CONSULTING EARTH SCIENTISTS

ACID SULFATE SOILS INVESTIGATION REPORT

251 ADELAIDE STREET, RAYMOND TERRACE, NEW SOUTH WALES

PREPARED FOR RAYMOND TERRACE PARKLANDS

CES DOCUMENT REFERENCE: CES200502-PHB-AG

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LIST OF ABBREVIATIONS

ACM	Asbestos containing material
BTEX	Benzene, toluene, ethylbenzene, xylenes
COC	Chain of Custody
CES	Consulting Earth Scientists Pty Ltd
CSM	Conceptual Site Model
DO	Dissolved oxygen
DP	Deposited Plan
DQI	Data Quality Indicators
DoH	Department of Health
DQO	Data Quality Objectives
EC	Electrical conductivity
Eh	Redox potential
EPA	Environment Protection Authority
Ha	Hectares
LCS	Laboratory Control Sample
LEP	Local Environmental Plan
LGA	Local government area
m	Metre
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NSW	New South Wales
OCP	Organochlorine pesticides
OPP	Organophosphorus Pesticides

PAH	Polycyclic aromatic hydrocarbons
PCB	Poly-chlorinated biphenyls
PFAS	Per- and polyfluoroalkyl substances
PQL	Practical Quantitation Limit
PSP	Project Safety Plan
RPD	Relative percentage difference
SAQP	Sampling and Analysis Quality Plan
TRH	Total Recoverable Hydrocarbons
QA/QC	Quality Assurance and Quality Control

1 INTRODUCTION AND OBJECTIVES

1.1 INTRODUCTION

Consulting Earth Scientists Pty Ltd (CES) was commissioned by Raymond Terrace Parklands (the Client) to undertake an Acid Sulfate Soil Investigation for the former quarry and associated land at 251 Adelaide Street, Raymond Terrace[1].

The site is formally defined as Lot 232 in Deposited Plan (DP) 593512 (the Site) and covers an area of 443,600m^2 (44.36Ha) of which approximately 207,100m^2 (20.71Ha) is covered by a flooded former quarry void. The area of the site that is considered to be impacted directly by former quarrying activities is 700m^2 (0.7Ha). Refer to **Figure 1**, **Figure 2**, and **Figure 3** for a Site Locality Map, Site Layout Plan, and Soil Bore Location Plan, respectively.

The acid sulfate soils investigation was a requirement of the Planning Secretary's Environmental Assessment Requirements (SEARs) 1409:

- *An assessment in accordance with ASSMAC Guidelines for the presence and extent of acid sulfate soils (ASS) and potential acid sulfate soils (PASS) on the site and, where relevant, appropriate mitigation measures.*

CES notes that no development plans indicative of soil disturbance was provided by the Client. CES further notes that the NSW ASSMAC (1998) *Acid Sulfate Soils Assessment Guidelines* are only applicable when soil is to be disturbed. There are also no plans to reduce the groundwater level since the proposed development comprises backfilling of a former quarry void. Therefore, it is anticipated that the groundwater level will remain the same during construction and operation activities.

[1] This report does not include any work required for the development application for the proposed residential area, which is located to the north and west of the former quarry area and is understood to be part of a separate package of work.

It is also noted that the vast majority of the site is currently inundated and large portions of the site are not accessible. As a result, there are unknown Acid sulfate soils conditions across the site – however, given the proposed development, these areas of unknown status are not considered to represent a risk to the backfilling of the former quarry void. In the event that excavation works or dewatering works are proposed, then a more comprehensive acid sulfate soils assessment is recommended.

1.2 ACID SULFATE SOILS

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 of excavation may lead to the generation of sulfuric acid.

Acid Sulfate Soils (ASS) include Actual Acid Sulfate Soils (AASS) and Potential Acid Sulfate Soils (PASS). AASS and PASS are often found in the same soil profile, with AASS generally overlying PASS horizons.

AASS are soils containing highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in sulfide, primarily iron sulfides. This oxidation produces hydrogen ions in excess of the capacity of the soil to neutralise the acidity resulting in soils of pH of 4 or less. These soils can usually be identified by the presence of pale-yellow mottles and coatings of jarosite.

PASS 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 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.

Characteristics of ASS typically include:

- Sediments of recent geological age (Holocene) up to 10,000 years old.
- Formation in soil horizons at an elevation of less than 5m AHD.
- Formation in marine or estuarine sediments and tidal lakes.
- Formation in coastal wetlands or back swamp areas; waterlogged or scalded areas interdune swales or coastal sand dunes.
- Formation where the dominant vegetation is mangroves, reeds, rushes and other swamp tolerant and marine vegetation.
- They may be present in areas identified in geological descriptions or in maps bearing sulfide minerals, coal deposits or former marine shales/sediments.
- They may be present in deeper older estuarine sediments greater than 10m below the ground surface of Holocene or Pleistocene age.

- They possess visual and olfactory indicators such as sulfidic odours, bright yellow, yellow or straw-coloured mottling and pore space and fissure infill and coatings that could indicate the presence of jarosite, goethite or other similar acid producing sulfate minerals.
- They may be indicated by the presence of shells, organic matter and dark reddish streaks that would indicate the presence of iron oxides.
- They may be indicated by the presence of dark grey or black monosulfidic sediments or material showing the characteristics of fluvial bottom sediments or sediments deposited in a lacustrine environment.

2 SCOPE OF WORK

The following scope of work was adopted to assess for the presence or absence of acid sulfate soils:

- Prepare a Project Safety Plan (PSP);
- Carried out a site walkover assessment;
- Drilled 17 boreholes for a visual and olfactory screening using pushtube methods;
- Drilled five soil bores to be converted into groundwater monitoring wells using casing advancer or hollow auger methods;
- Logged and sampled the strata encountered during drilling works, including any observations of water inflows and encountered groundwater;
- Carried out approximately 10 field peroxide acid sulfate soils screening tests for the full depth of each borehole[2];
- Selected two soil samples which were submitted to a NATA accredited laboratory for Suspension Peroxide Oxidation – Combined Acidity and Sulfate (SPOCAS) analysis;
- Collect and submit five groundwater samples to a NATA accredited laboratory for Soluble Chloride and Soluble Sulfate analysis;
- Record groundwater parameters such as pH and electrical conductivity readings during groundwater sampling; and

[2] Noting field peroxide tests could were not carried out on soil bore MW1 which utilised casing advancer methods due to the basic nature of the bentonite drilling fluid which would cause erroneous results.

- Carried out a site walkover to record pH and electrical conductivity readings in all encountered surface water across the flooded former quarry void, Grahamstown Drain, and Windeyers Creek[3].

[3] CES notes no other ponded surface water was encountered on Site.

3 SITE IDENTIFICATION AND ENVIRONMENTAL SETTING

3.1 SITE IDENTIFICATION

The site, as it is referred to in this ESA, consists of 251 Adelaide Street, Raymond Terrace, legally described as Lot 232 of DP 593512. A site location plan is attached as **Figure 1**.

The area of the site is approximately 443,600m^2.

The site located within the local government area (LGA) of Port Stephens.

The approximate coordinates of the centre of the site are 382310.47 East 6372882.941 North (MGA 1994 Zone 56).

3.2 SITE DESCRIPTION

The Site is relatively flat rising slightly in the north-west corner. To access the Site, access is gained across a bridge that crosses the Grahamstown Drain from Adelaide Street. A flooded former quarry void is situated in the centre of the Site. Grahamstown Drain runs from the north of the site to the southwest where it joins Windeyers Creek that runs from east to west in the southern portion of the Site.

3.3 SITE ZONING

The Port Stephens Local Environmental Plan (LEP) 2013 indicates that the site is currently zoned "RU2 – Rural Landscape".

3.4 SITE ENVIRONMENTAL SETTING

Detailed information on the environmental setting of the site is presented in the previous environmental reports listed in Section 1 and should be referred to. A summary of the site setting is presented below.

A review of the Newcastle 1:100,000 Geological Series Sheet 9232 (edition 1) 1995, indicated that the site is likely to be underlain by unconsolidated quaternary alluvium (Qa).

A review of the Newcastle 1:100.000 Soil Landscapes of the Newcastle 1995, indicated that the site is likely to ne underlain by the following two units:

- Disturbed Terrain is related to land that has been extensively modified by anthropogenic activities and soils can be widely varied; and
- Bobs Farm Variant A is characterised by "*deep (100 - <150 cm), moderately well-drained Lutic Rudosols (Siliceous Sands). where thin sand veneers overlie estuarine sediments, deep (100 - <150 cm), poorly drained Sulphidic Redoxic Hydrosols (affinity Humic Gley Soils) occur.*" In addition, "*Acid Sulfate Soils are likely to be present at depth below the*

beach ridges and also at shallower depths where thin veneers of sand overlie estuarine deposits."

If present, acid sulfate soils are likely to be present in the Bobs Farm Variant A Group.

A subsurface profile of the Site is presented below in table 1.

