic metres

Where excavated volumes of ASS are in excess of 10m³, or can't be easily accommodated within secure skip bins, the following treatment methodology would apply. In addition, the contractor may need to engage a qualified ASS consultant to assist in management, treatment, and validation of the ASS.

Treatment Pad and Liming Methodology

Excavated ASS will be placed in a specially prepared treatment pad for treatment via application of lime to the soil. The type and amount of lime to be applied should be such that a neutralising value (NV) of 95 to 100 can be achieved. The NV should be identified prior to mixing. NV relates to the purity of the lime and an NV of 95 to 100 is required to ensure that the lime is effective in neutralising the potential acid.

Fine powdered agricultural lime (CaCO₃) generally has an NV of 90% to 100% whilst other manufactured forms of lime can have an NV as low as 80%. Where NV is below 100, the factor of safety, hence the amount of lime will have to be adjusted accordingly.

The design of the treatment pad should be in general accordance with Figure 8.1, page 50, of Dear et al (2014), re-produced below.

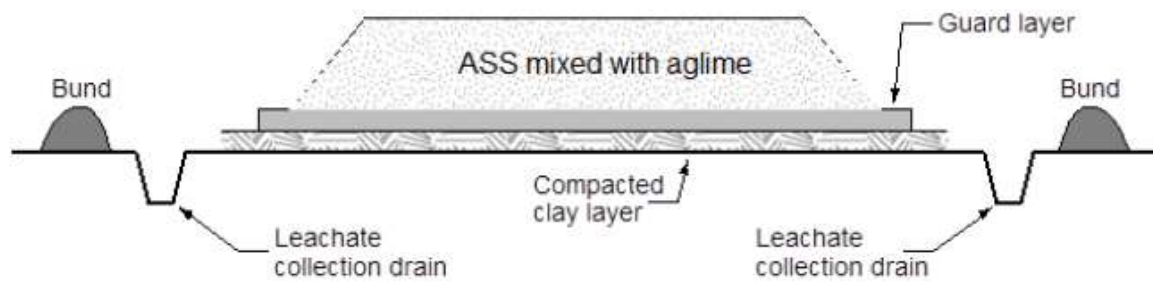


Figure 8-1: Schematic cross-section of a treatment pad, including a compacted clay layer, guard layer, leachate collection system and containment with bunding

The following procedures (or other equivalent) should be undertaken for the treatment pad and liming:

- The treatment pad should be located at least 40m from a permanent waterway or creek and, if possible, placed in a topographically high area to avoid inundation following heavy rain. The area should be appropriately bunded and provision made to collect run-off water;
- Spreading of the soil in about 0.3m thick layers within the boundary of the site works. Consideration should be given to providing a suitable foundation for the treatment area that can support the weight of the mixing machinery;
- A guard layer of neutralising agents should be provided at the base of the pad prior to the addition of ASS;
- Addition of lime by light weight truck followed by mixing, using light weight rotovators or similar tools; and,
- An amount of lime that allows for liming at a rate of 10kg/tonne should be kept on site by the Contractor for emergencies (i.e. monitoring indicates acidic run-off is occurring).

5.4 Liming Rate

The liming rates are based existing laboratory data and on the following formula:

$$\text{per m}^3 \text{ of soil} = \%S \times 30.59 \times 1.02 \times \frac{100}{ENV (\%)} \times D \times FOS$$

$$= 11 \text{ kg CaCO}_3/\text{m}^3 \text{ (6 kg CaCO}_3/\text{tonne)}$$

where %S is highest net acidity recorded per stratigraphic unit (0.10%S)

D is bulk density of soil (1.8 tonnes/m³)

FOS Factor of safety (1.5)

ENV is Effective Neutralisation value (usually 90 to 95% for agricultural lime)

6.0 Performance Criteria and Verification Testing

In order to demonstrate that appropriate quantities of lime have been used, a lime register shall be maintained by the Contractor. The register shall list the amount of lime delivered to the site, verified by delivery dockets, and where/when the lime has been used. The lime usage shall quantify areas limed and soil volumes treated, liming rates and quantities of lime used. The amount of lime to be kept on-site for emergencies will be assessed by the Contractor.

Verification testing should allow for:

- One sample per 250m³, with a minimum of 3 samples;
- Each test sample to be made from a composite of six individual samples;
- Samples to be tested using the S_{CR} suite with full acid base accounting including retained acidity.

Assuming that less than 1,000 tonnes will be disturbed, the performance criteria will be:

- No single sample shall exceed a net acidity of 18 mol H⁺/tonne (0.03% S).
- If any single sample is between 0 and 18mol H⁺/tonne (0.03 % S), then the average of any four spatially adjacent samples (including the exceeding sample) shall have an average net acidity of zero or less.

Where the results indicate that the treatment has not been effective, further liming will be required.

6.1 Off-site Disposal

If the material is proposed to be disposed to landfill, sampling and analysis of the soil for waste classifications will be required. The soil can then be classified in accordance with the NSW EPA (2014) Waste Classification Guidelines.

7.0 Contingency Plan

A contingency plan is outlined in Table 7.1, listing potential events relating to ASS that may arise during earthworks and actions that will be undertaken if unexpected conditions occur.

Table 7.1 – Contingency Plan

Unexpected Condition	Action
Accumulated run-off water is observed to be acidified (i.e. pH <4)	Emergency liming of water is to be carried out. Where emergency liming of water is required, and laboratory testing results are not available, liming of acidic water may be carried out at a rate such that residual lime is present and the pH of the water is not less than 6. The emergency liming rate is a temporary measure to lower the immediate risk to the environment and may not be sufficient for complete neutralisation.
Validation samples fail criteria	Carry out additional liming of soil.
Identification of unexpected contaminated materials or archaeological finds during excavations.	Refer to construction environment management plan (if available). An environmental consultant or archaeologist may be required to assess the material and provide management measures.

Unexpected Condition	Action
Other	Other unexpected events which may affect the outcome of the investigation would be notified to the client, and other relevant parties. At that time potential actions to address the unexpected event will be assessed and presented.

8.0 Conclusions

The assessment identified that estuarine/alluvial sands and clays below fill material (from about 1.5m bgs) are potentially Acid Sulfate Soils (ASS), which will require management to prevent the generation of sulfuric acid if exposed to oxygen (i.e. disturbed).

The management procedures in this ASSMP, will need to be implemented if soils greater than 1.5m are proposed to be disturbed.

