Preliminary Acid Sulfate Soils Assessment

Abbott Road Fields
Curl Curl NSW 2096

Prepared for

Urbis Pty Ltd
(On Behalf of Optus Pty Ltd)

May 2019

New South Wales
2 Tipperary Avenue
Killarney Heights NSW 2087

Queensland

11 Tintaldra Court
Buderim QLD 4556

Mob: **0412 987 456**
Fax: +612 9285 0528
Eml: fenn@canopyenterprises.com
ABN: 53 093 830 409

Ref No: CRAB-19-PASSA
Abbot Road Fields Curl Curl NSW 2096

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Fenn Hinchcliffe CEnvP
BA, MBEnv, CEnvP, MEIANZ
Director
Canopy Enterprises Pty Ltd

Dr Gunnar Haid
MSc; PhD (Petroleum Engineering) MUL
Senior Environmental Engineer
Canopy Enterprises Pty Ltd

Certified Environmental Practitioner
MEIANZ, CEnvP

24 May 2019

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Appendices

Acknowledgements and References

The following source imagery and documentation is attributed to and gratefully acknowledged:

General Searches:	Property Information: NSW Department of Planning and Environment Planning Portal https://www.planningportal.nsw.gov.au Google Earth Pro
Key Guidelines/Documents:	Ahern C R, Stone, Y, and Blunden B (1998). Acid Sulfate Soils Assessment Guidelines Published by the Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia. Referenced herein as Acid Sulfate Soil Guidelines. Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual, Department of Agriculture and Water Resources, Canberra ACT. CC BY 4.0 Acid Sulfate Mapping Guidelines for the use of Acid Sulfate Soils Risk Maps: Department of Land and Water Conservation (1998). Regional View of ASS Mapping: Courtesy of NSW Department of Planning and Environment.

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List of Abbreviations

A list of the common Acid Sulfate Soils abbreviations that may be used throughout this report is provided in the table below:

AASS	Actual Acid Sulfate Soils
ASS	Acid Sulfate Soils
ASSM	Acid Sulfate Soil Materials
ASSMAC	Acid Sulfate Soils Management Advisory Committee
ASSMP	Acid Sulfate Soil Management Plan
ANCM	Acid Neutralizing Capacity Method
bgl	Below ground level
CoPC	Contaminants of Potential Concern
CSR	Chromium Reducible Sulfur
LEP	Local Environmental Plan
NATA	National Association of Testing Authorities
PASS	Potential Acid Sulfate Soils
PASSA	Preliminary Acid Sulfate Soils Assessment
pH_{field}	Field pH (pH of soil and deionised water)
pH_{fox}	Oxidised Field pH (pH of soil and hydrogen peroxide)
pH_{KCl}	pH of a 1:5 solution of soil and 1M Potassium Chloride
sPOCAS	Suspension Peroxide Oxidation Combined Acidity and Sulfate
S_{POS}	Peroxide Oxidisable Sulfur
SWL	Standing Water Level
SWMS	Safe Work Method Statement
TAA	Total Actual Acidity
TPA	Total Potential Acidity
TOS	Total Oxidisable Sulfur
TSA	Total Sulfidic Acidity

1 Introduction to Acid Sulfate Soils

Acid Sulfate Soils (ASS) are divided into Potential Acid Sulfate Soils (PASS) and Actual Acid Sulfate Soils (AASS). PASS are, as the name indicates, soils that are in their present state not ASS, but have the potential to turn into ASS, given the right environment (mainly exposure to oxygen). AASS are soils that have already undergone oxidisation displaying high acidity (and low pH values). The term ASS covers both, PASS and AASS.

Officially, the Acid Sulfate Soil Guidelines[1] define ASS as follows (Canopy's highlights):

> ***Acid sulfate soils*** *are the common name given to naturally occurring sediments and soils containing iron sulfides (principally iron sulfide or iron disulfide or their precursors). The exposure of the sulfide in these soils to oxygen by drainage or excavation leads to the generation of sulfuric acid.*
>
> *"**acid sulfate soils**" include actual acid sulfate soils or potential acid sulfate soils. Actual and potential acid sulfate soils are often found in the same soil profile, with actual acid sulfate soils generally overlying potential acid sulfate soil horizons.*
>
> *"**actual acid sulfate soils**" are soils containing highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulfides, primarily sulfide. This oxidation produces hydrogen ions in excess of the sediment's capacity to neutralise the acidity resulting in soils of pH of 4 or less when measured in dry season conditions. These soils can usually be identified by the presence of pale yellow mottles and coatings of jarosite.*
>
> *"**potential acid sulfate soils**" are soils which contain iron sulfides or sulfidic material which have not been exposed to air and oxidised. The field pH of these soils in their undisturbed state is pH 4 or more and may be neutral or slightly alkaline. However, they pose a considerable environmental risk when disturbed, as they will become severely acid when exposed to air and oxidised.*

The guidelines state further:

> *Not all acid soils in coastal areas are acid sulfate soils. It is important to note that acidic soil and water conditions can occur with other soils that do not contain iron sulfide sediments. Organic acids (for example humic acid) are common in coastal ecosystems and can produce acid water and sediments. The pH of these sediments are usually around 4.5-5.5. As they do not have the ability to generate additional acid when exposed to air, they do not exhibit the same kinds of environmental risks that are associated with acid sulfate sediments. These guidelines only deal with acid sulfate materials.*

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

2 Site Information and Background

Canopy Enterprises (Canopy) was engaged by Mr Jason Bau of AW Geotechnics Pty Ltd (the Client) on behalf of others to perform a Preliminary Acid Sulfate Soils Assessment (PASSA) as per Canopy's Fee Proposal dated 16 January 2019. A summary of the project details is provided in Table 1 below:

Table 1: Summary of Site Details

Subject	Description
Site description (The Site)	Part of Lot 7356/DP1167221 Abbott Road Fields, Curl Curl 2096, NSW (as defined in Appendix B)
Site Area approximately	Approximately 150 m^2
The Client:	Urbis Pty Ltd (On behalf of Optus Pty Ltd)
Relevant Council and LEP	Northern Beaches Council Warringah Local Environmental Plan 2011 (Updated 2018), Map index 010A
Reason for Assessment	Proposed development for the installation of a telecommunication tower and equipment shelter. See Appendix A. Don't we have some sort of pan for this?
ASS Class and Risk Profile	Council's LEP Map ASS_010A ASS Classes 1 and 3. Considered to be high risk category which triggers a requirement for a PASSA to be undertaken. The ground level at the site is approximately 3.5 -4.5 meters AHD.
Requirement as per Table 2.1 of the Acid Sulfate Soils Assessment Guidelines (1998) for this Class and the LEP Clause 6.1 (2)	Class 1: Any works below one metre Class 3: Works beyond 1 metre below ground surface. Works by which the watertable is likely to be lowered beyond 2 m below natural ground surface. If these types of works are proposed further investigation is required to determine if Acid Sulfate Soils are actually present
Supporting relevant information provided to Canopy:	Geotechnical Investigation: Geosense Drilling and Engineering Ref: 232, Dated: 03/12/2018. Draft Site Layout, Ref: S 2711-P1 rev 1 Dated 03/12/2018
Additional Information	The investigation was undertaken by suitably qualified personnel with reference to the Acid Sulfate Soil Assessment Guidelines (August 1998) and the ASS Manual and related documents and requirements.