Table 1 - Inferred Subsurface Model

Geotechnical Unit	Approximate Depth to Top of Unit (m)	Approximate Thickness (m)	Typical Description
Unit 1 – Fill	0.0	~0.0 – 3.7	Silty, clayey, SAND: fine to medium grained, medium plasticity, with gravels, organic material, some aggregate, no odours or staining, brown/grey Sandy CLAY: low plasticity, brown SAND: fine grained, beige
Unit 2 – Natural	0.0 – 3.7	Unknown	Silty, clayey, SAND: fine to medium grained, with organic material, some siltstone gravels, white/light brown/grey Silty, sandy CLAY: high plasticity, with organic material, dark grey CLAY: moderate plasticity, dark grey CLAY: medium plasticity, shale fragments and ironstone gravels, no odours or staining, grey/red/yellow/orange, dry

The Site is generally flat with no discernible slope. The site was a former quarry.

3.5 ACID SULFATE SOILS RISK MAP

The Beresfield 1:25,000 *Acid Sulfate Soils Risk Map* (Department of Land and Conservation, 1997) indicates that the majority portion of the Site is classified as High *Probability of occurrence of Acid Sulfate Soil in the soil profile, Ap1 (Alluvial, Plain, elevation between 1-2m). The environment of deposition has been suitable for the formation of acid sulfate soil materials. Acid sulfate soil materials are widespread or sporadic and may be buried by alluvium or windblown sediments.*

A copy of the Beresfield 1:25,000 *Acid Sulfate Soils Risk Map* is provided in **Appendix D**.

3.6 PORT STEPHENS LOCAL ENVIRONMENT PLAN

The Port Stephens *Acid Sulfate Soils Map ASS_002* (Port Stephens Local Environmental Plan 2013 [Amendment No 22]) denotes the Site is classified as Class 2 Land indicating *"A person must not, without development consent, carry out works below more than 1 metres below the natural ground surface and/or works likely to lower the water table."*

3.7 HYDROGEOLOGY

The relevant hydrogeology of the site consists of a shallow unconfined aquifer, which is likely to have a relatively high permeability due to the formation consisting of sands, silts, and clays. Previous investigations carried out by CES at the Site indicated that groundwater is likely to be approximately at surface (for the inundated quarry to 1.86m below ground level (across the remaining portion of the site, dependant on the topographical elevation) in the study area.

The shallow aquifer underlying the study area is expected to discharge to Grahamstown Drain and Windeyer's Creek which meet on the south-western portion of the site. Windeyer's Creek is a tributary of the Hunter River. Based on the previous investigation data, the shallow aquifer is flows from east to west.

3.8 AERIAL PHOTOGRAPH SUMMARY FOR INVESTIGATION AREA

In order to understand the likelihood and spatial extent of the potential and actual acid sulfate soils it is necessary to understand the topographical, hydrogeological and land use changes that may have occurred to the Investigation Area. As such the following historical aerials indicate changes in topography, hydrogeology, and land use due to development. Historical aerials are provided in **Appendix C**.

The Investigation Area, based on a review of historical aerial photography is described below:

- 1954 (Source: Lotsearch Historical Aerials, NSW Department of Customer Service): The Site consists of undeveloped land. Grahamstown Drain runs east to west across the northern and western portion of the Site. A swamp adjacent to Windeyer's Creek is located in the southern portion of the Site.
- 1966 (Source: Lotsearch Historical Aerials, NSW Department of Customer Service): Quarrying activities have begun in the central portion of the site and a small water body is observed on the western portion of the quarried area.
- 1976 (Source: Lotsearch Historical Aerials, NSW Department of Customer Service): Quarrying activities have extended towards the east of the Site. Haul roads have been developed across the Site and a processing area is located in northern central portion of the Site. Quarrying activity has begun in the north-western portion of the Site (not inclusive of

this investigation). The water body in the centre of the Site is now approximately a quarter of the size of the present day flooded former quarry void.

- 1984 (Source: Lotsearch Historical Aerials, NSW Department of Customer Service): Quarrying activities have continued and the flooded quarry void is now approximately half the size of the present day flooded former quarry void.
- 1993 (Source: Lotsearch Historical Aerials, NSW Department of Customer Service): Quarrying activities have extended further to the north-eastern and western portion of the Site. The water body in the centre of the Site is now approximately 65% of the present day flooded former quarry void.
- 2001 (Source: Lotsearch Historical Aerials, NSW Department of Customer Service): Quarrying activities have extended to the south-west portion of the site. The central water body is now approximately 75% of the present day flooded former quarry void.
- 2010 (Source: Lotsearch Historical Aerials, NSW Department of Customer Service): Quarrying activities have further extended to the north-east portion of the site. The processing area located on the centre of the Site has been subsequently quarried and is now located on the western portion of the Site. The central water body now occupies most of the site is approximately the same as present day.
- 2020 (Source: Lotsearch Historical Aerials, NSW Department of Customer Service): The processing area located on the western portion of the Site has been disbanded. The flooded former quarry void occupies most of the Site.

3.9 SURROUNDING LAND USE

Based on current information, the surrounding land use comprised the following:

- **North** – Residential properties;
- **East** – Bushland and Raymond Terrace Wastewater Treatment Works with the Pacific Highway beyond;
- **South** – Bushland and Windeyers Creek with the Pacific Highway and commercial industrial properties beyond; and
- **West** – Adelaide street with farmland beyond.

3.10 GEOLOGY

With reference to the Gosford – Lake Macquarie 1:100, 000 Geological Series Map (9131, 9231) the lithology underlying the Investigation Area is divided into two units:

- Qa, *Quaternary sediments, undifferentiated alluvial deposits; sand, silt, clay and gravel; some residual and colluvial deposits. Includes some channel, levee, lacustrine, floodplain and swamp deposits of the Cainozoic age.*

- "Rn" *Sandstone, interbedded sandstone and siltstone, claystone. conglomerate and sandstone (Widden Brook conglomerate) of the Narrabeen Group (Clifton Subgroup) of the Mesozoic age.*

If present acid, sulfate soils are likely to be present in the Quaternary sediments.

3.11 PREVIOUS ACID SULFATE REPORTS - PRELIMINARY GEOTECHNICAL INVESTIGATION (AARGUS 2020)

The Aargus (2020) preliminary geotechnical, although investigating an area directly north of the site, stated the following:

- Subsurface materials consisted of disturbed or reworked sandy soils, residual clay (at location BH4), and sandstone;
- There exists a pre-existing groundwater well in the south-west of the site;
- Five groundwater wells (GW1 to GW5) were installed to up to approximately 2.8m in depth on the site (to the north);
- Groundwater was encountered at depths between 1.6 and 1.92m during drilling works;
- Stabilised groundwater levels were measured at depths between 1.46 and 1.74m; and
- Analytical results reported there are no potential acid sulfate soils or acid sulfate soils on the site.

4 FIELDWORK

Drilling fieldwork was undertaken during August, September, and October 2020.

The surface water assessment was undertaken on 25 August 2020.

Groundwater sampling was undertaken on 29 October 2020.

A copy of Field Data Sheets and Calibration Certificates are provided in **Appendix B**.

4.1 SOIL SCREENING AND SAMPLING

17 boreholes were completed as part of the investigation works. Boreholes were advanced using hand auger and/or pushtube techniques to natural materials or refusal. 5 additional boreholes were advanced using casing advancer or hollow stem augers and converted into groundwater monitoring wells. Borehole logs are presented as **Appendix A**.

The log recorded the following data:

- Sample number and depth;
- Soil classification, colour, consistency or density, and moisture content;
- Depth of excavation;
- Drill rig refusal;
- Method of drilling; and
- The depth of first encountered free water.

Locations of boreholes are presented on **Figure 2**.

Representative soil samples were collected across the 5 soil bores to be converted into groundwater monitoring wells. A subsample of each sample collected was screened for acid sulfate soils in accordance with the *Acid Sulfate Soils Assessment Guidelines* (ASSMAC 1998) *Appendix 1 field peroxide test procedure*. Field data sheets for the field screening are presented as **Appendix B**. A calibrated pH meter was used for the field screening. The field screening data is also summarised in Table T1. Based on the field screening results, two samples (MW2/1.0 andMW3/3.0) were selected for SPOCAS analysis, based on the samples exhibiting strong indicators of acid sulfate soils.

Care was taken when collecting samples to ensure the most representative sample of the targeted material was sampled. The soil was then transferred to the sample bag using new nitrile gloves and efforts were made to minimise the air in the bag with the soil sample. Samples were double bagged and immediately placed in an ice cooled cool box for transport to the laboratory. At the end of each day the samples in the cool box were transported to the laboratory (within one day).

Samples were collected directly from the hand auger. All samples were collected with new disposable nitrile gloves.

While on site, the supervising engineer/scientist filled out a copy of CES "sample register", which documents:

- Time of sample collection;
- Weather; and
- Sample location and depth.

All samples were classified in the field based on soil/fill characteristics and obvious signs of ASS such as sulfidic odour or other olfactory evidence of ASS noted on a log. All samples were transported to the laboratory under Chain-of Custody procedures and maintained in an ice-filled cooler. The COC forms detail the following information:

- Site identification;
- The sampler's name;
- Nature of the sample;
- Collection time and date;
- Analyses to be performed;
- Sample preservation method;
- Departure time from site; and
- Dispatch courier(s).

4.2 GROUNDWATER AND SURFACE WATER SAMPLING AND ASSESSMENT

Surface water pH and electrical conductivity assessment was undertaken on 25 August 2020. The assessment consisted of the assessment of the pH and electrical conductivity of all water bodies encountered in the Investigation Area. Recordings were made using a calibrated water quality meter. Field data sheets for the recordings and the water quality meter are presented in **Appendix B**. Surface Water and Groundwater screening results are provided in Table T3. In addition, Groundwater Monitoring Levels are provided in Table T4.