9.0 Limitations

The treatment and management procedures in this report, and used as the basis for recommendations presented herein, are preliminary and are based on limited site investigations and laboratory testing.

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

10.0 References

ASSMAC (1998) Acid Sulfate Soils Manual Acid Sulfate Soils Management Advisory Committee (ASSMAC)

Dear, S.E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M. (2014) Queensland Acid Sulfate Soil Technical Manual - Soil Management Guidelines Version 4.0

Department of Land and Water (1997) Acid Sulfate Soils Risk Map for Swansea (Edition Two)

NSW Land and Property Information, Spatial Information eXchange (SIX) Maps - Topographic Map, accessed from <https://maps.six.nsw.gov.au/>, accessed on 3 Febaury 2021.

Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, *National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual*, Department of Agriculture and Water Resources, Canberra, ACT).

APPENDIX A:

Figures

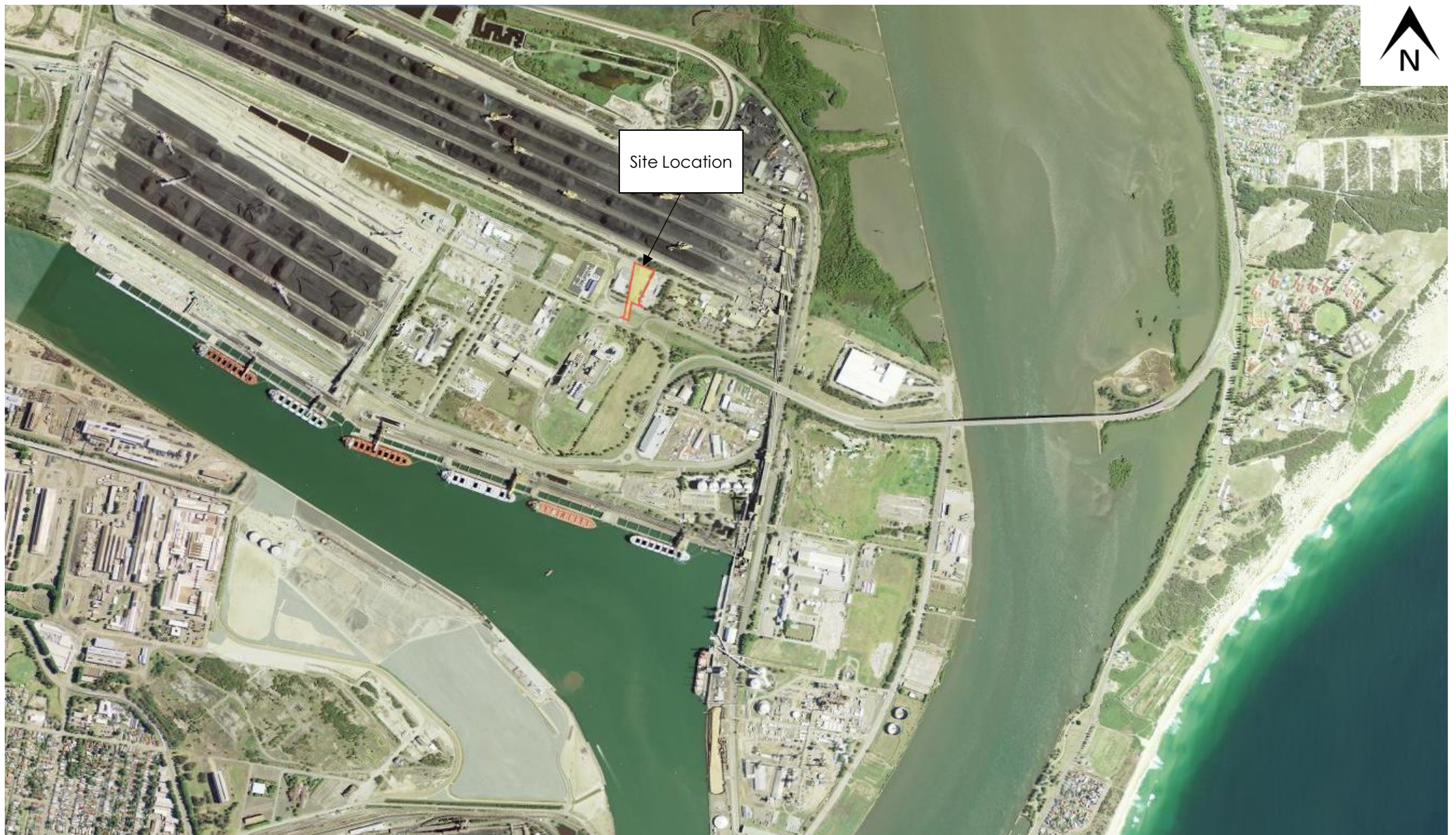


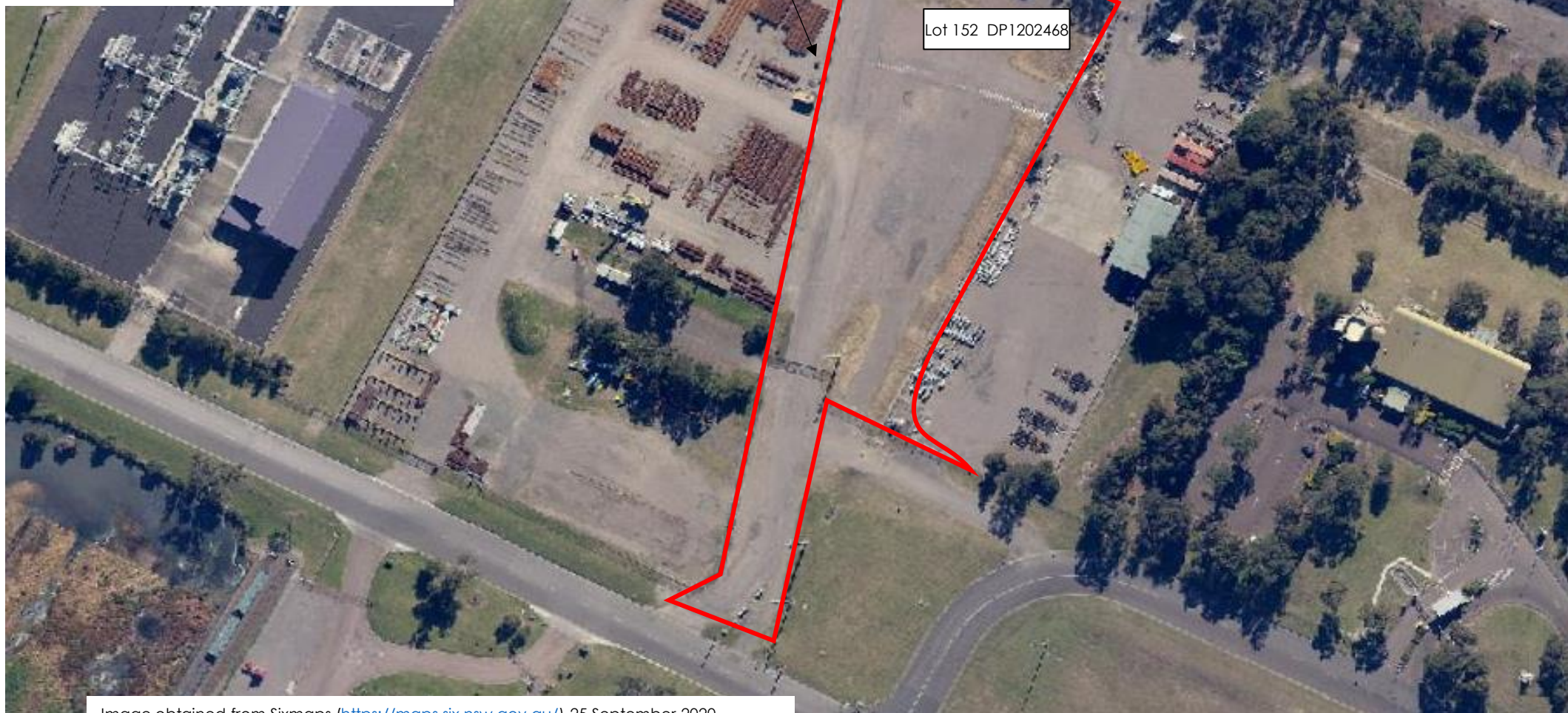
Image obtained from Sixmaps (<https://maps.six.nsw.gov.au/>) 11 January 2021

Client:	EJE ARCHITECTURE PTY LTD	Drawing No:	FIGURE 1
Project:	ASS ASSESSMENT	Project No:	NEW20P-0171-AA
Location:	70 RAVEN STREET (LOT 152 DP1202468)	Scale:	N.T.S.
Title:	SITE LOCATION PLAN	Date:	3/02/2021

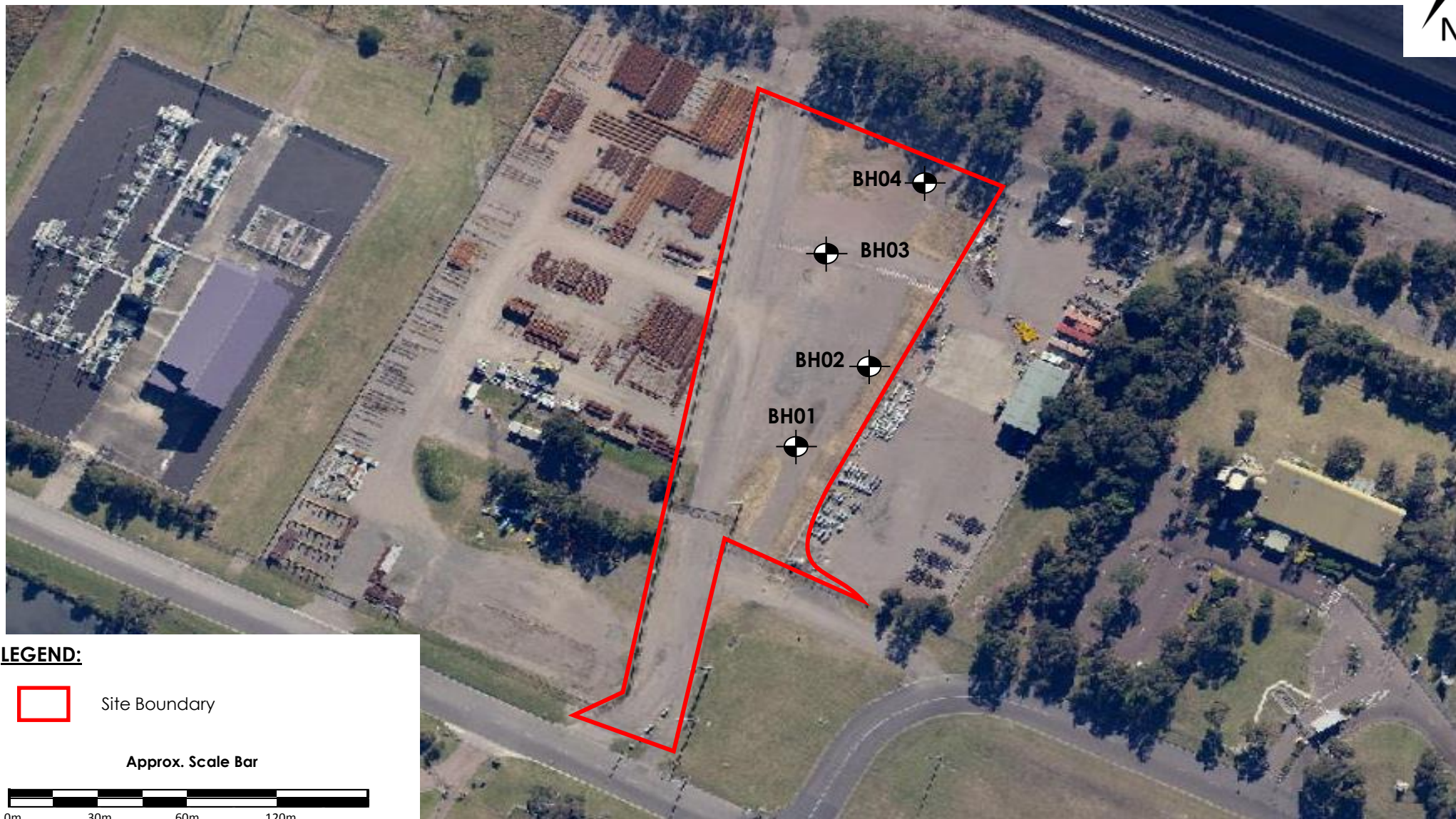
LEGEND:

Site Boundary

Approx. Scale Bar

Image obtained from Sixmaps (<https://maps.six.nsw.gov.au/>) 25 September 2020

Client:	EJE ARCHITECTURE PTY LTD	Drawing No:	FIGURE 2
Project:	ASS CONTAMINATION ASSESSMENT	Project No:	NEW20P-0171-AA
Location:	70 RAVEN STREET (LOT 152 DP1202468)	Scale:	N.T.S.
Title:	LOT LAYOUT PLAN	Date:	03/02/2021