3 Objectives

The objectives of this PASSA were to:

- Assess whether there was a presence of Potential Acid Sulfate Soils (PASS) or Actual Acid Sulfate Soils (AASS) across the Site, in the proximity of the location of the proposed works;
- If required, provide the Client with recommendations relating to the development of an Acid Sulfate Soils Management Plan (ASSMP) for the proposed redevelopment works;

4 Scope of Works

To achieve the objectives of the investigation the following scope of works was undertaken:

- A review of relevant information provided to Canopy by the Client;
- A desktop review of relevant published information relating to the risk of the presence of ASS at the Site;
- Advancement of boreholes across the investigation area and sampling for soils at various depth intervals;
- Analysis of samples for pH_{field} and pH_{fox} and if required for Suspension Peroxide Oxidation Combined Acidity & Sulfur (sPOCAS);
- Preparation of a Report herein.

5 Desktop Review

All information provided to Canopy was reviewed. In particular Council's Acid Sulfate Soils Risk Maps (ASSRM) as contained within Council's LEP were reviewed to determine the Site's location within the relevant ASS Map, the ASS Class, the general risk consideration and the assessment requirements. Please refer to Table 1 titled: 'Summary of Site Details' in Section 2 above.

A desktop underground services search was carried out for the Site by contacting Dial Before You Dig (DBYD). As part of this search the approximate location of all active underground services and installations as listed on DBYD within the vicinity of the Site were identified.

6 Field Work Methodology

During an initial site walkover and utilities check, the most suitable locations to undertake the soil investigation were selected. The approximate locations of all boreholes are shown in the Borehole Location Plan which is provided in Appendix B.

While the Acid Sulfate Soil Guidelines provide a number of four boreholes as the minimum for an investigation of an area of less than 1 ha (10,000 m^2), Canopy considered the information gained from two borehole to be sufficient for the proposed development which features an area of approximately 105 m^2 only (refer to Appendix A for plans).

A total of two Boreholes (B1 – B3) was advanced into the subsurface of the Site using a truck mounted drill rig using solid flight augers.

Samples were collected from the boreholes at approximately 0.5 m to 1 m intervals noting the site conditions. All samples were visually checked for signs of abnormality and also for olfactory evidence of ASS. Soil samples earmarked for possible sPOCAS analysis were placed into plastic zip lock bags and air removed within the bags to the extent practicable. All samples were immediately placed into a chilled environment for transport to the laboratory.

Subsets of each sample were placed into small laboratory provided 50 ml plastic jars for field (pH_{field}) and peroxide (pH_{fox}) analysis. Field and peroxide testing using H_2O_2 was conducted on the samples using a calibrated PHT-026 pH Meter following the procedure outlined in Appendix 1 of the Acid Sulphate Soils Assessment Guidelines (Ahern et al, 1998a).

Sample containers were labelled and identified with a unique ID which was recorded on a Chain-of-Custody (CoC) form. The CoC form accompanied samples upon dispatch to the laboratory for analysis. Samples were analysed at Envirolab Services in their Chatswood laboratory, which is NATA registered for the requested sPOCAS analysis.

7 Action Criteria

The following is an excerpt from Appendix 1 of the Acid Sulfate Soil Guidelines:

> *Field pH of actual acid sulfate soils tends to be ≤ 4 while the field pH of potential acid sulfate soils tends to be neutral. Field pH provides a useful quick indication of the likely presence and severity of "actual" acid sulfate soils.*
>
> *In order to test for potential acid sulfate soils that contain unoxidised sulfides, peroxide is used to rapidly oxidise the iron sulfides (usually pyrite), resulting in the production of acid with a corresponding drop in pH. Potentially positive reactions include one or more of the following:*
>
> - *Change in colour of the soil from grey tones to brown tones*
> - *Effervescence*
> - *The release of sulfurous odours*
> - *A substantial depression in pH below pH_{field}*
> - *pH < 3*

The Acid Sulfate Soil Guidelines define action criteria based on oxidisable sulfur levels constituting significant environmental risk for broad categories of soil types as outlined in Table 2 below. Works in soils that exceed the Action Criteria levels presented in the below table may require the preparation of an ASSMP.

Table 2: Action Criteria based on Broad Texture Categories of Soil

		Action Criteria < 1 000 Tonnes		Action Criteria > 1 000 Tonnes	
Soil Texture and approximate clay content		**Sulfur trail** *% S oxidisable (oven dry basis) e.g. S_{TOS} or S_{POS}*	**Acid Trail** *Mol H^+/Tonne (oven-dry basis) e.g. TPA or TSA*	Sulfur trail *% S oxidisable (oven dry basis) e.g. S_{TOS} or S_{POS}*	Acid Trail *Mol H^+/Tonne (oven-dry basis) e.g. TPA or TSA*
Coarse (sands – gravels)	< 5	**0.03**	**18**	0.03	18
Medium (sandy loam – light clay)	5 – 40	**0.06**	**36**	0.03	18
Fine (medium to heavy clays, silty clays)	> 40	**0.10**	**62**	0.03	18

Source: Table 4.4 (ASSMAC 1998).

The acidity trail portion in sPOCAS comprises a Titratable Actual Acidity (TAA) and a Titratable Peroxide Acidity (TPA) component.

- TAA is a measure of the acidity that is present in the soils as they are naturally occurring without any exposure to oxygen.
- TPA is the acidity of the sample as it naturally occurs, plus any acidity generated by artificial means in the laboratory (i.e. the addition of Hydrogen Peroxide). It is the total acidity the soil could (theoretically) produce.
- TSA is Titratable Sulfidic Acidity. It is the acidity after Oxygen added which is potentially but not necessarily caused by the presence of Sulfur (TSA = TPA – TAA).
- S_{POS} is the sulfur trail portion of the sPOCAS test and is a measure for the potential of acidity to be formed in the soils as a result of sulfur and exposure to oxygen.