Five groundwater samples were collected from the groundwater monitoring wells circling the flooded former quarry void. The collected water samples were submitted for TRH, PAH, dissolved heavy metals, pH, total organic carbon, soluble chloride, and soluble sulfate4. Sample handling was undertaken similarly to soil samples (as detailed above) with samples collected in appropriately preserved laboratory prepared sample containers suitable for the targeted analytes.

[4] Noting that only soluble chloride, soluble sulfate, and pH have been included in Table T5.

5 ASSESSMENT CRITERIA

The following assessment criteria were selected for comparison with the laboratory analytical results as a screening assessment.

5.1 ACID SULFATE SOILS

For the assessment of field screening for acid sulfate soils, the following criteria are considered to be indicators of acid sulfate soils:

- Initial pH of less than 4;
- Final pH of less than 3 following addition of hydrogen peroxide;
- Vigorous or volcanic reaction following addition of hydrogen peroxide; and
- A drop in pH from the initial pH following addition of hydrogen peroxide.

For assessment of the acid sulfate soils SPOCAS analysis the action criteria published in the NSW ASSMAC (1998) *Acid Sulfate Soils Assessment Guidelines* is dependent on the amount of tonnes disturbed. Although there are no current plans for the disturbance of any soils for the proposed industrial/commercial development, it is prudent to compare the SPOCAS results to the disturbance of 1-1,000 tonnes of soil.

Therefore, for assessment of the acid sulfate soils SPOCAS analysis the action criteria published in the NSW ASSMAC (1998) *Acid Sulfate Soils Assessment Guidelines* for disturbance of 1-1,000 tonnes of soil was selected. Relevant action criteria are presented with the laboratory results in Table T2.

5.2 WATER INVESTIGATION CRITERIA

For assessment of quality a combination of the ANZECC (2000) *Australia and New Zealand Guidelines for Fresh and Marine Water Quality* trigger values for 95% protection of marine ecosystems and default trigger values for physical and chemical stressors for south-eastern Australia, slightly disturbed ecosystems (estuaries). Screening criteria are presented in Table T5.

6 DISCUSSION AND RECOMMENDATIONS

Laboratory Certificates are provided in **Appendix E**.

6.1 SOILS

The soil bore logs did not indicate any odours or colours (bright yellow to yellow streaks) or physical evidence (such as shells, organic matter or dark grey or black monosulfidic sediments) that are commonly associated with acid sulfate soils.

Soil pH readings indicated that soil across the Investigation Area were acidic to basic with pH (1: 5 deionised water) readings as low as 4.50 and as high as 8.34 detected. Following the addition of hydrogen peroxide, pH readings as low as 3.60 were detected and a maximum post hydrogen peroxide pH of 7.41 was detected. The maximum pH change following the addition of hydrogen peroxide of 2.43 was detected.

Low reactions with no visible effervescence to slight to moderate effervescence were recorded as having occurred following the addition of hydrogen peroxide to a number of soils.

Acidic soils with pH of less than 4 with vigorous and exothermic reactions following addition of the hydrogen peroxide and a pH change of greater that 1 pH unit between the initial pH and the pH following the addition of hydrogen peroxide are indicators of the presence of acid sulfate soils. Acidic soils with pH of less than 3 following addition of hydrogen peroxide and a pH change of greater than 1 are indicators of potential acid sulfate soils.

No field pH readings were reported with a pH less than 4 and no pH readings following addition of hydrogen peroxide with a pH less than 3 were reported. Therefore, no actual acid sulfate soils and no potential acid sulfate soils were detected in the field screening.

SPOCAS laboratory analysis detected TAA and TPA in excess of the action criteria in sample MW3/3.0. The detection of S_{POS} (0.03% w/w) was equal to the action criteria in sample MW3/3.0. This indicates low level of potential sulfur within sample MW3/3.0. The sample which detected exceedances of the TAA and TPA action criteria were detected in the shallow soils located below the standing water level.

The results of field observations, field screening and pH analysis indicate no acid sulfate or acidic soils on Site. The laboratory analysis indicates that the site does contain acidic soils. However, S_{POS} results equal to the action criteria indicate the source of the acidity is likely not from sulfidic ores and/or materials and is more likely from organics and/or other minerals.

As noted in the Introduction, acid sulfate soils are an issue when the soil is disturbed (i.e. excavated allowing oxidation of the sulphidic minerals within the soil, or the groundwater level is reduced. Given that the proposed development comprises the backfilling of a former quarry void, the

groundwater level should not be altered. In addition, as noted above there is no physical or chemical evidence for the presence of acid sulfate soils.

6.2 WATER

The current groundwater levels in the Investigation Area present conditions which are unlikely to be suitable for the oxidation of potential acid sulfate soils (PASS) to form actual acid sulfate soils (AASS), as the soils are saturated, therefore if potential acid sulfate soils remain onsite, it is unlikely that further oxidation to form acid will occur.

pH and EC readings from surface water and groundwater monitoring wells at the site indicated that no acid formed in the soils has been mobilised and is causing significant acidification (pH<5.0) with the potential exception of MW5 (pH = 3.65). However, MW5 is located on the hydraulically up-gradient eastern boundary of the site with no down-gradient surface water readings registering pH levels below 5.0. The pH reading taken in down gradient surface water of Windeyer's Creek (sample SW13) was 6.81, indicating that any acid generated is not causing significant impact to the receiving water body. This indicates that it is unlikely that any acid formed in the soils is having a detrimental effect on water quality in the down-gradient receptor. Therefore any acid generated is unlikely to present an unacceptable risk to offsite receptors.

6.3 POTENTIAL IMPACTS

It is understood by CES that there are no plans for the disturbance of any soils during the proposed backfilling of the former quarry void, therefore there is no risk of disturbance of acid sulfate soils.

As discussed in Section 6.1, based on the results of the fieldwork, although there are acidic soils (NB. The acidic soils were only identified through laboratory analysis, but there was no physical evidence or field screening evidence) on site, it is unlikely that the acidic soils present on the site are acid sulfate soils.

With respect to groundwater and surface water investigated, the following should be noted:

- Acidified groundwater (pH<6.5) was identified during the investigation in the groundwater monitoring wells. pH was observed to return to neutral conditions in all the surface water locations (down-gradient location SW13). Therefore, the acidic conditions are being naturally ameliorated and there is no risk to down-gradient receptors.

Based on the above the acidified groundwater and surface water are considered to present a low risk to the environment through migration or discharge.

Based on the investigation, it is unlikely that conditions with respect to acid generation will deteriorate in the Site.

6.4 RECOMMENDATIONS

Recommendations for further work are:

- If any future development requires the disturbance of natural soils, further acid sulfate sampling compliant to the sampling density set out in NSW ASSMAC (1998) should be undertaken;
- If any future development proposals require a lowering of the groundwater level, further acid sulfate soil assessment and groundwater/surface water monitoring should be undertaken to ensure the water quality parameters are compliant with NSW ASSMAC (1998).

7 LIMITATIONS OF THIS REPORT

This report has been prepared for use by the client who commissioned the works in accordance with the project brief and based on information provided by the client. The advice contained in this report relates only to the current project and all results, conclusions and recommendations should be reviewed by a competent person with experience in geotechnical and environmental investigations before being used for any other purpose. CES accepts no liability for use or interpretation by any person or body other than the client. This report must not be reproduced except in full and must not be amended in any way without prior approval by the client and CES.

This report does not provide a complete assessment of the environmental status of the site and is limited to the scope defined therein. It is noted that areas of the site could not be investigated due to the presence of structures including the residential property and presence of ponds. Should information become available regarding conditions at the site including previously unknown sources of contamination, CES reserves the right to review the report in the context of the additional information.