LEGEND:



Site Boundary

Approx. Scale Bar



Image obtained from Sixmaps (<https://maps.six.nsw.gov.au/>) 11 January 2021



Client:	EJE ARCHITECTURE PTY LTD	Drawing No:	FIGURE 3
Project:	ASS ASSESSMENT	Project No:	NEW20P-0171-AA
Location:	70 RAVEN STREET (LOT 152 DP1202468)	Scale:	N.T.S.
Title:	SAMPLING PLAN	Date:	3/02/2021

APPENDIX B:

Laboratory Reports



CHAIN OF CUSTODY RECORD

Eurofins | Environment | Testing | ABN 50 005 085 524

☐ Sydney Laboratory

Unit F3 Bld F 16 Mars Road Lane Cove West NSW 2006
02 9500 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory

Unit 1 21 Shalwood Place Marano QLD 4172
07 3802 4500 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory

Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9800 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory

6 Montney Road Dandenong South VIC 3175
03 8594 5000 EnviroSampleVIC@eurofins.com

1053

Company	Qualitest
Address	8 Ironbark Close Warabrook NSW 2304
Contact Name	Emma Coleman
Phone No	
Special Directions	
Purchase Order	
Quote ID No	180622QUAN-1

Analyses
Where metals are requested, please specify "Total" or "Filtered".
SUITE code must be used to attract SUITE pricing.

Chromium Reducible Sulfur

L2 Aggressivity

Suite B7

Asbestos (presence/absence)

No	Client Sample ID	Sampled Date/Time <small>(dd/mm/yyyy hh:mm)</small>	Matrix <small>Solid (S) Water (W)</small>	Project Name	Project Manager	EDD Format	EMMA COLEMAN	Samplers	Handed over by	Required Turnaround Time (TAT) <small>Default will be 5 days if not ticked.</small>	Sample Comments / Dangerous Goods Hazard Warning
1	BH01 1.0-1.1	12/01/21	SOIL	X						1	
2	BH01 2.0-2.1	12/1/21	SOIL							1	
3	BH01 2.5-2.6	12/1/21	SOIL							1	
4	BH01 3.5-3.6	12/1/21	SOIL							1	
5	BH01 4.0-4.1	12/1/21	SOIL	X						1	
6	BH02 1.0-1.1	12/1/21	SOIL							1	
7	BH02 1.5-1.6	12/1/21	SOIL		X					1	
8	BH02 2.0-2.1	12/1/21	SOIL							1	
9	BH03 1.5-1.6	12/1/21	SOIL							1	
10	BH03 2.5-2.6	12/1/21	SOIL							1	
Total Counts				2	1					10	

Method of Shipment	<input type="checkbox"/> Courier (#)	<input checked="" type="checkbox"/> Hand Delivered	<input type="checkbox"/> Postal	Name	Signature	Date	Time
--------------------	---------------------------------------	--	---------------------------------	------	-----------	------	------

Laboratory Use Only	Received By	Received By	Signature	Date	Time	Temperature	Report No
	SV0 BNE MEL PER ADL IDL DRW	SV0 BNE MEL PER ADL IDL DRW	Signature	Date	Time	Report No	



CHAIN OF CUSTODY RECORD

Eurolife | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory
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02 9900 8400 EnviroSampleNSW@eurolife.com

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☐ Melbourne Laboratory
6 Kewdale Road Dandenong South VIC 3175
03 8624 5000 EnviroSampleVic@eurolife.com

2053

Company		Qualitest		Project Name		NEW20P-0171		Project Manager		Emma Coleman		Sampler(s)		Billy Snow	
Address		8 Ironbark Close Warabrook NSW 2304		EJE, KOORAGANG		EDD Format ESDAL EQUS etc		Excel		Handed over by		accounts@qualitest.com.au			
Contact Name		Emma Coleman								Email for Invoice		ibbybetz@qualitest.com.au emmacoleman@qualitest.com.au stephcullell@qualitest.com.au billysnow@qualitest.com.au			
Phone No										Email for Results					
Special Directions										Containers		Required Turnaround Time (TAT) Default will be 5 days if not ticked.			
Purchase Order										500mL Plastic		<input type="checkbox"/> Overnight (reporting by 8am) + <input type="checkbox"/> Same day <input type="checkbox"/> 1 day <input type="checkbox"/> 2 days <input checked="" type="checkbox"/> 3 days (Standard) <input type="checkbox"/> Other*			
Quote ID No		100622QUAN-1								250mL Plastic					
										125mL Plastic					
										200mL Amber Glass					
										40mL VOA vial					
										500mL PFAS Bottle					
										Jar (Glass or HDPE)					
										Other (Asbestos AS4964, WA Guidelines)					
Client Sample ID		Sampled Date/Time determine by whom		Matrix Solid (S) Water (W)								Sample Comments / Dangerous Goods Hazard Warning			
1		BH03 3.0-3.1		12/01/21		SOIL						1			
2		BH03 3.5-3.6		12/1/21		SOIL		X				1			
3		BH03 4.0-4.1		12/1/21		SOIL						1			
4		BH04 0.5-0.6		12/1/21		SOIL		X				1			
5		BH04 1.5-1.6		12/1/21		SOIL						1			
6		BH04 2.5-2.6		12/1/21		SOIL		X				1			
7		BH04 3.5-3.6		12/1/21		SOIL						1			
8		BH04 4.0-4.1		12/1/21		SOIL						1			
9		BH01 0.0-0.1		12/1/21		SOIL						1			
10		BH01 1.5-1.6		12/1/21		SOIL						1			
Total Counts		2		1								2			
Method of Shipment		<input type="checkbox"/> Courier #		<input type="checkbox"/> Hand Delivered		<input type="checkbox"/> Postal		Name		Signature		Date		Time	
Laboratory Use Only		Received By		CHTS		Signature		Date		14/1/21		Time		8:00AM	
		Received By		Signature		Date		14/1/21		Time		8:00AM		Report No	
		Signature		Date		14/1/21		Time		8:00AM		Report No		20213	

Submission of samples to the laboratory will be deemed as acceptance of Eurolife | Environment Testing Standard Terms and Conditions unless agreed otherwise. A copy is available on request.