8 Results

8.1 Field Observations

Field works for the PASSA were undertaken by Dr Gunnar Haid, a suitably qualified Senior Environmental Engineer on 8 May 2019. Site Photographs are provided in Appendix C.

The subsurface conditions found during drilling were broadly speaking a thin layer of top soil (grass covered) followed by a fill layer of fine to medium grained sand with silt and clay containing some rock fragments. Foreign material (rubber, cloth) was encountered to a depth of approximately 4 m bgl indicating that the Site is located on recently (in geological terms) reclaimed land.

The fill was followed by natural medium grained to coarse clayey and silty sand of a dark grey colure to a depth of approximately 6.7 m bgl followed by a layer of light grey sandy clay to the total depth of the boring at 10.0 m bgl. Groundwater was encountered at approximately 1.9-2.0 m bgl. A sandy layer of approximately 0.3 m thickness containing a large amount of organic material was notice at the approximate depth of the groundwater level.

Borehole logs attached in Appendix B provide further details.

Samples obtained between 2 and 3 m bgl were noted to have odour of decaying organic material. The samples had a dark grey almost black colour and had a buttery doe-like texture which is typically associated with PASS.

The encountered types of soils would be classified as ‘coarse’ for comparison to Action Criteria in Table 2 above.

8.2 Field and Laboratory Analytical Results

All soil samples were tested in the field for pH_{field} / pH_{fox} using the procedure outlined in Appendix 1 of the Acid Sulphate Soils Assessment Guidelines (Ahern et al, 1998a). A summary of the test results is provided in the following table.

Table 3: Summary of field and peroxide tests

Sample ID	Depth [m bgl]	pH_{field}	pH_{fox}	Difference (pH_{field} - pH_{fox})	Reaction Rate*
B1	0.5	7.7	6.2	1.5	X
B1	1.0	7.6	6.7	0.9	X
B1	1.5	7.8	6.3	1.5	X
B1	2.0	7.7	3.2	4.5	XXX
B1	3.0	7.5	2.3	5.2	XX
B1	3.5	7.5	3.4	4.1	XX
B1	5.0	6.7	2.4	4.3	XX
B1	5.5	6.6	4.0	2.6	X
B1	6.5	6.7	5.4	1.3	X
B1	7.0	6.9	5.3	1.6	X
B1	7.5	7.0	5.1	1.9	X
B1	8.0	7.0	3.1	3.9	X
B1	8.5	6.9	4.7	2.2	X
B1	9.0	6.9	4.4	2.5	X
B1	10.0	6.9	4.4	2.5	X
B2	0.5	6.5	6.4	0.1	X
B2	1.0	6.8	6.1	0.7	X
B2	2.0	6.8	5.1	1.7	XX
B2	2.5	6.8	4.6	2.2	X
B2	3.0	6.6	2.4	4.2	XXXX

* Reaction Rates are either slight (X), moderate (XX), high (XXX) or vigorous (XXXX)
Blue shading indicates sample selected for laboratory sPOCAS analysis

The pH of the soil samples (field pH test) show that the natural soil sampled was within the neutral range and that there is a low likelihood for the presence of AASS. The pH values following reaction with hydrogen peroxide (field peroxide test) are also listed in the above table. The difference in pH values between the oxidised and unoxidized samples can be an indicator for the presence of PASS, especially when the difference exceeds a value of two and when visible reactions to the oxidisation (such as bubbling, odours, temperature changes) are observed.

A number of samples showed a pH difference greater than two. Reaction rates in many of those samples also showed visible reaction to oxidisation. The samples with the highest drop in pH value and the most vigorous reaction rates also showed the lowest oxidised pH with values as low as 1.7 in the 2.0 m sample in Boring B1.

The pH measurements carried out on-site are used as a screening tool and assist in the decision whether further, more sophisticated, laboratory analysis is required. Based on the results of the tests carried out on-site, three soil samples, B1 2.0 m, B1 8.0 m and B2 3.0 m, were submitted for Suspension Peroxide Oxidation - Combined Acidity and Sulfate (sPOCAS) laboratory analysis to determine Sulfur Trail and Acid Trail values (as listed in Table 2 as criteria that would require action if exceeded).

Based on information provided by the Client, the mass of soil to be excavated from the investigation area will not exceed the 1,000 tonnes. A summary of the laboratory analytical results in relation to the action criteria is presented in the below table.

Table 4: Laboratory analytical results for volumes less than 1000 tonnes.

Sample ID	Action Criterion Sulfur Trail *% S oxidisable (oven dry basis) e.g. S_{TOS} or S_{POS}*	**Analytical Results Sulfur Trail *(S_{POS}) %w/w***	Action Criterion Acid Trail *Mol H^+/Tonne (oven-dry basis) e.g. TPA or TSA*	**Analytical Results Acid Trail *TPA pH 6.5)***	**Analytical Results Acid Trail *(TSA pH 6.5)***
B1 - 2.0 m	0.03	**0.14**	18	**<5**	**<5**
B1 - 8.0 m		**0.007**		**12**	**6**
B2 - 3.0 m		**0.27**		**68**	**64**

Note:
Green Shading indicates compliance with the Action Criteria
Orange Shading indicates exceedance of the Action Criterion

The above results show that in all three analysed samples at least one result exceeded the adopted action criterion for either acid trail or sulfur trail. In the case of Sample B2-3.0m both sulfur and acid trail analysis results exceeded the action criteria for both samples. Laboratory analysis reports including CoC documentation are included in Appendix D (See Page 11 of 25).

9 Conclusions and Recommendations

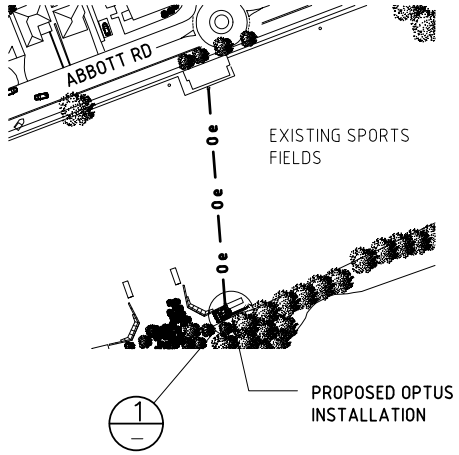
Based on the available information and data herein PASS is present at the Site at depths beyond 2.0 m bgl (and potentially at shallower depths). I**t is therefore recommended that an Acid Sulfate Soil Management Plan is developed and implemented during construction works**.

Should you have any enquiries in relation to the findings of this assessment, please do not hesitate to contact Fenn Hinchcliffe on **0412 987456** or via email at fenn@canopyenterprises.com.