8 REFERENCES

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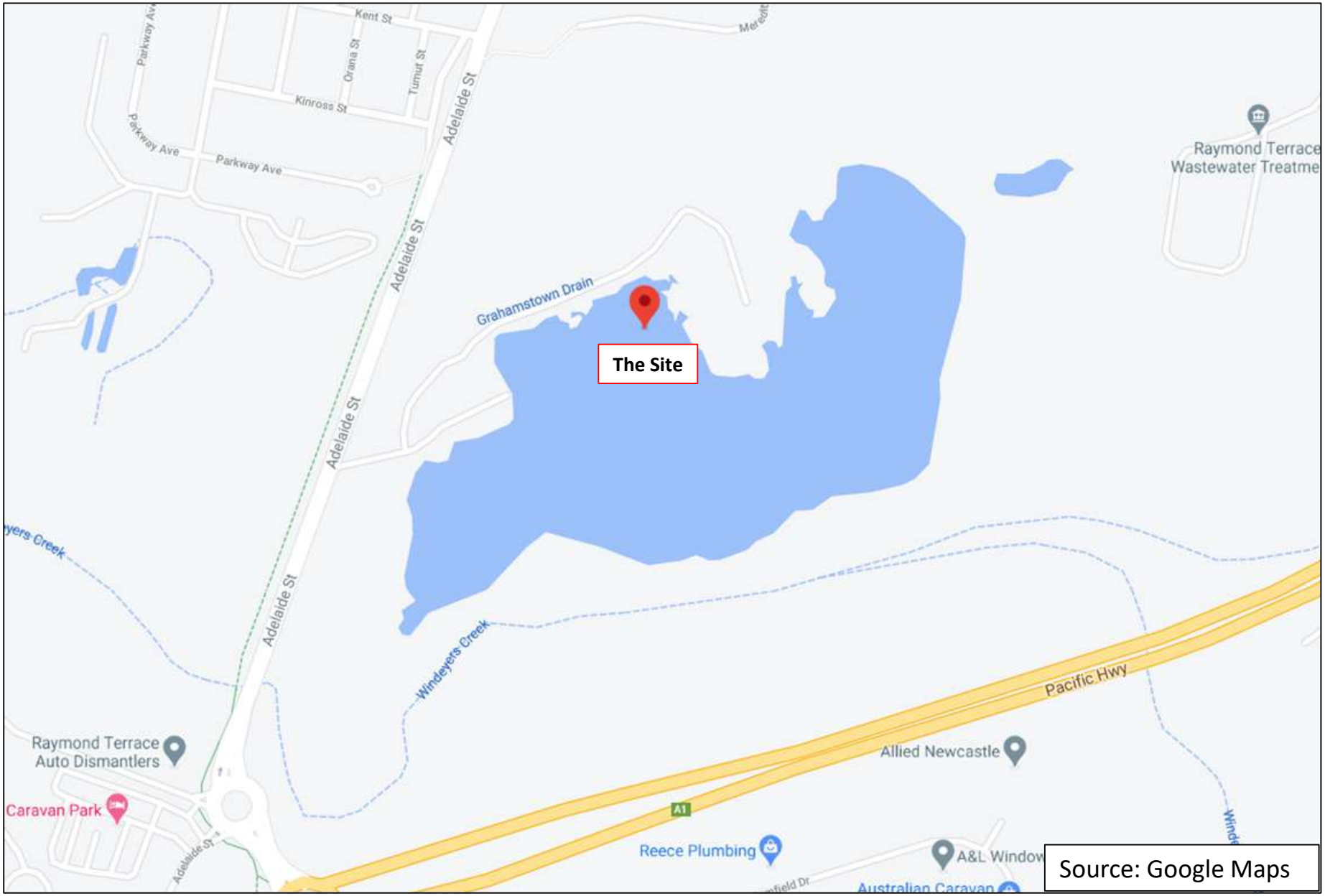
Figures



Source: Google Maps

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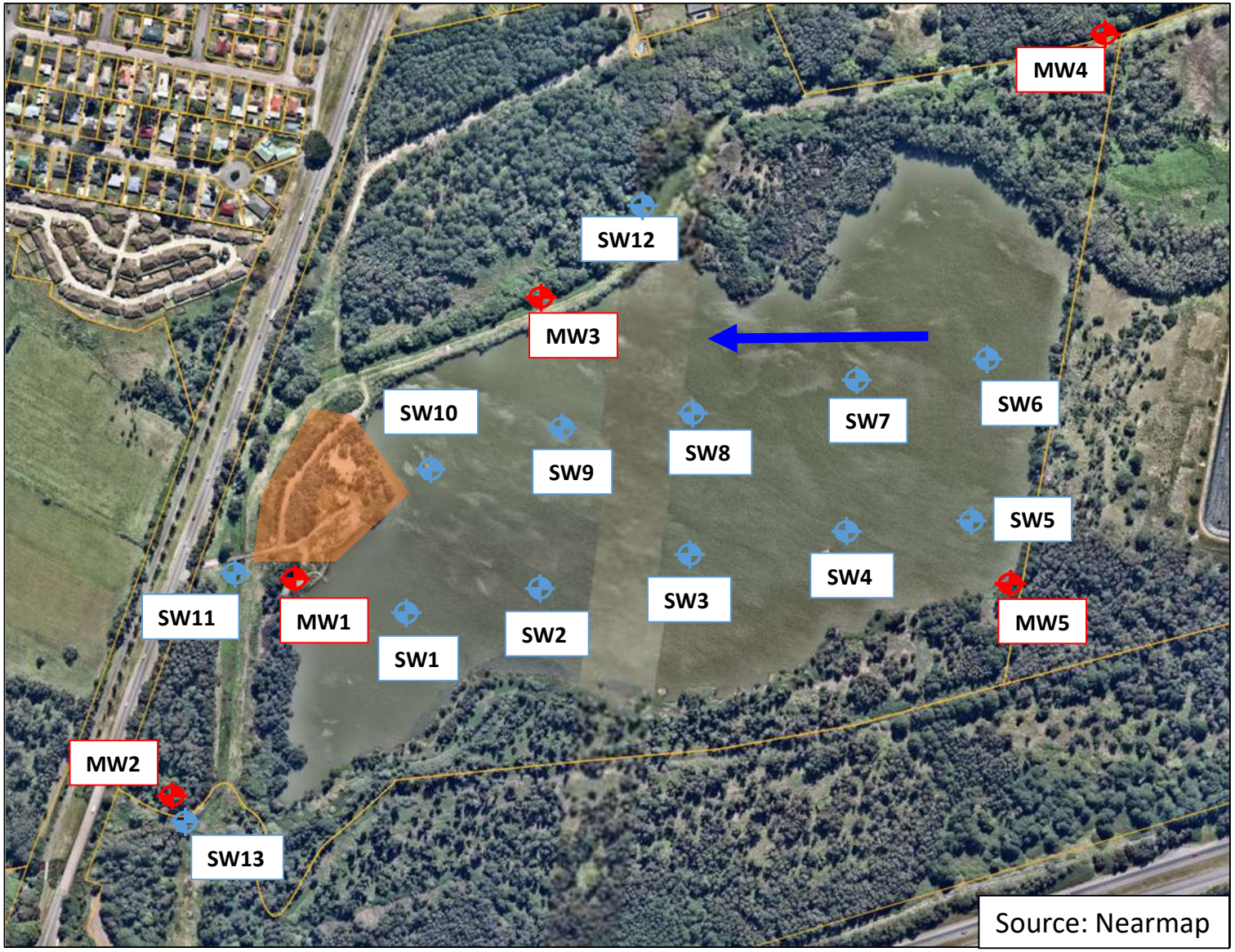
Figure 1: Site Locality Map

CES Project ID: CES200502-PHB	Date: 15/07/20
Prepared by: A.Carras	Checked by: M.Challoner



Soil Bore Investigation Area

Surface Water Monitoring Location

Monitoring Well (Water Balance and Groundwater Quality

Inferred Groundwater Flow

CONSULTING EARTH SCIENTISTS

Suite 3, Level 1
55 Grandview Street, Pymble, NSW, 2073
ph 9569 2269 fax 9983 6582

Figure 2: Site Layout Plan

CES Project ID: CES200502-PHB	Date: 15/07/20
Prepared by: A.Carras	Checked by: M.Challoner

Soil Bore Location

CONSULTING EARTH SCIENTISTS

Figure 3: Soil Bore Location Plan

CES Project ID: CES200502-PHB	Date: 15/07/20
Prepared by: A.Carras	Checked by: M.Challoner