Sydney Laboratory
Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnvironSampleNSW@austrli.net Fax: 02 9900 8401

☐ **Brisbane Laboratory**
Unit 1 21 Smallwood Place Murarie QLD 4172

☐ **Perth Laboratory**
Unit 2/91 Leach Highway Kewdale WA 6105

☐ Melbourne Laboratory

30

[illegible]

Modified by Dr R Symons Approved by G Jackson Approved on 8 August 2019

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Temperature	10.5
Report No	767263

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Sample Receipt Advice

Company name: Qualtest
Contact name: Emma Coleman
Project name: EJE KOORAGANG
Project ID: NEW20P-0171
Turnaround time: 5 Day
Date/Time received: Jan 14, 2021 8:00 AM
Eurofins reference: 767263

Sample Information

- ✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ✓ All samples have been received as described on the above COC.
- ✓ COC has been completed correctly.
- ✓ Attempt to chill was evident.
- ✓ Appropriately preserved sample containers have been used.
- ✓ All samples were received in good condition.
- ✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ✓ Appropriate sample containers have been used.
- N/A Sample containers for volatile analysis received with zero headspace.
- ✗ Split sample sent to requested external lab.
- ✗ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Additional samples logged on hold: BH01_0.5-0.6, BH01_3.0-3.1, BH02_0.5-0.6, BH03_1.0-1.1, BH03_2.0-2.1, BH04_0.0-0.1, BH04_2.0-2.1, BH04_3.0-3.1

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Emma Coleman - emmacoleman@qualtest.com.au.

Qualtest
8 Ironbark Close
Warabrook
NSW 2304



NATA Accredited
Accreditation Number 1261
Site Number 18217

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

Attention: **Emma Coleman**

Report **767263-S**
 Project name **EJE KOORAGANG**
 Project ID **NEW20P-0171**
 Received Date **Jan 14, 2021**

Client Sample ID			BH01 1.0-1.1	BH01 4.0-4.1	BH02 1.5-1.6	BH03 3.5-3.6
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			N21-Ja08375	N21-Ja08379	N21-Ja08381	N21-Ja08386
Date Sampled			Jan 12, 2021	Jan 12, 2021	Jan 12, 2021	Jan 12, 2021
Test/Reference	LOR	Unit				
Chromium Suite						
pH-KCL	0.1	pH Units	9.1	7.5	-	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	< 2	< 2	-	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	< 0.003	< 0.003	-	-
Chromium Reducible Sulfur ^{S04}	0.005	% S	< 0.005	0.12	-	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	72	-	-
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	-	-
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	-	-
HCl Extractable Sulfur	0.02	% S	n/a	n/a	-	-
Net Acid soluble sulfur	0.02	% S	n/a	n/a	-	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	-	-
Net Acid soluble sulfur - equivalent S% pyrite ^{S02}	0.02	% S	n/a	n/a	-	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	2.1	0.40	-	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	410	79	-	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt) ^{S03}	0.02	% S	0.66	0.13	-	-
ANC Fineness Factor		factor	1.5	1.5	-	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	< 0.02	0.03	-	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	< 10	19	-	-
CRS Suite - Liming Rate ^{S01}	1	kg CaCO3/t	< 1	1.5	-	-
Extraneous Material						
<2mm Fraction	0.005	g	150	140	-	-
>2mm Fraction	0.005	g	9.9	1.2	-	-
Analysed Material	0.1	%	94	99	-	-
Extraneous Material	0.1	%	6.1	0.8	-	-
% Moisture	1	%	14	18	24	16
Chloride	10	mg/kg	-	-	< 10	19
Conductivity (1:5 aqueous extract at 25°C as rec.)	10	uS/cm	-	-	1800	230
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	-	-	6.5	7.8
Resistivity*	0.5	ohm.m	-	-	5.6	44
Sulphate (as SO4)	10	mg/kg	-	-	9600	820

Client Sample ID			BH04 0.5-0.6	BH04 2.5-2.6
Sample Matrix			Soil	Soil
Eurofins Sample No.			N21-Ja08388	N21-Ja08390
Date Sampled			Jan 12, 2021	Jan 12, 2021
Test/Reference	LOR	Unit		
Chromium Suite				
pH-KCL	0.1	pH Units	9.1	6.7
Acid trail - Titratable Actual Acidity	2	mol H+/t	< 2	< 2
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	< 0.003	< 0.003
Chromium Reducible Sulfur ^{S04}	0.005	% S	0.010	0.021
Chromium Reducible Sulfur -acidity units	3	mol H+/t	6.1	13
Sulfur - KCl Extractable	0.02	% S	n/a	n/a
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0
HCl Extractable Sulfur	0.02	% S	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite ^{S02}	0.02	% S	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO ₃	1.6	1.2
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	310	250
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt) ^{S03}	0.02	% S	0.50	0.39
ANC Fineness Factor		factor	1.5	1.5
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	< 0.02	< 0.02
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	< 10	< 10
CRS Suite - Liming Rate ^{S01}	1	kg CaCO ₃ /t	< 1	< 1
Extraneous Material				
<2mm Fraction	0.005	g	100	94
>2mm Fraction	0.005	g	9.9	< 0.005
Analysed Material	0.1	%	91	100
Extraneous Material	0.1	%	9.0	< 0.1
% Moisture	1	%	4.7	30

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chromium Reducible Sulfur Suite			
Chromium Suite	Brisbane	Jan 20, 2021	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Jan 20, 2021	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Jan 17, 2021	14 Days
- Method: LTM-GEN-7080 Moisture			
Chloride	Sydney	Jan 15, 2021	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Conductivity (1:5 aqueous extract at 25°C as rec.)	Sydney	Jan 15, 2021	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25°C as rec.)	Sydney	Jan 15, 2021	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
Sulphate (as SO ₄)	Sydney	Jan 15, 2021	28 Days
- Method: E045 Anions by Ion Chromatography			

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Company Name: Qualtest
Address: 8 Ironbark Close
Warabrook
NSW 2304

Project Name: EJE KOORAGANG
Project ID: NEW20P-0171

Order No.:
Report #: 767263
Phone: 02 4968 4468
Fax: 02 4960 9775

Received: Jan 14, 2021 8:00 AM
Due: Jan 21, 2021
Priority: 5 Day
Contact Name: Emma Coleman