APPENDIX A

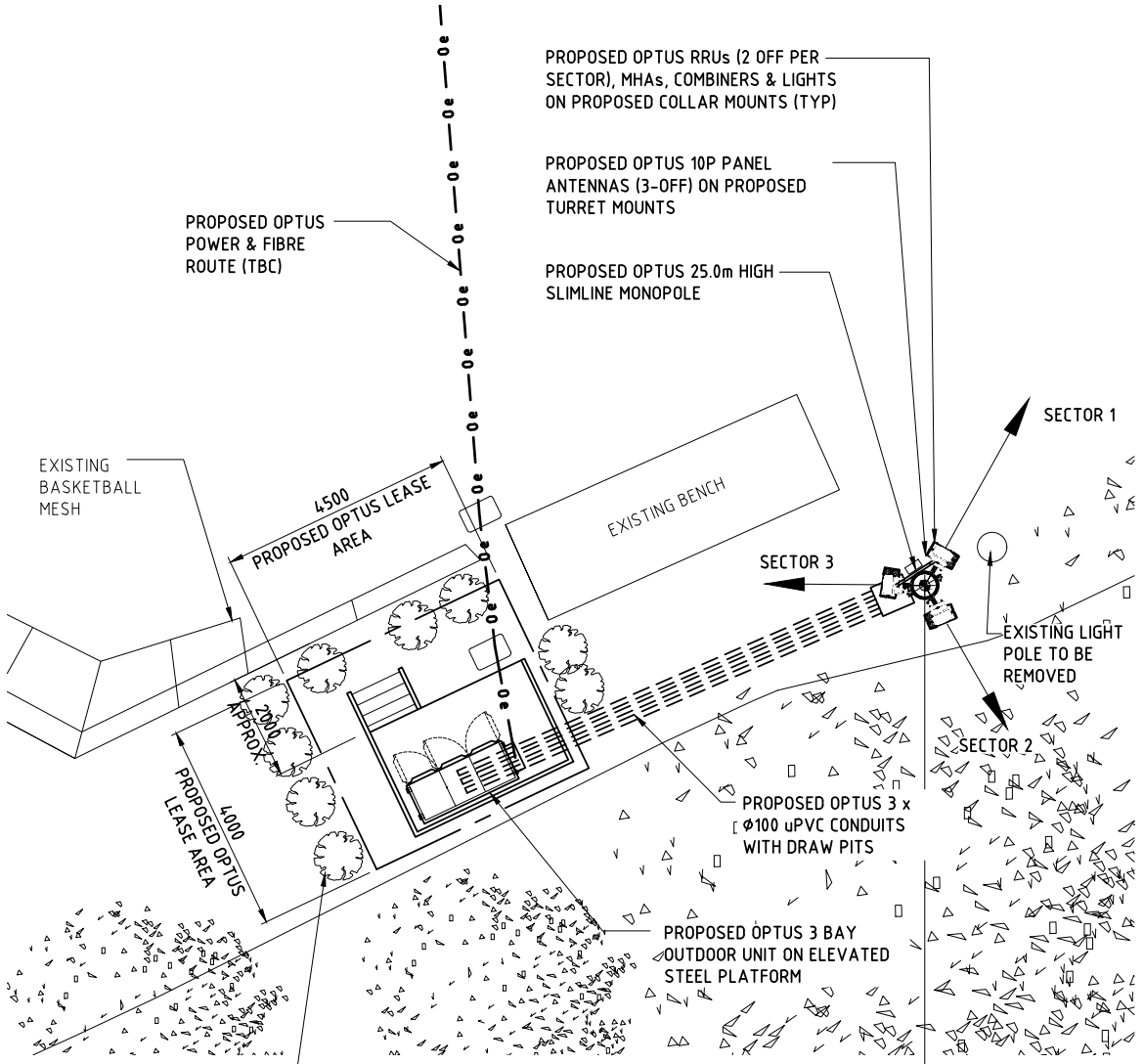
CONSTRUCTION PLANS

LOCALITY MAP



OVERALL SITE PLAN

SCALE 1:2500



DETAIL 1

SCALE 1:100

NOTE:
THIS DRAWING IS DIAGRAMMATIC ONLY AND SHOULD NOT BE SCALED. DIMENSIONS, COORDINATES, AND LEVELS SHOWN ARE NOMINAL AND SUBJECT TO CONFIRMATION BY SURVEYOR.

SITE ADDRESS:

LOT 7201 GRIFFIN ROAD,
NORTH CURL CURL,
NSW 2099

NOTES:

1. **BASIS OF DESIGN**
   - SITE INSPECTION 20/10/15
2. **PANEL ANTENNAS**
   - 1-OFF PER SECTOR (EACH 2.7m LONG) AT EL 25.5m
   - SECTOR 1 - ??, SECTOR 2 - ??, SECTOR 3 -??
   - MOUNTED ON PROPOSED TURRET MOUNTS
3. **TRANSMISSION**
   - FIBRE - OPTUS TO CONFIRM
4. **EQUIPMENT SHELTER**
   - 3 BAY OUTDOOR UNIT, COLOURED "PALE EUCALYPT/PAPER BARK" ON ELEVATED STEEL PLATFORM
5. **OPTUS MONOPOLE**
   - 25.0m HIGH MONOPOLE WITH 2 OFF COLLAR MOUNT AT EL 25m AND 22m FOR PANEL ANTENNAS AND RRUs RESPECTIVELY
6. **FEEDER CABLES**
   - SIZE: 7/8" ALL SECTORS ??????
   - LENGTH: 45m ALL SECTORS
   - OTHER DETAIL NOT SHOWN ON PLAN
7. **SITE ACCESS**
   - VIA ABBOTT ROAD
8. **ANTENNA ACCESS**
   - ACCESS VIA CHERRY PICKER ???
9. **POWER SUPPLY**
   - 3-PHASE 63 AMP POWER SUPPLY TO BE PROVIDED
   - DETAILS TO BE CONFIRMED/ADVISED
10. **OTHER (PAINTING, LANDSCAPING, SCREENING)**
    - LOCATED IN FLOOD ZONE.
    - EXISTING FLOOD LIGHT POLE TO BE REMOVED, LIGHTS TO BE RELOCATED TO THE NEW MONOPOLE AT CL 22.0m

MGA ZONE	56
E	341 903
N	6 262 499
AT	℄ MONOPOLE

Rev	Date	Revision Details	Consultant	CAD	Designer	Verifier	Approver
02	18.02.19	LAYOUT & CONFIGURATION UPDATED FOR APPROVAL	URBIS	PP	PP	PP	NSN
01	11.11.15	ISSUED FOR APPROVAL	MYD	NA	NA	RS	PM