Tables

Table T1: Acid Sulfate Soils Field Screening

Client: ***Pheonix Builders*** | Date: ***27/03/2018 to 04/04/2018***

Principal: ***M. Challoner*** | Test: ***pH_f and pH_{fox}***

Project: ***CES200502-PHB*** | Tested By: ***AC***

Location: ***251 Adelaide Street, Raymond Terrace NSW*** | Checked By: ***MC***

Sample Location	Depth (m)	Soil Description	$_pH_F$ pH in 1:5 distilled water	$_pH_{FOX}$ (oxidation in 30% hydrogen peroxide)							
				time (Mins)	pH FOX	Effervescence (see note below)	Odour	Colour change during reaction	$_pH$ Change (ie $_pH_F$-$_pH_{FOX}$)	Additional comments	Submitted to Laboratory for SPOCAS
MW1	0.10	See Borelog	5.62	10.00	5.31	a(L)	None	No	0.31	-	-
MW1	1.00	See Borelog	5.62	10.00	5.29	a(L)	None	No	0.33	-	-
MW2	0.10	See Borelog	6.03	10.00	4.40	b(L)	None	No	1.63	-	-
MW2	0.50	See Borelog	6.11	10.00	4.31	a(L)	None	No	1.80	-	Yes
MW2	1.00	See Borelog	5.13	10.00	3.60	a(L)	None	No	1.53	-	-
MW2	3.00	See Borelog	4.50	10.00	4.10	a(L)	None	No	0.40	-	-
MW2	5.00	See Borelog	5.73	10.00	5.01	a(L)	None	No	0.72	-	-
MW2	7.00	See Borelog	6.07	10.00	4.11	a(L)	None	No	1.96	-	-
MW2	9.00	See Borelog	6.67	10.00	6.11	a(L)	None	No	0.56	-	-
MW2	11.00	See Borelog	7.30	10.00	5.91	a(L)	None	No	1.39	-	-
MW2	13.00	See Borelog	7.45	10.00	6.35	a(L)	None	No	1.10	-	-
MW2	15.00	See Borelog	7.92	10.00	6.50	a(L)	None	No	1.42	-	-
MW2	17.00	See Borelog	7.43	10.00	7.41	a(L)	None	No	0.02	-	-
MW3	0.10	See Borelog	8.24	10.00	6.69	a(L)	None	No	1.55	-	-
MW3	1.00	See Borelog	8.33	10.00	6.32	a(L)	None	No	2.01	-	-
MW3	3.00	See Borelog	8.34	10.00	5.91	b(L)	None	No	2.43	-	Yes
MW3	5.00	See Borelog	5.89	10.00	4.93	a(L)	None	No	0.96	-	-
MW3	7.00	See Borelog	5.86	10.00	4.61	a(L)	None	No	1.25	-	-
MW3	9.00	See Borelog	6.10	10.00	5.51	a(L)	None	No	0.59	-	-
MW3	11.00	See Borelog	6.35	10.00	6.11	a(L)	None	No	0.24	-	-
MW3	13.00	See Borelog	6.36	10.00	6.02	a(L)	None	No	0.34	-	-
MW4	0.10	See Borelog	6.30	10.00	5.90	a(L)	None	No	0.40	-	-
MW4	1.00	See Borelog	5.8	10.00	5.2	a(L)	None	No	0.60	-	-
MW4	3.00	See Borelog	6.2	10.00	5.9	a(L)	None	No	0.30	-	-
MW4	6.00	See Borelog	6.4	10.00	5.8	a(L)	None	No	0.60	-	-
MW4	9.00	See Borelog	6.1	10.00	4.9	a(L)	None	No	1.20	-	-
MW4	12.00	See Borelog	6	10.00	5.00	a(L)	None	No	1.00	-	-
MW4	13.50	See Borelog	6.10	10.00	5.90	a(L)	None	No	0.20	-	-
MW5	0.10	See Borelog	6.90	10.00	5.90	a(L)	None	No	1.00	-	-
MW5	1.00	See Borelog	7.10	10.00	6.40	a(L)	None	No	0.70	-	-
MW5	3.00	See Borelog	6.30	10.00	5.10	a(L)	None	No	1.20	-	-
MW5	6.00	See Borelog	5.90	10.00	4.90	a(L)	None	No	1.00	-	-
MW5	9.00	See Borelog	6.40	10.00	5.90	a(L)	None	No	0.50	-	-
MW5	12.00	See Borelog	6.20	10.00	4.90	a(L)	None	No	1.30	-	-
MW5	15.00	See Borelog	6.40	10.00	5.20	a(L)	None	No	1.20	-	-
MW5	18.00	See Borelog	6.30	10.00	5.90	a(L)	None	No	0.40	-	-
MW5	20.00	See Borelog	6.5	10.00	5.90	a(L)	None	No	0.60	-	-

NOTES: 1. Observed Reaction: a. No visible effervescence b. Slight to moderate effervescence c. Vigorous effervescent reaction

NOTES: 2. Observed Reaction (as per WA DER Guidelines): (L) Low Reaction (M) Medium Reaction (H) High Reaction (X) Extreme Reaction (V) Volcanic Reaction

Table T2: Laboratory SPOCAS Results Summary

Reference	Sample	Depth	Date Sampled	Texture	pH kcl	TAA pH 6.5	s-TAA pH 6.5	pH Ox	TPA pH 6.5	s-TPA pH 6.5	TSA pH 6.5	s-TSA pH 6.5	ANCE	a-ANCE	s-ANCE	SKCl	SP	SPOS	a-SPOS	CaKCl
Units					pH units	moles H+/t	%w/w S	pH units	moles H+/t	%w/w S	moles H+/t	%w/w S	% CaCO3	moles H+/t	%w/w S	%w/w S	%w/w	%w/w	moles H+/t	%w/w
PQL						5	0.01		5	0.01	5	0.01	0.05	5	0.05	0.005	0.005	0.005	5	0.005
250828	MW2/1.0	1.0	07/08/2020	Medium	4.1	22	0.03	4.2	31	0.05	9	0.02	NA	NA	NA	0.009	0.02	0.009	5	0.005
250828	MW3/3.0	3.0	08/09/2020	Coarse	4.3	**30**	0.05	3.7	**100**	0.16	**70**	0.11	NA	NA	NA	0.02	0.04	0.03	17	0.1
Action Criteria (Coarse Texture/Meidum Texture)						**18/36**			**18/36**		**18/36**							**0.03/0.06**		

BOLD Exceedance of Action Criteria

Note: Action criteria based on 1-1000 tonnes disturbed material

Table T2: Laboratory SPOCAS Results Summary

Reference	Sample	Depth	Date Sampled	Texture	CaP	CaA	MgKCl	MgP	MgA	SHCl	SNAS	a-SNAS	s-SNAS	Fineness Factor	a-Net Acidity	s-Net Acidity	Liming rate	s-Net Acidity without - ANCE	a-Net Acidity without ANCE	Liming rate without ANCE
Units					%w/w	%w/w	%w/w	%w/w	%w/w	%w/w S	%w/w S	moles H+/t	%w/w S	-	moles H+/t	%w/w S	kg CaCO3/t	%w/w S	moles H+/t	kg CaCO3/t
PQL					0.005	0.005	0.005	0.005	0.005	0.005	0.005	5	0.01	1.5	5	0.01	0.75	0.01	5	0.75
250828	MW2/1.0	1.0	07/08/2020	Medium	0.007	<0.005	<0.005	0.011	0.01	0.019	0.01	<5	<0.01	1.5	32	0.05	2.4	0.051	32	2.4
250828	MW3/3.0	3.0	08/09/2020	Coarse	0.11	0.01	0.04	0.049	0.009	0.023	0.006	<5	<0.01	1.5	**50**	**0.08**	3.8	0.081	50	3.8
Action Criteria (Coarse Texture/Meidum Texture)															**18/36**	**0.03/0.06**				

BOLD Exceedance of Action Criteria

Note: Action criteria based on 1-1000 tonnes disturbed material

Table T3: Surface Water and Groundwater Screening Results			
Location	EC mS/cm	pH	Notes
SW1	368.1	7.79	Cross-gradient
SW2	366.3	7.75	Cross-gradient
SW3	363.8	7.66	Cross-gradient
SW4	363	7.63	Cross-gradient
SW5	362.9	7.62	Cross-gradient
SW6	363.2	7.69	Cross-gradient
SW7	363.4	7.6	Cross-gradient
SW8	363.2	7.64	Cross-gradient
SW9	363.1	7.63	Cross-gradient
SW10	365.8	7.54	Cross-gradient
SW11	488	7	Up-gradient
SW12	485.1	6.77	Down-gradient
SW13	509	6.81	Down-gradient
MW1	2169	6.38	Down-gradient
MW2	1739	6.05	Down-gradient
MW3	607	5.46	Cross-gradient
MW4	980	5.52	Up-gradient
MW5	5401	3.65	Up-gradient

Table T4: Groundwater Monitoring Well Water Levels (29 October 2020)

Location	SWL (m BTOC)	Stickup (m agl)	SWL (m bgl)
MW1	2.46	0.6	1.86
MW2	0.21	0.96	-0.75
MW3	2.3	0.85	1.45
MW4	0.35	0.63	-0.28
MW5	1.15	0.63	0.52

Table T5: Laboratory Water Quality Analysis Results								
	Laboratory Report ID		254589-A	254589-A	254589-A	254589-A	254589-A	Adopted Screening Criteria*
	Sample ID		MW1	MW2	MW3	MW4	MW5	
	Sample Location		Down Gradient	Down Gradient	Cross Gradient	Up Gradient	Up Gradient	
	Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020	
Analyte	Units	PQL						
Chloride, Cl	mg/L	1	270	320	86	220	740	-
Sulfate, SO4	mg/L	0.1	290	<1	65	67	2700	-
Cl:SO4	-	-	0.9	640	1.3	3.3	0.3	-
Bold	Exceedance of Adopted Screening Criteria							

* Adopted Screening Criteria based on the lower of marine GILs ASC NEPM (NEPC, 2013) or the default trigger values for physical and chemical stressors for south-eastern Australia, slightly disturbed ecosystems (estuaries) ANZECC (2000) .

Appendix A – Borehole Logs

GROUNDWATER WELL MW1

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 07/09/20
DRILLIN COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Casing Advancer
TOTAL DEPTH 19

COORDINATES -32.776776, 151.740395
COORD SYS Latitude/Longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

Depth (m)	Samples	Water	Graphic Log	Moisture	Material Description	pH	pH Fox	Well Diagram (0.60m Stickup) MW1	Additional Observations
0				D	FILL: Sandy CLAY: fine grained, brown	5.62	5.31	Grout	
1	MW2/1.0			M	Clayey SAND: fine to medium grained, with organic material, light brown/grey	5.65	5.29	Bentonite	
2									
3		▽		W	Sandy CLAY: high plasticity, dark grey with white fine grained sand				
4					Clayey SAND: fine to medium grained, white with grey clays				
5									
6									
7									
8									
9									
10								Filter Pack	
11									
12									
13									
14									
15									
16									
17									
18									
19					Termination Depth at: 19m			Borehole Collapse	

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

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GROUNDWATER WELL MW2

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 07/09/20
DRILLIN COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Hollow Flight Augers
TOTAL DEPTH 19

COORDINATES -32.778581, 151.739263
COORD SYS Latitude/Longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