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						HOLD	Aggressivity Soil Set	Chromium Reducible Sulfur Suite	Moisture Set	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271										
Sydney Laboratory - NATA Site # 18217							X		X	X
Brisbane Laboratory - NATA Site # 20794						X	X	X	X	X
Perth Laboratory - NATA Site # 23736										
Mayfield Laboratory										
External Laboratory										
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID					
1	BH01 1.0-1.1	Jan 12, 2021		Soil	N21-Ja08375			X	X	
2	BH01 2.0-2.1	Jan 12, 2021		Soil	N21-Ja08376	X				
3	BH01 2.5-2.6	Jan 12, 2021		Soil	N21-Ja08377	X				
4	BH01 3.5-3.6	Jan 12, 2021		Soil	N21-Ja08378	X				
5	BH01 4.0-4.1	Jan 12, 2021		Soil	N21-Ja08379			X	X	
6	BH02 1.0-1.1	Jan 12, 2021		Soil	N21-Ja08380	X				
7	BH02 1.5-1.6	Jan 12, 2021		Soil	N21-Ja08381		X			X
8	BH02 2.0-2.1	Jan 12, 2021		Soil	N21-Ja08382	X				
9	BH03 1.5-1.6	Jan 12, 2021		Soil	N21-Ja08383	X				

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Sydney Laboratory - NATA Site # 18217							X		X	X
Brisbane Laboratory - NATA Site # 20794						X	X	X	X	X
Perth Laboratory - NATA Site # 23736										
Mayfield Laboratory										
External Laboratory										
10	BH03 2.5-2.6	Jan 12, 2021		Soil	N21-Ja08384	X				
11	BH03 3.0-3.1	Jan 12, 2021		Soil	N21-Ja08385	X				
12	BH03 3.5-3.6	Jan 12, 2021		Soil	N21-Ja08386		X			X
13	BH03 4.0-4.1	Jan 12, 2021		Soil	N21-Ja08387	X				
14	BH04 0.5-0.6	Jan 12, 2021		Soil	N21-Ja08388			X	X	
15	BH04 1.5-1.6	Jan 12, 2021		Soil	N21-Ja08389	X				
16	BH04 2.5-2.6	Jan 12, 2021		Soil	N21-Ja08390			X	X	
17	BH04 3.5-3.6	Jan 12, 2021		Soil	N21-Ja08391	X				
18	BH04 4.0-4.1	Jan 12, 2021		Soil	N21-Ja08392	X				
19	BH01 0.0-0.1	Jan 12, 2021		Soil	N21-Ja08393	X				
20	BH01 1.5-1.6	Jan 12, 2021		Soil	N21-Ja08394	X				

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Eurofins Analytical Services Manager : Andrew Black

Sample Detail						HOLD	Aggressivity Soil Set	Chromium Reducible Sulfur Suite	Moisture Set	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271										
Sydney Laboratory - NATA Site # 18217							X		X	X
Brisbane Laboratory - NATA Site # 20794						X	X	X	X	X
Perth Laboratory - NATA Site # 23736										
Mayfield Laboratory										
External Laboratory										
21	BH02 0.0-0.1	Jan 12, 2021		Soil	N21-Ja08395	X				
22	BH02 1.0-1.1	Jan 12, 2021		Soil	N21-Ja08396	X				
23	BH03 0.25-0.35	Jan 12, 2021		Soil	N21-Ja08397	X				
24	BH03 1.5-1.6	Jan 12, 2021		Soil	N21-Ja08398	X				
25	BH04 0.0-0.1	Jan 12, 2021		Soil	N21-Ja08399	X				
26	BH04 1.5-1.6	Jan 12, 2021		Soil	N21-Ja08400	X				
27	D.12.1.21	Jan 12, 2021		Soil	N21-Ja08401	X				
28	BH01_0.5-0.6	Jan 12, 2021		Soil	N21-Ja23127	X				
29	BH01_3.0-3.1	Jan 12, 2021		Soil	N21-Ja23128	X				
30	BH02_0.5-0.6	Jan 12, 2021		Soil	N21-Ja23129	X				

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Melbourne Laboratory - NATA Site # 1254 & 14271										
Sydney Laboratory - NATA Site # 18217							X		X	X
Brisbane Laboratory - NATA Site # 20794						X	X	X	X	X
Perth Laboratory - NATA Site # 23736										
Mayfield Laboratory										
External Laboratory										
31	BH03_1.0-1.1	Jan 12, 2021		Soil	N21-Ja23130	X				
32	BH03_2.0-2.1	Jan 12, 2021		Soil	N21-Ja23131	X				
33	BH04_0.0-0.1	Jan 12, 2021		Soil	N21-Ja23132	X				
34	BH04_2.0-2.1	Jan 12, 2021		Soil	N21-Ja23133	X				
35	BH04_3.0-3.1	Jan 12, 2021		Soil	N21-Ja23134	X				
Test Counts						29	2	4	6	6

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ug/L: micrograms per litre
ppm: Parts per million	ppb: Parts per billion	%: Percentage
org/100mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Chloride			mg/kg	< 10			10	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)			uS/cm	< 10			10	Pass	
Sulphate (as SO ₄)			mg/kg	< 10			10	Pass	
LCS - % Recovery									
Chromium Suite									
pH-KCL			%	99			80-120	Pass	
Acid trail - Titratable Actual Acidity			%	97			80-120	Pass	
Chromium Reducible Sulfur			%	94			80-120	Pass	
Acid Neutralising Capacity (ANCbt)			%	99			80-120	Pass	
LCS - % Recovery									
Chloride			%	100			70-130	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)			%	92			70-130	Pass	
Resistivity*			%	92			70-130	Pass	
Sulphate (as SO ₄)			%	112			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Chromium Suite				Result 1	Result 2	RPD			
pH-KCL	N21-Ja08375	CP	pH Units	9.1	9.1	<1	30%	Pass	
Acid trail - Titratable Actual Acidity	N21-Ja08375	CP	mol H+/t	< 2	< 2	<1	30%	Pass	
sulfidic - TAA equiv. S% pyrite	N21-Ja08375	CP	% pyrite S	< 0.003	< 0.003	<1	30%	Pass	
Chromium Reducible Sulfur	N21-Ja08375	CP	% S	< 0.005	< 0.005	<1	30%	Pass	
Chromium Reducible Sulfur -acidity units	N21-Ja08375	CP	mol H+/t	< 3	< 3	<1	30%	Pass	
Sulfur - KCl Extractable	N21-Ja08375	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur	N21-Ja08375	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - acidity units	N21-Ja08375	CP	mol H+/t	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - equivalent S% pyrite	N21-Ja08375	CP	% S	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity (ANCbt)	N21-Ja08375	CP	% CaCO ₃	2.1	2.0	4.0	30%	Pass	
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)	N21-Ja08375	CP	% S	0.66	0.63	4.0	30%	Pass	
ANC Fineness Factor	N21-Ja08375	CP	factor	1.5	1.5	<1	30%	Pass	
CRS Suite - Net Acidity (Sulfur Units)	N21-Ja08375	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity (Acidity Units)	N21-Ja08375	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate	N21-Ja08375	CP	kg CaCO ₃ /t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M21-Ja08218	NCP	%	11	11	4.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S21-Ja21362	NCP	mg/kg	110	120	4.0	30%	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	N21-Ja08832	NCP	uS/cm	67	62	7.0	30%	Pass	
pH (1:5 Aqueous extract at 25°C as rec.)	S21-Ja17768	NCP	pH Units	7.5	7.8	Pass	30%	Pass	
Resistivity*	N21-Ja08832	NCP	ohm.m	150	160	7.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	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/m ³ in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m ³ '
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl is greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised By