NOKIA

Client: OPTUS

Project: MOBILE NETWORK AUSTRALIA
SITE ID- S2711 - ?
CURL CURL-O
LOT 7201 GRIFFIN RD,NSW,2099

Drawing Title: DRAFT SITE LAYOUT

Drawing Status: FOR APPROVAL

Drawing No. S2711-P1

Revision 02

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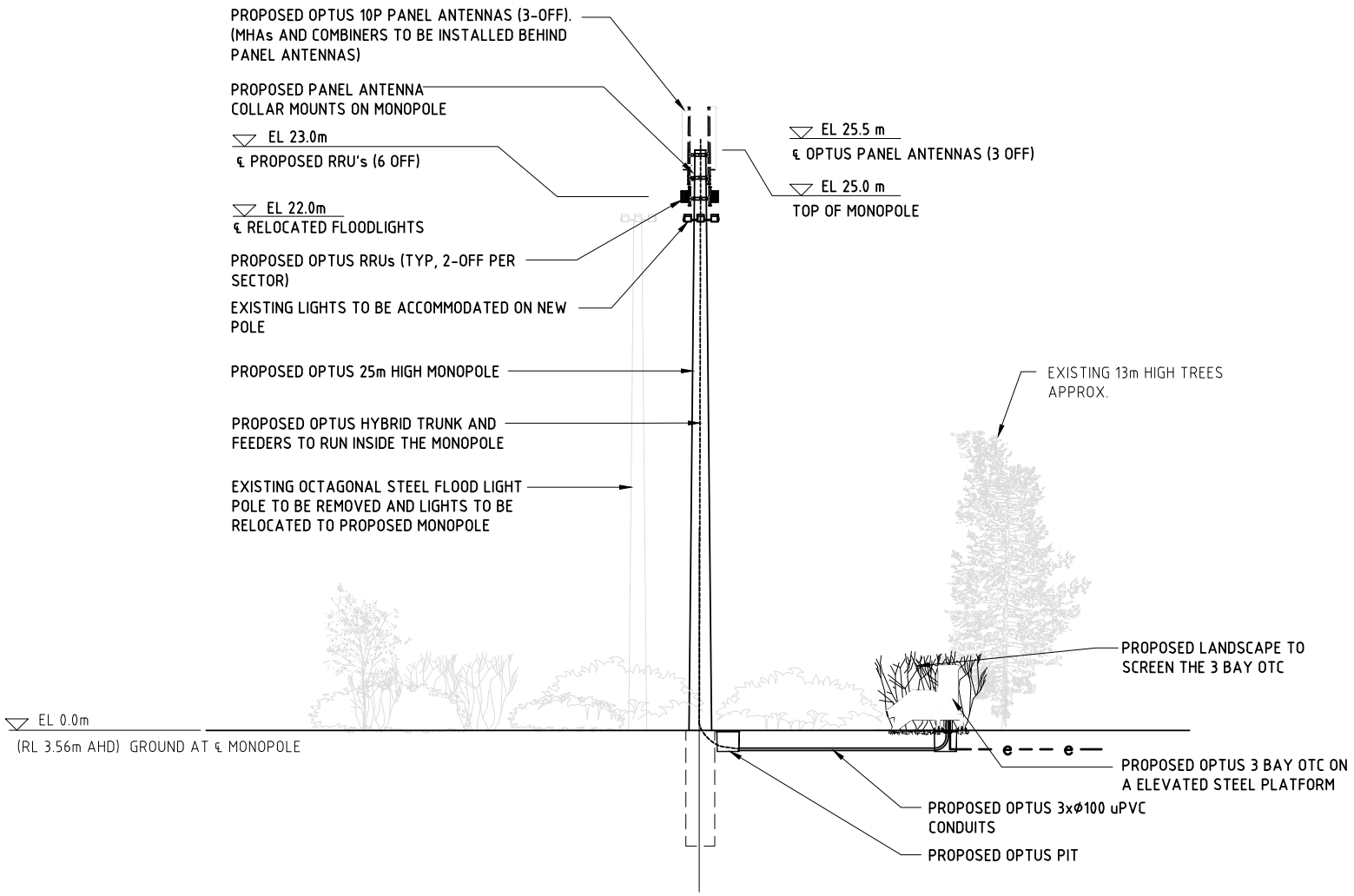
20 10 0 10 20 30 40 50mm

A3

NOTE:
THIS DRAWING IS DIAGRAMMATIC ONLY AND SHOULD NOT BE SCALED.



NORTH WEST ELEVATION

SCALE 1:200

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02	18.02.19	LAYOUT & CONFIGURATION UPDATED FOR APPROVAL	URBIS	PP	PP	PP	NSN
01	11.11.15	ISSUED FOR APPROVAL	MYD	NA	NA	RS	PM

NOKIA

Client: OPTUS

Project: MOBILE NETWORK AUSTRALIA
SITE ID- S2711 - ?
CURL CURL-O
LOT 7201 GRIFFIN RD,NSW,2099

Drawing Title: DRAFT SITE ELEVATION

Drawing Status: FOR APPROVAL

Drawing No. S2711-P2

Revision 02

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20 10 0 10 20 30 40 50mm

A3

APPENDIX B

BOREHOLE LOCATION MAP AND BORE LOGS

Borehole Location Map

Property boundaries (red line) and borehole locations (red dots) are approximated

Source: Google Earth Pro

BORE LOG

Project: Curl Curl Date: 8/05/2019 Bore ID: B1

Site: Abbot Road Fields
Curl Curl NSW 2095
Logged by: Gunnar Haid
Driller: D Hart
Company:

Project ID: CUAB-19

Method: Full flight auger
Water Level: 1.9 m Static:

Depth [m]	Groundwater	Sample	PID (PPM)	UCSC Class	Description
					Top soil loam, grass, organics, roots
		0.5			Fill, layers of fine to medium grained sand, rock fragments, some foreign material, light brown, getting darker with depth, damp
1m		1.0			
		1.5			
2m	GW	2.0			Fill, fine to medium grained sand with silt, dark grey, wet Organic decay odour
3m		3.0			
		3.5			
4m					
5m		5.0			Fine to medium grained sand with clay and silt content increasing with depth, dark grey, wet
		5.5			
6m					Continue next sheet