Depth (m)	Samples	Water	Graphic Log	Moisture	Material Description	pH	pH FOX	Well Diagram (0.96m Stickup) MW2	Additional Observations
0				D	FILL: Sandy CLAY: moderate plasticity, with silt, foregin materials include aggregate and ceramic tiles, dark brown/grey	6.03	4.40	Grout	
1	MW1/1.0					6.11	4.31		
						5.13	3.60		
2				H					
3		▽		M	Clayey SAND: fine to medium grained, white/grey	4.50	4.10	Bentonite	
				W					
4									
5						5.73	5.01		
6									
7						6.07	4.11		
8									
9						6.67	6.11		
10									
11						7.30	5.91	Filter Pack	
12									
13						7.45	6.35		
14									
15						7.92	6.50		
16					Clayey SAND: fine to medium grained, brown				
17						7.43	7.41		
18									
19					Termination Depth at: 19m			Borehole collapse	

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produced by ESlog.ESdat.net on 17 Nov 2020

GROUNDWATER WELL MW3

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLIN COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Hollow Flight Auger
TOTAL DEPTH 19

COORDINATES -32.774930, 151.741825
COORD SYS Latitude/Longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

Depth (m)	Samples	Water	Graphic Log	Moisture	Material Description	pH	pH FOX	Well Diagram (0.85m Stickup) MW3	Additional Observations
0				D	FILL: Silty Sandy CLAY: moderate plasticity, with some gravels, organic material, dark brown	8.24	6.69	Grout	
1						8.33	6.32	Bentonite	
2				H					
3	MW3/3.0	▽		M W		8.34	5.91		
4					Clayey SAND: fine to medium grained, white sand with dark grey clay				
5						5.89	4.93		
6									
7						5.86	4.61		
8								Filter Pack	
9						6.10	5.51		
10					increasing clay content				
11						6.35	6.11		
12									
13						6.36	6.02		
14								Borehole collapse	
15					Termination Depth at: 15m Refusal on inferred bedrock				
16									
17									
18									
19									

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

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GROUNDWATER WELL MW4

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 23/10/20
DRILLIN COMPANY STRATACORE
DRILLER Mike
DRILLING METHOD Hollow Flight Auger
TOTAL DEPTH 13.5

COORDINATES -32.772527, 151.748027
COORD SYS Latitude/Longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

Depth (m)	Samples	Water	Graphic Log	Moisture	Material Description	pH	pH FOX	Well Diagram (0.63m Stickup) MW4	Additional Observations
0		▽		H	FILL: Silty SAND: fine grained, with organic material, brown	6.3	5.9	Bentonite	
1	MW4/1.0			M	Silty Sandy CLAY: high plasticity, white sand with dark grey clays and silts	5.8	5.2		
2				W					
3						6.2	5.9		
4									
5									
6						6.4	5.8	Filter Pack	
7									
8									
9						6.1	4.9		
10									
11									
12						6.0	5.0	Borehole collapse	
13						6.4	5.9		
14					Termination Depth at: 13.5m Refusal on inferred bedrock				

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GROUNDWATER WELL MW5

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 22/10/20
DRILLIN COMPANY STRATACORE
DRILLER Mike
DRILLING METHOD Hollow Flight Auger
TOTAL DEPTH 20

COORDINATES -32.776781, 151.747116
COORD SYS Latitude/Longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

Depth (m)	Samples	Water	Graphic Log	Moisture	Material Description	pH	pH FOX	Well Diagram (0.63m Stickup) MW5	Additional Observations
0	MW5/0.5			D	Sandy CLAY: high plasticity, with organic detritus, grey/brown	6.9	5.9	Bentonite	
1		▽		H		7.1	6.4		
2				M	Clayey Sandy: fine to medium grained, with silt and minor quartz gravels, white sand with grey clay				
3				W		6.3	5.1		
4									
5					Light grey with lower clay content				
6						5.9	4.9		
7								Filter Pack	
8									
9						6.4	5.9		
10									
11					Brown				
12						6.2	4.9		
13									
14									
15						6.3	5.2		
16									
17								Borehole collapse	
18						6.3	5.9		
19									
20					Termination Depth at: 20m Initial well installation attempt failed.	6.5	5.9		

ENVIRONMENTAL BOREHOLE SB01

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 01/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 4.8

COORDINATES -32.776784, 151.740492
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
0	0.0			FILL: Silty SAND: fine to medium grained, with clay, foreign materials include aggregate, tiles, and ceramic pieces, brown	M	No staining or odours
0.5	0.1					
1	0.1					
1.5	0.1					
				FILL: Silty SAND: fine to medium grained, with clay, foreign materials include ceramic pieces, brown	M	
2	0.5	SB1/2.0		Increasing sand content		
2.5	0.2			Clayey SAND: fine to medium grained, with silt, grey	W	No staining or odours
3	0.7					
3.5						
4						
4.5						
				Termination Depth at:3.2 m		

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ENVIRONMENTAL BOREHOLE SB02

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 01/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 3.6

COORDINATES -32.776660, 151.740597
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
0	0.7			FILL: Silty SAND: fine to medium grained, with clay, foreign materials include aggregate, brown/grey	D	No staining or odours
0.5	0.4	SB2/0.5			M	
1	0.7			Increasing sand content		
1.5	0.6					
2	0.5					
2.5	1.3			Silty SAND: medium to coarse grained, with siltstone gravels, brown	W	No staining or odours
3	1.2					No staining, slight organic odour
3.5						
4				Termination Depth at:3.6 m		
4.5						

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ENVIRONMENTAL BOREHOLE SB03

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 01/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 3.6

COORDINATES -32.776529, 151.740316
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
0	0.1			FILL: Silty SAND: fine to medium grained, with clay, foreign materials include aggregate, brown/grey	D	No staining or odours
0.5	0.5	SB3/0.5				
1	0.4			CLAY: moderate plasticity, grey	M	No staining, slight organic odour
1.5	0.6			Clayey SAND: medium to coarse grained, white/grey	W	No staining or odours
2	0.9			Grey		
2.5	0.7			Increasing clay content		
3						
3.5						
4				Termination Depth at:3.6 m		
4.5						

ENVIRONMENTAL BOREHOLE SB04

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 01/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 3.6

COORDINATES -32.776383, 151.740509
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
0.5	0.6 0.4			FILL: Silty SAND: fine to medium grained, with clay and cobbles, foreign materials include aggregate, brown/grey	D	No staining or odours
1	0.7	SB4/1.0		CLAY: moderate plasticity, grey	M	No staining or odours
1.5	0.2					
2	0.9			Clayey SAND: fine to medium grained, grey	W	No staining or odours
2.5	0.7					
3						
3.5						
4				Termination Depth at:3.6 m		
4.5						

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ENVIRONMENTAL BOREHOLE SB05

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 01/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 3.6

COORDINATES -32.776411, 151.740816
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
0	0.5			FILL: Silty SAND: fine to medium grained, with clay, foreign materials include aggregate, brown/grey	D	No staining or odours
0.5	0.7	SB5/0.5				
1	0.9			CLAY: moderate plasticity, grey	M	No staining or odours
1.5	3.1			Clayey SAND: medium to coarse grained, grey	W	No staining or odours
2	0.7					
2.5	0.6					
3						
3.5						
				Termination Depth at:3.6 m		
4						
4.5						

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ENVIRONMENTAL BOREHOLE SB06

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 01/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 3.6

COORDINATES -32.776317, 151.740721
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
0	0.5	SB6/0.1		FILL: Silty SAND: fine to medium grained, with clay, foreign materials include aggregate, light brown	D	No staining or odours
0.5	0.9			dark brown		
1	0.3				M	No staining or odours
1.5	1.0			Clayey SAND: medium to coarse grained, grey	W	No staining or odours
2	0.7					
2.5	0.8					
3						
3.5				Termination Depth at:3.6 m		
4						
4.5						

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ENVIRONMENTAL BOREHOLE SB07

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 0.8

COORDINATES -32.775851, 151.740965
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.6	SB7/0.1		Clayey SAND: fine to medium grained, with siltstone gravels, brown	D	No staining or odours
	0.9					No staining or odours
0.5						
				Termination Depth at: 0.8 m		

ENVIRONMENTAL BOREHOLE SB08

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 0.8

COORDINATES -32.775824, 151.740829
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.3	SB8/0.1		Clayey SAND: fine to medium grained, brown	D	No staining or odours
	0.8					No staining or odours
0.5						
				Termination Depth at: 0.8 m		

ENVIRONMENTAL BOREHOLE SB09

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 0.6

COORDINATES -32.775728, 151.740605
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.2	SB9/0.1		FILL: Silty Gravelly SAND: fine to medium grained, brown/red	D	No staining or odours
0.5	0.6			Clayey SAND: fine to medium grained, beige/grey	D	No staining or odours
				Termination Depth at: 0.6 m		

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ENVIRONMENTAL BOREHOLE SB10

PROJECT NUMBER CES200502-PHB	**DRILLING DATE** 08/09/20	**COORDINATES** -32.775828, 151.740504
PROJECT NAME Raymond Terrace	**DRILLING COMPANY** NUMAC	**COORD SYS** Latitude, longtitude
CLIENT Phoenix Builders	**DRILLER** Lewis	
ADDRESS 251 Adelaide Street, Raymond Terrace NSW	**DRILLING METHOD** Push Tube	**LOGGED BY** Andrew Carras
	TOTAL DEPTH 0.2	**CHECKED BY** Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.1	SB10/0.1		FILL: Silty Gravelly SAND: fine to medium grained, foregin materials include concrete and tiles, brown/red	D	No staining or odours
0.5				Termination Depth at: 0.2 m Refusal on concrete aggregate		