Andrew Black	Analytical Services Manager
Charl Du Preez	Senior Analyst-Inorganic (NSW)
Myles Clark	Senior Analyst-SPOCAS (QLD)



Glenn Jackson General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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APPENDIX C:

Borehole Logs




ENGINEERING LOG - BOREHOLE

CLIENT: NORTHROP CONSULTING ENGINEERS
PROJECT: PROPOSED INDUSTRIAL WAREHOUSE FACILITY
LOCATION: LOT 152, RAVEN STREET, KOORAGANG

BOREHOLE NO: BH01
PAGE: 1 OF 1
JOB NO: NEW20P-0171
LOGGED BY: BS
DATE: 12/1/21

DRILL TYPE: TRACK MOUNTED DRILL RIG
BOREHOLE DIAMETER: 100 mm

SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T		0.10m E				GP	FILL: Sandy GRAVEL - fine to medium grained, sub-angular to angular, pale grey to brown, fine to medium grained sand, trace fines of low plasticity. / FILL: SAND - fine to medium grained, brown, with shells.	D				FILL
		0.50m 0.60m E		0.5								
		1.00m 1.10m E		1.0		SP		D - M				
		1.50m 1.60m E		1.5			Silty CLAY - medium to high plasticity, grey to dark grey.					ESTUARINE DEPOSITS
		2.00m 2.10m E		2.0		CH		M > w _p	F / St	HP	100	
		2.50m 2.60m E		2.5						HP	110	
		2.50m 2.60m E		2.5						HP	55	
		2.50m 2.60m E		2.5						HP	65	
		3.00m 3.10m E		3.0		CH	Silty Sandy CLAY - medium to high plasticity, grey to dark grey, fine to medium grained sand.					
		3.00m 3.10m E		3.0		SC	Clayey SAND - fine to medium grained, grey to dark grey, fines of low to medium plasticity.					
		3.50m 3.60m E		3.5								ALLUVIAL
		3.50m 3.60m E		3.5								
		4.00m 4.10m E		4.0		SP	SAND - fine to medium grained, grey with shells.	W				
		4.00m 4.10m E		4.0								
					4.5			Hole Terminated at 4.10 m Borehole Collapse				

LEGEND:		Notes, Samples and Tests		Consistency		UCS (kPa)	Moisture Condition	
Water		U ₃₀ 50mm Diameter tube sample		VS	Very Soft	<25	D	Dry
Water Level (Date and time shown)		CBR Bulk sample for CBR testing		S	Soft	25 - 50	M	Moist
Water Inflow		E Environmental sample (Glass jar, sealed and chilled on site)		F	Firm	50 - 100	W	Wet
Water Outflow		ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)		St	Stiff	100 - 200	W _p	Plastic Limit
Strata Changes		B Bulk Sample		VSt	Very Stiff	200 - 400	W _L	Liquid Limit
Gradational or transitional strata		Field Tests		H	Hard	>400		
Definitive or distinct strata change		PID Photoionisation detector reading (ppm)		Fb	Friable			
		DCP(x-y) Dynamic penetrometer test (test depth interval shown)		V	Very Loose			Density Index <15%
		HP Hand Penetrometer test (UCS kPa)		L	Loose			Density Index 15 - 35%
				MD	Medium Dense			Density Index 35 - 65%
				D	Dense			Density Index 65 - 85%
				VD	Very Dense			Density Index 85 - 100%

ENGINEERING LOG - BOREHOLE

CLIENT: NORTHROP CONSULTING ENGINEERS
PROJECT: PROPOSED INDUSTRIAL WAREHOUSE FACILITY
LOCATION: LOT 152, RAVEN STREET, KOORAGANG

BOREHOLE NO: BH02
PAGE: 1 OF 1
JOB NO: NEW20P-0171
LOGGED BY: BS
DATE: 12/1/21

DRILL TYPE: TRACK MOUNTED DRILL RIG
BOREHOLE DIAMETER: 100 mm

SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T		0.10m E				GC	FILL: Clayey Sandy GRAVEL - fine to medium grained, sub angular to angular, brown to grey-brown, fine to coarse grained sand, fines of low to medium plasticity.	M				FILL
		0.50m		0.5								
		0.60m E				ML	FILL: SILT - low plasticity, white to pale grey, with some crystalline material, possibly gypsum.	M < w _p				
		1.00m		1.0		SP	FILL: SAND - fine to medium grained, brown.					
		1.10m E				CH	FILL: CLAY - medium to high plasticity, brown to dark brown.	D - M		HP	270	
		1.50m		1.5		SP	FILL: SAND - fine to medium grained, grey to dark grey, with some black, with trace glass.	M - W		HP	330	
		1.60m E					SAND - fine to medium grained, brown.			HP	250	
		2.00m		2.0		SP	Becoming brown to pale brown.	W				
		2.10m E										
				2.20m								
				2.5			Hole Terminated at 2.20 m Borehole Collapse					ALLUVIAL / POSSIBLE FILL
				3.0								
				3.5								
				4.0								
				4.5								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 50mm Diameter tube sample
- CBR Bulk sample for CBR testing
- E Environmental sample (Glass jar, sealed and chilled on site)
- ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
- B Bulk Sample

Field Tests

- PID Photoionisation detector reading (ppm)
- DCP(x-y) Dynamic penetrometer test (test depth interval shown)
- HP Hand Penetrometer test (UCS kPa)

Consistency

- VS Very Soft
- S Soft
- F Firm
- St Stiff
- VSt Very Stiff
- H Hard
- Fb Friable

UCS (kPa)