Description		Colour	Structure	Moisture	Cohesive Soils		Sand & Gravel			Secondary
Fill	Clayey	Red	Homogenous	Dry	Very soft	Non plastic	Very loose	Boulders	Poorly sorted	And (35-50%)
Clay	Silly	Yellow	Heterogeneous	Damp	Soft	Low plasticity	Loose	Cobbles	(well graded)	Some (20-35%)
Silt	Sandy	White	Stratified	Moist	Firm	Mod plasticity	Medium loose	Coarse gravel	well sorted	Little (10-20%)
Sand	Gravelly	Black	Laminated	Wet	Stiff	High plasticity	Dense	Fine gravel	(poorly graded)	Trace (0-10%)
Gravel	Organic	Brown	Lens	Saturated	Very stiff		Very dense	Coarse sand		Contamination
Topsoil		Grey	Root holes		Hard					Odour
Peat		Mottled	occasional							

Disclaimer: This bore log is intended for environmental not geotechnical purposes

BORE LOG

Project: Curl Curl Date: 8/05/2019 Bore ID: B1

Site: Abbot Road Fields
Curl Curl NSW 2095
Logged by: Gunnar Haid

Project ID: CUAB-19

Driller: D Hart
Company:

Method: Full flight auger
Water Level: 1.9 m Static:

Depth [m]	Groundwater	Sample	PID (PPM)	UCSC Class	Description
		6.5			Fine to medium grained sand with clay and silt content increasing with depth, dark grey, wet
7m		7.0			
		7.5			
8m		8.0			Sandy clay, medium plasticity, light grey, wet
9m		9.0			
10m		10.0			EOH @ 10.0 m
11m					
12m					

Description		Colour	Structure	Moisture	Cohesive Soils		Sand & Gravel			Secondary
Fill	Clayey	Red	Homogenous	Dry	Very soft	Non plastic	Very loose	Boulders	Poorly sorted	And (35-50%)
Clay	Silly	Yellow	Heterogeneous	Damp	Soft	Low plasticity	Loose	Cobbles	(well graded)	Some (20-35%)
Silt	Sandy	White	Stratified	Moist	Firm	Mod plasticity	Medium loose	Coarse gravel	well sorted	Little (10-20%)
Sand	Gravelly	Black	Laminated	Wet	Stiff	High plasticity	Dense	Fine gravel	(poorly graded)	Trace (0-10%)
Gravel	Organic	Brown	Lens	Saturated	Very stiff		Very dense	Coarse sand		Contamination
Topsoil		Grey	Root holes		Hard					Odour
Peat		Mottled	occasional							

Disclaimer: This bore log is intended for environmental not geotechnical purposes

BORE LOG

Project: Curl Curl Date: 8/05/2019 Bore ID: B2

Site: Abbot Road Fields
Curl Curl NSW 2095

Project ID: CUAB-19

Logged by: Gunnar Haid

Driller: D Hart

Method: Full flight auger

Company:

Water Level: 1.9 m Static:

Depth [m]	Groundwater	Sample	PID (PPM)	UCSC Class	Description
					Top soil loam, grass, organics, roots
		0.5			Fill, layers of fine to medium grained sand, rock fragments, some foreign material, light brown, getting darker with depth, damp
1m		1.0			
		1.5			
	GW				
2m		2.0			Fill, fine to medium grained sand with silt, dark grey, wet Organic decay odour
		2.5			
3m		3.0			EOH @ 3.0 m

Description		Colour	Structure	Moisture	Cohesive Soils		Sand & Gravel			Secondary
Fill	Clayey	Red	Homogenous	Dry	Very soft	Non plastic	Very loose	Boulders	Poorly sorted (well graded)	And (35-50%)
Clay	Silly	Yellow	Heterogeneous	Damp	Soft	Low plasticity	Loose	Cobbles		Some (20-35%)
Silt	Sandy	White	Stratified	Moist	Firm	Mod plasticity	Medium loose	Coarse gravel		Little (10-20%)
Sand	Gravelly	Black	Laminated	Wet	Stiff	High plasticity	Dense	Fine gravel	well sorted (poorly graded)	Trace (0-10%)
Gravel	Organic	Brown	Lens	Saturated	Very stiff		Very dense	Coarse sand		Contamination
Topsoil		Grey	Root holes		Hard					
Peat		Mottled	occasional							Odour

Disclaimer: This bore log is intended for environmental not geotechnical purposes

APPENDIX C

SITE PHOTOGRAPHS

Photo 1:
Setup process for Boring B1

Photo 2:
Locations of Borings B1 and B2 upon completion of drilling operations

APPENDIX D

LABORATORY REPORTS AND CHAIN OF CUSTODY

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories.
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Client: Canopy Enterprises
Contact Person: Fenn Hinchcliffe
Sampler: G Haid
Address:
Phone: Mob: 0402 411 177
Email: fenn@canopyenterprises.com, gunnar@canopyenterprises.com

Client Project Name / Number / Site etc (ie report title): CUAB-19
PO No.:
Date results required:
Or choose: standard / same day / 1 day / 2 day / 3 day
Report format: esdat / equis /
Lab Comments:

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Priority Metals	PAH	OC/OP	BTEX/TRH	PCB	Comb 6	Comb 6a	SPOCAS							Provide as much information about the sample as you can
1	B1	0.5	8.5.19	Soil x 2															
2	B1	1.0	"	x 1															
3	B1	1.5	"	x 2							X								
4	B1	2.0	"	x 1								X							
5	B1	3.0	"	x 1															
6	B1	3.5	"	x 2						X									
7	B1	4.0	"	x 1															
8	B1	5.5	"	x 1															
9	B1	6.5	"	x 1															
10	B1	7.0	"	x 1															
11	B1	7.5	"	x 1															
12	B1	8.0	"	x 1		-					-	X							
13	B1	8.5	"	x 1															
14	B1	9.0	"	x 1															
15	B1	10.0	"	x 1															
16	B2	0.5	"	x 1						X									
17	B2	1.0	"	x 1															
18	B2	2.0	"	x 1															
19	B2	3.0	"	x 1								X							
extra 20	B2	2-5																	

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 217051
Date Received: 080519
Time Received: 1331
Received by: EMS
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (Company): Canopy Enterprises
Print Name: G Haid
Date & Time: 8.5.19 / 13:35
Signature:

Received by (Company): EMS
Print Name: Ellen MS
Date & Time: 080519 1331
Signature:

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 217051

Client Details

Client	Canopy Enterprises Pty Ltd
Attention	Fenn Hinchcliffe
Address	16/40 Hilly St, Mortlake, NSW, 2137

Sample Details

Your Reference	**CUAB-19**
Number of Samples	20 Soil
Date samples received	08/05/2019
Date completed instructions received	08/05/2019

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	13/05/2019
Date of Issue	13/05/2019

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Aida Marner
Authorised by Asbestos Approved Signatory: Matt Tang