ENVIRONMENTAL BOREHOLE SB11

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 0.2

COORDINATES -32.776076, 151.740318
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.1	SB11/0.1		FILL: Silty Gravelly SAND: fine to medium grained, foregin materials include concrete and tiles, brown/red	D	No staining or odours
0.5				Termination Depth at: 0.2 m Refusal on concrete aggregate		

ENVIRONMENTAL BOREHOLE SB12

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 2.7

COORDINATES -32.776093, 151.740626
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
0.5	0.5 1.8			FILL: Silty Gravelly SAND: fine to medium grained, brown/grey/red	D	No staining or odours
1	0.3			Sandy CLAY: moderate plasticity, dark grey mottled brown	M	No staining or odours
1.5	0.4	SB12/1.5		Clayey SAND: medium grained, beige	W	No staining or odours
2	0.5					
2.5						
				Termination Depth at:2.7 m		
3						
3.5						
4						
4.5						

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ENVIRONMENTAL BOREHOLE SB13

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 2.7

COORDINATES -32.776003, 151.740754
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.7			FILL: Silty Gravelly SAND: fine to medium grained, brown/grey/red	D	No staining or odours
0.5	0.6			FILL: Gravelly SAND: fine to medium grained, brown/red/grey	D	No staining or odours
1	0.2	SB13/1.0				
1.5	0.4			FILL: Sandy CLAY: moderate plasticity, red/grey	H	No staining or odours
				Sandy CLAY: moderate to high plasticity, with organic material, dark grey	M	No staining or odours
2	0.9					
2.5	0.8					
				Termination Depth at:2.7 m		
3						
3.5						
4						
4.5						

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ENVIRONMENTAL BOREHOLE SB14

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 1.5

COORDINATES -32.776317, 151.740929
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.2			FILL: Silty SAND: fine to medium grained, with minor clay, grey/brown	D	No staining or odours
0.5	0.3			CLAY: moderate plasticity, grey mottled brown	H	No staining or odours
1	0.7	SB14/1.0		Clayey SAND: medium to coarse grained, light/dark grey	M W	No staining or odours
1.5	0.8			Termination Depth at: 1.5 m		

ENVIRONMENTAL BOREHOLE SB15

PROJECT NUMBER CES200502-PHB	**DRILLING DATE** 08/09/20	**COORDINATES** -32.776164, 151.740890
PROJECT NAME Raymond Terrace	**DRILLING COMPANY** NUMAC	**COORD SYS** Latitude, longtitude
CLIENT Phoenix Builders	**DRILLER** Lewis	
ADDRESS 251 Adelaide Street, Raymond Terrace NSW	**DRILLING METHOD** Push Tube	**LOGGED BY** Andrew Carras
	TOTAL DEPTH 2.7	**CHECKED BY** Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.3			FILL: SAND: fine grained, beige	D	No staining or odours
0.5	0.6	SB15/0.5		FILL: Silty Gravelly SAND: fine to medium grained, brown/red/grey	D	No staining or odours
1	0.2				H	
1.5	0.4			Sandy CLAY: moderate plasticity, grey	M	No staining or odours
2	0.7				W	
2.5						
				Termination Depth at: 2.7 m		
3						
3.5						
4						
4.5						

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ENVIRONMENTAL BOREHOLE SB16

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 2.7

COORDINATES -32.776184, 151.741073
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.4			FILL: Silty SAND: fine to medium grained, grey/brown	D	No staining or odours
0.5	1.1			FILL: Sandy GRAVEL: fine to medium grained, grey/brown	D	No staining or odours
1	2.2	SB17/1.0				
1.5	2.6			CLAY: moderate plasticity, dark grey	M	No staining or odours
2	1.7			Clayey SAND: medium to coarse grained, beige	W	No staining or odours
2.5						
3				Termination Depth at: 2.7 m		
3.5						
4						
4.5						

ENVIRONMENTAL BOREHOLE SB17

PROJECT NUMBER CES200502-PHB
PROJECT NAME Raymond Terrace
CLIENT Phoenix Builders
ADDRESS 251 Adelaide Street, Raymond Terrace NSW

DRILLING DATE 08/09/20
DRILLING COMPANY NUMAC
DRILLER Lewis
DRILLING METHOD Push Tube
TOTAL DEPTH 0.8

COORDINATES -32.776072, 151.740948
COORD SYS Latitude, longtitude

LOGGED BY Andrew Carras
CHECKED BY Mark Challoner

COMMENTS

Depth (m)	PID	Samples	Graphic Log	Material Description	Moisture	Additional Observations
	0.4	SB17/0.1		FILL: Silty Gravelly SAND: fine to medium grained, dark grey/brown	D	No staining or odours
	0.5					No staining or odours
0.5				increasing gravel content		
				Termination Depth at: 0.8 m		

Disclaimer This log is intended for environmental not geotechnical purposes.

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Appendix B – Field Data Sheets and Calibration Certificates

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB1

Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR:

JOB NUMBER:
DATE COMMENCED: 1/9/20
DATE COMPLETED:
LOGGED BY: AC

Drill Model:
Drilling Fluid:
Hole Angle:
Orientation:
deg.
deg.
Bore Size:
Co-ords:
RL:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	0									
			0.1	Fill: silty SAND: v clayey f-m sand. FM = ASS. brown. tiles, ceramics	M		0.0		ASB to 2.0.	
	0.5		0.5	" "			0.1			
				1.6						
	1.0		1.0	Fill: silty SAND v. fine. ceramics + clay. brown/grey.	M		0.1			
	1.5		1.5	increasing sand	M		0.1			
	2.0		2.0				0.5			
				2.5						
	2.5		2.5	Nat. clayey SAND: f-m grained v. silt (riversand). grey	W		0.2			
	3.0		3.0				0.7			
				EOH @ 4.8.						

Produced By: _____
Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB2

Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR:

JOB NUMBER:
DATE COMMENCED: 1/9/20
DATE COMPLETED:
LOGGED BY: AC

Drill Model:
Drilling Fluid:
Hole Angle:
Orientation:
deg.
deg.
Bore Size:
Co-ords:
RL:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, Insitu testing, groundwater observations/regime, additional Information	Well construction details
	.0									
		0.1		Fill silty SAND: w clay FM = ASS f-m grained	D		0.7		Asb sample up to 0.5	
	.5	0.5		brown grey	M		0.4		Ins. sample aftr.	
		1.0		↓ increasing SAND	M		0.1			
		1.5			M		0.6			
	.0	2.0		2.2 Nat. SAND m-c grained w. siltstone gravel, minor silt.	W		0.5			
		2.5					1.3			
	.5	3.0					1.2		Slight organic smell.	
				EOH @ 3.6						
	.0									
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____
Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB3

Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR:

JOB NUMBER:
DATE COMMENCED: 1/9/20
DATE COMPLETED:
LOGGED BY: AC

Drill Model:
Drilling Fluid:
Hole Angle:
Orientation:
deg.
deg.
Bore Size:
Co-ords:
RL:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	0		0.1	FM silty SAND w. clay FM = Aggregate		D	0.1		As 6 for 0.1 & 0.5 only	
			0.5	increasing clay/sand. 0.9		D	0.5			
	0.5		1.0	Nat CLAY: m. plasticity grey.			0.4			
			1.5	1.2 Nat sands: white/grey m-c grained becomes grey increasing clay.			0.6			
	1.0		2.0				0.9			
			2.5				0.7			
	1.5									
	2.0									
	2.5									
	3.0									
	3.5									
	4.0									
	4.5									
	5.0									
	5.5									
	6.0									
	6.5									
	7.0									
	7.5									
	8.0									

EOH @ 3.6

Produced By: _____
Checked By: _____

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB4

Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR:

JOB NUMBER:
DATE COMMENCED:
DATE COMPLETED:
LOGGED BY: NC

Drill Model:
Drilling Fluid:
Hole Angle:
Orientation:
deg.
deg.
Bore Size:
Co-ords:
RL:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	.0									
			0.1	Fill silty SAND: w clay cobbles, minor asphalt brown/grey	D		0.6			
	.5		0.5	" "	D					
				0.9	M		0.4			
	.0		1.0	Nat clay - mod plast. Grey			0.7			
	.5			1.6						
			1.5	Nat ~~SAND~~ clayey SAND. m-f grained grey			0.2			
	.0		2.0				0.9			
	.5		2.5				0.7			
	.0			EOH @ 2.6						
	.5									
	.0									
	.5									
	.0									

Produced By: _____
Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB5

Sheet of

CLIENT:	JOB NUMBER:
PROJECT:	DATE COMMENCED:
LOCATION:	DATE COMPLETED:
DRILL CONTRACTOR:	LOGGED BY:

Drill Model: Hole Angle: deg. Bore Size: RL:

Drilling Fluid: Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, Insitu testing, groundwater observations/regime, additional information	Well construction details
	.0									
			0.1	FILL SILTY SAND w. clay fine grained FM - ASBN gate.		D	0.5		~~SPT~~ Asb bags taken for 0.1 & 0.5 only.	
	.5		0.5			M	0.7			
				0.9						
	1.0		1.0	Nat CLAY soft mod plast.		M	0.9			
				1.4						
	.5		1.5	Nat ~~SAND~~ ~~zone~~ clayey SAND m.c grained		W	0.1			
			2.0	↓		W	0.7			
	.5		2.5			W	0.6			
				EOH @ 3.6m						
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____

Checked By: _____

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB6

Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR:

JOB NUMBER:
DATE COMMENCED: 1/9/20
DATE COMPLETED:
LOGGED BY: AC

Drill Model:
Drilling Fluid:

Hole Angle:
Orientation:

deg.
deg.