- <25
- 25 - 50
- 50 - 100
- 100 - 200
- 200 - 400
- >400

Moisture Condition

- D Dry
- M Moist
- W Wet
- W_p Plastic Limit
- W_L Liquid Limit

Density

- V Very Loose
- L Loose
- MD Medium Dense
- D Dense
- VD Very Dense

- Density Index <15%
- Density Index 15 - 35%
- Density Index 35 - 65%
- Density Index 65 - 85%
- Density Index 85 - 100%


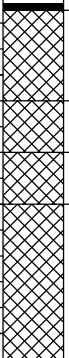
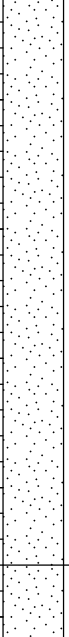
ENGINEERING LOG - BOREHOLE

CLIENT: NORTHROP CONSULTING ENGINEERS
PROJECT: PROPOSED INDUSTRIAL WAREHOUSE FACILITY
LOCATION: LOT 152, RAVEN STREET, KOORAGANG

BOREHOLE NO: BH03
PAGE: 1 OF 1
JOB NO: NEW20P-0171
LOGGED BY: BS
DATE: 12/1/21

DRILL TYPE: TRACK MOUNTED DRILL RIG
BOREHOLE DIAMETER: 100 mm

SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result			
AD/T		0.25m					Asphalt.	D				ASPHALT		
		0.35m E				ML	FILL: SILT - low plasticity, white to pale grey, with some crystalline material, possibly gypsum.	M < w _p				FILL		
		0.50m				SP	FILL: SAND - fine to medium grained, pale brown to yellow-brown.	D						
						SP	FILL: SAND - fine to medium grained, grey to grey-brown, trace fine grained, angular gravel, with shells.	D - M						
		1.00m				SP	FILL: SAND - fine to medium grained, brown to dark brown with some grey-brown, trace fine grained, sub-rounded to sub-angular gravel, with shells.	D						
		1.50m					SAND - fine to medium grained, grey to dark grey-brown.	M				ALLUVIAL		
		1.60m E												
		2.00m						Becoming brown to pale brown.	M - W					
		2.10m E												
		2.50m							W					
		2.60m E												
		3.00m						Becoming brown to grey-brown.						
	3.10m E													
	3.50m													
	3.60m E													
	4.00m					SP	SAND - fine to coarse grained, grey with some grey-brown.							
	4.10m E													
				4.5			Hole Terminated at 4.10 m Borehole Collapse							

LEGEND:		Notes, Samples and Tests		Consistency		UCS (kPa)		Moisture Condition	
Water		U ₃₀ 50mm Diameter tube sample		VS Very Soft		<25		D Dry	
Water Level (Date and time shown)		CBR Bulk sample for CBR testing		S Soft		25 - 50		M Moist	
Water Inflow		E Environmental sample (Glass jar, sealed and chilled on site)		F Firm		50 - 100		W Wet	
Water Outflow		ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)		St Stiff		100 - 200		W _p Plastic Limit	
Strata Changes		B Bulk Sample		VSt Very Stiff		200 - 400		W _L Liquid Limit	
Gradational or transitional strata		Field Tests		H Hard		>400			
Definitive or distinct strata change		PID Photoionisation detector reading (ppm)		Fb Friable					
		DCP(x-y) Dynamic penetrometer test (test depth interval shown)		Density		V Very Loose		Density Index <15%	
		HP Hand Penetrometer test (UCS kPa)		L Loose		MD Medium Dense		Density Index 15 - 35%	
				D Dense		VD Very Dense		Density Index 35 - 65%	
								Density Index 65 - 85%	
								Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

CLIENT: NORTHROP CONSULTING ENGINEERS
PROJECT: PROPOSED INDUSTRIAL WAREHOUSE FACILITY
LOCATION: LOT 152, RAVEN STREET, KOORAGANG

BOREHOLE NO: BH04
PAGE: 1 OF 1
JOB NO: NEW20P-0171
LOGGED BY: BS
DATE: 12/1/21

DRILL TYPE: TRACK MOUNTED DRILL RIG
BOREHOLE DIAMETER: 100 mm

SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result		
AD/T		0.10m E				GP	FILL: Sandy GRAVEL - fine to medium grained, sub-angular to angular, grey-brown to brown, fine to medium grained sand, trace fines of low plasticity.	D - M				FILL	
				SP		FILL: Gravelly SAND - fine to medium grained, brown, fine grained, angular to sub-angular gravel.	M						
		0.50m 0.60m E		0.5			FILL: SAND - fine to medium grained, brown and pale brown, with shells.						
		1.00m 1.10m E		1.0		SP		M					
		1.50m 1.60m E		1.5									
		2.00m 2.10m E		2.0			CLAY - medium to high plasticity, grey and dark grey.	M > w _p	F / St	HP	120	ESTUARINE DEPOSITS	
		2.50m 2.60m E		2.5		CH							
		3.00m 3.10m E		3.0									
		3.50m 3.60m E		3.5		SP	SAND - fine to medium grained, grey, trace fines of low plasticity, trace fine grained, sub-rounded gravel.						M - W
							Becoming brown and pale brown.	W					ALLUVIAL
		4.00m 4.10m E		4.0									
					4.10m		Hole Terminated at 4.10 m Borehole Collapse						
					4.5								

LEGEND:		Notes, Samples and Tests		Consistency		UCS (kPa)	Moisture Condition
Water		U ₃₀ 50mm Diameter tube sample		VS	Very Soft	<25	D Dry
Water Level (Date and time shown)		CBR Bulk sample for CBR testing		S	Soft	25 - 50	M Moist
Water Inflow		E Environmental sample (Glass jar, sealed and chilled on site)		F	Firm	50 - 100	W Wet
Water Outflow		ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)		St	Stiff	100 - 200	W _p Plastic Limit
Strata Changes		B Bulk Sample		VSt	Very Stiff	200 - 400	W _L Liquid Limit
Gradational or transitional strata		Field Tests		H	Hard	>400	
Definitive or distinct strata change		PID Photoionisation detector reading (ppm)		Fb	Friable		
		DCP(x-y) Dynamic penetrometer test (test depth interval shown)		Density		V Very Loose	Density Index <15%
		HP Hand Penetrometer test (UCS kPa)		L Loose		MD Medium Dense	Density Index 15 - 35%
				D Dense		D Dense	Density Index 35 - 65%
				VD Very Dense		VD Very Dense	Density Index 65 - 85%
							Density Index 85 - 100%