Results Approved By
Ken Nguyen, Reporting Supervisor
Matthew Tang, Asbsestos Supervisor
Nick Sarlamis, Inorganics Supervisor
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		217051-3	217051-6	217051-16
Your Reference	UNITS	B1	B1	B2
Depth		1.5	3.5	0.5
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	10/05/2019	10/05/2019	10/05/2019
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	112	112	113

svTRH (C10-C40) in Soil				
Our Reference		217051-3	217051-6	217051-16
Your Reference	UNITS	B1	B1	B2
Depth		1.5	3.5	0.5
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	09/05/2019	09/05/2019	09/05/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	86	89	90

PAHs in Soil				
Our Reference		217051-3	217051-6	217051-16
Your Reference	UNITS	B1	B1	B2
Depth		1.5	3.5	0.5
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	10/05/2019	10/05/2019	10/05/2019
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.2	<0.1	0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.3	<0.1	0.6
Pyrene	mg/kg	0.3	<0.1	0.7
Benzo(a)anthracene	mg/kg	0.1	<0.1	0.4
Chrysene	mg/kg	0.2	<0.1	0.5
Benzo(b,j+k)fluoranthene	mg/kg	0.3	<0.2	0.9
Benzo(a)pyrene	mg/kg	0.2	0.05	0.61
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	0.3
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.1	<0.1	0.4
Total +ve PAH's	mg/kg	1.7	0.05	4.7
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	0.8
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	0.8
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	0.9
Surrogate p-Terphenyl-d14	%	99	91	92

Organochlorine Pesticides in soil				
Our Reference		217051-3	217051-6	217051-16
Your Reference	UNITS	B1	B1	B2
Depth		1.5	3.5	0.5
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	09/05/2019	09/05/2019	09/05/2019
HCB	mg/kg	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	94	96	95

Organophosphorus Pesticides				
Our Reference		217051-3	217051-6	217051-16
Your Reference	UNITS	B1	B1	B2
Depth		1.5	3.5	0.5
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	09/05/2019	09/05/2019	09/05/2019
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	94	96	95

PCBs in Soil				
Our Reference		217051-3	217051-6	217051-16
Your Reference	UNITS	B1	B1	B2
Depth		1.5	3.5	0.5
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	09/05/2019	09/05/2019	09/05/2019
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1
Surrogate TCLMX	%	94	96	95

Acid Extractable metals in soil				
Our Reference		217051-3	217051-6	217051-16
Your Reference	UNITS	B1	B1	B2
Depth		1.5	3.5	0.5
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	09/05/2019	09/05/2019	09/05/2019
Arsenic	mg/kg	5	<4	10
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	6	10	6
Copper	mg/kg	11	16	6
Lead	mg/kg	27	27	14
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	2	3	2
Zinc	mg/kg	48	33	26

Moisture				
Our Reference		217051-3	217051-6	217051-16
Your Reference	UNITS	B1	B1	B2
Depth		1.5	3.5	0.5
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	10/05/2019	10/05/2019	10/05/2019
Moisture	%	13	23	6.5

Asbestos ID - soils		
Our Reference		217051-3
Your Reference	UNITS	B1
Depth		1.5
Date Sampled		08/05/2019
Type of sample		Soil
Date analysed	-	09/05/2019
Sample mass tested	g	Approx. 30g
Sample Description	-	Brown sandy soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected

sPOCAS + %S w/w				
Our Reference	UNITS	217051-4	217051-12	217051-19
Your Reference		B1	B1	B2
Depth		2.0	8.0	3.0
Date Sampled		08/05/2019	08/05/2019	08/05/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	09/05/2019	09/05/2019	09/05/2019
Date analysed	-	09/05/2019	09/05/2019	09/05/2019
pH $_{kcl}$	pH units	8.2	4.6	5.5
TAA pH 6.5	moles H^+ /t	<5	6	<5
s-TAA pH 6.5	%w/w S	<0.01	0.01	<0.01
pH $_{Ox}$	pH units	8.0	4.6	2.8
TPA pH 6.5	moles H^+ /t	<5	12	68
s-TPA pH 6.5	%w/w S	<0.01	0.02	0.11
TSA pH 6.5	moles H^+ /t	<5	6	64
s-TSA pH 6.5	%w/w S	<0.01	0.01	0.10
ANC_E	% $CaCO_3$	0.44	<0.05	<0.05
a-ANC_E	moles H^+ /t	88	<5	<5
s-ANC_E	%w/w S	0.14	<0.05	<0.05
S_{KCl}	%w/w S	0.01	<0.005	0.02
S_P	%w/w	0.16	0.007	0.29
S_{POS}	%w/w	0.14	0.007	0.27
a-S_{POS}	moles H^+ /t	90	<5	170
Ca_{KCl}	%w/w	0.12	0.01	0.04
Ca_P	%w/w	0.45	0.02	0.20
Ca_A	%w/w	0.33	0.008	0.15
Mg_{KCl}	%w/w	0.005	0.022	0.007
Mg_P	%w/w	0.026	0.029	0.018
Mg_A	%w/w	0.021	0.007	0.011
S_{HCl}	%w/w S	<0.005	<0.005	<0.005
S_{NAS}	%w/w S	<0.005	<0.005	<0.005
a-S_{NAS}	moles H^+ /t	<5	<5	<5
s-S_{NAS}	%w/w S	<0.01	<0.01	<0.01
Fineness Factor	-	1.5	1.5	1.5
a-Net Acidity	moles H^+ /t	<5	11	170
s-Net Acidity	%w/w S	<0.01	0.02	0.27
Liming rate	kg $CaCO_3$ /t	<0.75	0.81	13
s-Net Acidity without -ANCE	%w/w S	0.14	0.017	0.27
a-Net Acidity without ANCE	moles H^+ /t	90	11	170
Liming rate without ANCE	kg $CaCO_3$ /t	6.7	0.81	13

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.

Method ID	Methodology Summary
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	217051-6
Date extracted	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Date analysed	-			10/05/2019	3	10/05/2019	10/05/2019		10/05/2019	10/05/2019
TRH C_6 - C_9	mg/kg	25	Org-016	<25	3	<25	<25	0	109	100
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	3	<25	<25	0	109	100
Benzene	mg/kg	0.2	Org-016	<0.2	3	<0.2	<0.2	0	105	96
Toluene	mg/kg	0.5	Org-016	<0.5	3	<0.5	<0.5	0	108	101
Ethylbenzene	mg/kg	1	Org-016	<1	3	<1	<1	0	111	100
m+p-xylene	mg/kg	2	Org-016	<2	3	<2	<2	0	110	101
o-Xylene	mg/kg	1	Org-016	<1	3	<1	<1	0	113	101
naphthalene	mg/kg	1	Org-014	<1	3	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	115	3	112	109	3	118	115

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	217051-6
Date extracted	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Date analysed	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	3	<50	<50	0	104	105
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	3	<100	<100	0	106	117
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	3	<100	<100	0	114	108
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	3	<50	<50	0	104	105
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	3	<100	<100	0	106	117
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	3	<100	<100	0	114	108
Surrogate o-Terphenyl	%		Org-003	90	3	86	88	2	102	100

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	217051-6
Date extracted	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Date analysed	-			10/05/2019	3	10/05/2019	10/05/2019		10/05/2019	10/05/2019
Naphthalene	mg/kg	0.1	Org-012	<0.1	3	<0.1	<0.1	0	106	108
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	3	<0.1	<0.1	0	100	102
Phenanthrene	mg/kg	0.1	Org-012	<0.1	3	0.2	0.2	0	90	92
Anthracene	mg/kg	0.1	Org-012	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	3	0.3	0.4	29	90	90
Pyrene	mg/kg	0.1	Org-012	<0.1	3	0.3	0.4	29	92	92
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	3	0.1	0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	3	0.2	0.2	0	116	118
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	3	0.3	0.3	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	3	0.2	0.2	0	104	104
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	3	<0.1	0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	3	0.1	0.2	67	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	95	3	99	94	5	97	93

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	217051-6
Date extracted	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Date analysed	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
HCB	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	92	86
gamma-BHC	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	99	89
Heptachlor	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	100	95
delta-BHC	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	93	89
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	105	100
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	99	96
Dieldrin	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	110	106
Endrin	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	97	83
pp-DDD	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	103	78
Endosulfan II	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	102	99
Methoxychlor	mg/kg	0.1	Org-005	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	101	3	94	95	1	95	87

QUALITY CONTROL: Organophosphorus Pesticides						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	217051-6
Date extracted	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Date analysed	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	106	105
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	106	101
Dimethoate	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	102	112
Fenitrothion	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	102	99
Malathion	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	97	75
Parathion	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	99	96
Ronnel	mg/kg	0.1	Org-008	<0.1	3	<0.1	<0.1	0	103	100
Surrogate TCMX	%		Org-008	101	3	94	95	1	96	96

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	217051-6
Date extracted	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Date analysed	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	3	<0.1	<0.1	0	117	117
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	101	3	94	95	1	96	96

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	217051-6
Date prepared	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Date analysed	-			09/05/2019	3	09/05/2019	09/05/2019		09/05/2019	09/05/2019
Arsenic	mg/kg	4	Metals-020	<4	3	5	<4	22	87	105
Cadmium	mg/kg	0.4	Metals-020	<0.4	3	<0.4	<0.4	0	111	105
Chromium	mg/kg	1	Metals-020	<1	3	6	6	0	120	112
Copper	mg/kg	1	Metals-020	<1	3	11	17	43	108	108
Lead	mg/kg	1	Metals-020	<1	3	27	35	26	109	117
Mercury	mg/kg	0.1	Metals-021	<0.1	3	<0.1	<0.1	0	95	102
Nickel	mg/kg	1	Metals-020	<1	3	2	2	0	109	104
Zinc	mg/kg	1	Metals-020	<1	3	48	57	17	111	105

QUALITY CONTROL: sPOCAS + %S w/w					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			09/05/2019	[NT]	[NT]	[NT]	[NT]	09/05/2019	[NT]
Date analysed	-			09/05/2019	[NT]	[NT]	[NT]	[NT]	09/05/2019	[NT]
pH $_{kcl}$	pH units		Inorg-064	[NT]	[NT]	[NT]	[NT]	[NT]	90	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	105	[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]	101	[NT]
TPA pH 6.5	moles H^+ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	88	[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]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-064	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

QUALITY CONTROL: sPOCAS + %S w/w					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	[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.

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; 60-140% for organics (+/-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.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Asbestos: Excessive sample volume was provided for asbestos analysis.
A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicativeof the entire sample.
Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Sample 217051-3 was sub-sampled from a bag provided by the client.

APPENDIX E
LIMITATIONS

The findings of this Preliminary Acid Sulfate Soils Assessment PASSA are based on the scope of work as outlined in Section 4 noting the PASSA is limited in depth and laterally as defined herein. Canopy Enterprises Pty Ltd (Canopy) performed services in a manner consistent with industry standards.

Canopy's PASSA is strictly limited to Architecturals as attached in Appendix A (Site) and to the areas and depths as defined in Appendix B and Appendix C, respectively. The PASSA was undertaken with regard to the level of excavation works. The probability of Acid Sulfate Soils (ASS) on the subject site has been considered on the basis of the analysis results and relevant field observations and findings undertaken in conjunction with the PASSA. It is not however possible to identify with certainty the depth that ASS are actually present. This assessment should not be interpreted as a guarantee that ASS do not exist at other depths or locations outside of the sampling/analysis points. It should be noted that different conditions can be found to be present near sampling points or at depth or as a result of different groundwater levels or conditions which are by nature variable. This Report is limited to a PASSA and did not nor is it intended to address any contamination which may be present at the Site.

The sampling regime and analysis strategy was designed to achieve the Client's objective of executing the proposed works (PASSA) as defined in the Client's proposal.

The PASSA was undertaken with relevant consideration to NSW environmental guideline regime for the undertaking of a PASSA in particular the Acid Sulfate Soils Assessment Guidelines NSW- Acid Sulfate Soils Management Advisory Committee, August (1998). The sampling was undertaken with consideration and appropriate response considering the scale of the proposed works, observations and the relevant guidelines. The adopted sampling plan was intended to provide sufficient data to support the findings of the PASSA.

Canopy accepts no liability for use or interpretation by any person or entity other than reasonable use and reasonable interpretation by the Client or their representative who engaged the works or relevant third parties and that which relates directly to the intended purposes of the PASSA.

The results of the PASSA are based upon the visual inspection, field investigation analysis and information provided by the Client and other knowledgeable persons regarding the site or site conditions. The relevant guidelines and regulations have been interpreted with due diligence, competence and professionalism and in good faith. However, Canopy does not accept responsibility to the extent the law permits for consequences arising from differing interpretations by third parties or authorities.

This PASSA Report may only be used for the specific purposes for which it was commissioned in accordance with the terms of engagement. Canopy retains unfettered ownership of the PASSA Report until all payment obligations have been fulfilled. Canopy retains continuing ownership and associated rights in perpetuity in respect of permitting any use outside of the engagement herein and its intended purpose.

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The Conclusions and Recommendations must be read in conjunction with the full Report. The Report should not be reproduced in part or full without joint authorisation from the Client and Canopy unless related directly to its intended purposes, in which case all relevant acknowledgements should be included.