Bore Size:
Co-ords:

RL:

Method/ Casing	Depth (m)	Penetration (E, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	0									
		0.1		Fill: silty SAND w. clay FM = Aggregate light brown - dark brown.	D		0.5		QD1 / QS1-4	
	0.5	0.5			D		0.9		Ins. sample for ASb.	
		1.0		0.9 Not Clay mod plast. Grey.	M		0.5			
	1.0	1.5		1.4 Not sandy clayey SAND.	W		1.0			
		2.0					0.7			
	1.5	2.5					0.4			
	2.0			EOH @ 3.6						
	2.5									
	3.0									
	3.5									
	4.0									
	4.5									
	5.0									

Produced By: _____
Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB7

Sheet of

CLIENT:	**JOB NUMBER:**
PROJECT:	**DATE COMMENCED:** 8/9/20
LOCATION:	**DATE COMPLETED:**
DRILL CONTRACTOR: NUMAC	**LOGGED BY:** AC
Drill Model:	Hole Angle: deg. Bore Size: RL:
Drilling Fluid:	Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Wall construction details
	.0									
				Nat(a)SAND: m-f grained some [illegible] stone stones		D	0.6	0.1	QS3 / QS3A 1A6 @ 0.1	
	.5			~~[illegible]~~		M	0.9	0.5		
	.0			Ref. @ 0.8						
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____

Checked By: _____

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: 288

Sheet of

CLIENT:	**JOB NUMBER:**
PROJECT:	**DATE COMMENCED:**
LOCATION:	**DATE COMPLETED:** 8/9/20
DRILL CONTRACTOR: NUNOR	**LOGGED BY:** AE

Drill Model: Hole Angle: deg. Bore Size: RL:

Drilling Fluid: Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	.0									
				Not clayey SAND: mf grained:			0.5	0.1		
	.5						0.8	0.5		
	.0			Ref. @ 0.8						
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____

Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB9

Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR: NJMA

JOB NUMBER:
DATE COMMENCED:
DATE COMPLETED: 8/9/20
LOGGED BY: AC

Drill Model: Hole Angle: deg. Bore Size: RL:
Drilling Fluid: Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, Insitu testing, groundwater observations/regime, additional information	Well construction details
	.0			Fill silty SANDY : f m grained gravelly Brown/red 0.2			0.2	D1	ABS tarm	
	.5			Nat clayey SAND: Beige/grey. m-f grained 0.6			0.6	0.5		
	.0			Ref @ 0.6						
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____
Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB10

Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR: UMAC

JOB NUMBER:
DATE COMMENCED: ~~9/5~~ 8/9/20
DATE COMPLETED:
LOGGED BY:

Drill Model: Hole Angle: deg. Bore Size: RL:
Drilling Fluid: Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour, secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, Insitu testing, groundwater observations/regime, additional information	Well construction details
	.0			Concrete refusal on Ass. "Concrete"						
	.5			Surface sample collected.			0.1	0.1	Ab Sample collected	
	.0			Fill: silty SAND/ Gravel FM = Conc., tiles, [illegible]						
	.5			EOH @ 0.2						
	.0									
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____
Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB11

Sheet of

CLIENT:	JOB NUMBER:
PROJECT:	DATE COMMENCED:
LOCATION:	DATE COMPLETED:
DRILL CONTRACTOR:	LOGGED BY:

Drill Model: Hole Angle: deg. Bore Size: RL:

Drilling Fluid: Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample interval	Field Records/Comments: Sample ID, Insitu testing, groundwater observations/regime, additional information	Well construction details
	0			Concrete refusal on Assumed "Concrete" surface sample collected			0.1-0.1		Asb sample collected	
	0.5			Fill: silty sandy Gravel FM = Conc. tiles						
	0.8			EOH @ 0.2						
	1.0									
	1.5									
	2.0									
	2.5									
	3.0									
	3.5									
	4.0									
	4.5									
	5.0									

Produced By: _____

Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB12

Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR: NVMAC

JOB NUMBER:
DATE COMMENCED:
DATE COMPLETED:
LOGGED BY: AC

Drill Model:
Drilling Fluid:
Hole Angle:
Orientation:
deg.
deg.
Bore Size:
Co-ords:
RL:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	0			FILL: silty sandy gravel. m-f grained brown/grey/red			0.5	0.1	ASB @ 0.1 & 0-5	
	0.5						1.8	0.5		
	1.0			0.9 Nat CLAY: mod plast. dark grey mott. brown			0.5	1.0		
	1.5			1.4 Nat clayey SAND: minor clay. m-grained beige.			0.4	1.5		
	2.0						0.5	2.0		
	2.5			EOH @ 2.7						
	3.0									
	3.5									
	4.0									
	4.5									
	5.0									

Produced By: _____
Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB13

Sheet of

CLIENT: JOB NUMBER:

PROJECT: DATE COMMENCED: 8/9/20

LOCATION: DATE COMPLETED:

DRILL CONTRACTOR: NUMAC LOGGED BY: DK

Drill Model: Hole Angle: deg. Bore Size: RL:

Drilling Fluid: Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	.0			Fill: silty SAND gravel: m-f grained. 0.4	D		0.7	0.4	NSB to 1.0	
	.5			+ gravelly sand; m-f sand 1.1	D		0.6	0.5		
					M		0.2	1.0		
	.0			sandy clay red grey	M			1.5		
	.5			1.8						
				Dark sandy CLAY: mod-high plast. dark grey w<PL sand	M			2.0		
	.0				M			2.5		
	.5			EOH @ 2.7						
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____

Checked By: _____

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB14
Sheet of

CLIENT:
PROJECT:
LOCATION:
DRILL CONTRACTOR: NUMAL

JOB NUMBER:
DATE COMMENCED: 8/9/20
DATE COMPLETED:
LOGGED BY: AC

Drill Model: Hole Angle: deg. Bore Size: RL:
Drilling Fluid: Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg. fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional Information	Well construction details
	.0									
				Fill: silty SAND minor clay m-f grained sand/brown 0.4	D		0.2	0.1	Also to 0-1 only.	
	.5			Nat Clay m plast. grey mott. brown	M		0.3	0.5		
	.0			OR Nat SAND. m-c grained light/dark grey minor silt & clay.	M		0.7	1.0		
	.5				W		0.8	1.5	QS4/QS4A	
	.0			EOH @ 1.5						
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____
Checked By: _____

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB15

Sheet of

CLIENT:	JOB NUMBER:
PROJECT:	DATE COMMENCED: 8/9/20
LOCATION:	DATE COMPLETED:
DRILL CONTRACTOR: NUMAC	LOGGED BY: AC
Drill Model:	Hole Angle: deg. Bore Size: RL:
Drilling Fluid:	Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	.0			Fill: SAND f. grained beige.	D	S	0.3	0.1	Ab to 0.5	
	.5			0.3						
				Fill: s(l)sandy gravel. m-f grained	D		0.6	0.5		
	.0				H		0.2	1.0		
				1.4						
	.5			Natural CLAY: grey high plast.	M		0.4	1.5		
	.0				W		0.7	2.0		
				EOH @ 2.7						
	.5									
	.0									
	.5									
	.0									
	.5									
	.0									

Produced By: _____

Checked By: _____

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB16

Sheet of

CLIENT:	JOB NUMBER:
PROJECT:	DATE COMMENCED:
LOCATION:	DATE COMPLETED: 8/9/20
DRILL CONTRACTOR: NUMAC	LOGGED BY: AC
Drill Model:	Hole Angle: deg. Bore Size: RL:
Drilling Fluid:	Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg, fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime, additional information	Well construction details
	0									
				Fill silty SAND: f-m grained. grey/brown.			0.4	0.1	taken Asb @ 0.1	
	0.5			0.3					0.5	
				Fill sandy Gravel: f-m grained			1.1	0.5	1.0	
	1.0			1.4			2.2	1.0		
				Nat CLAY: mod plast. dark grey.			2.6	1.5		
	1.5			1.8			1.7	2.0		
	2.0			Nat SAND: m-c grained. minor clay						
	2.5			EOH @ 2.7						
	3.0									
	3.5									
	4.0									
	4.5									
	5.0									

Produced By: _____

Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

BOREHOLE LOG

Borehole No: SB17

Sheet of

CLIENT:	JOB NUMBER:
PROJECT:	DATE COMMENCED: 8/4/20
LOCATION:	DATE COMPLETED:
DRILL CONTRACTOR: NUMAC	LOGGED BY: AC
Drill Model:	Hole Angle: deg. Bore Size: RL:
Drilling Fluid:	Orientation: deg. Co-ords:

Method/ Casing	Depth (m)	Penetration (S, M, H, R)	USCS Classification	Material Description: TYPE; plasticity / particle size, colour; secondary / minor components; moisture; consistency / density; additional observations; geologic origin (eg. fill, residual, alluvium)	Moisture/SWL	Consistency	PID/ Explosimeter	Sample Interval	Field Records/Comments: Sample ID, insitu testing, groundwater observations/regime; additional information	Well construction details
	0			FILL: SAND: dark grey/brown m-f grained	D	S	0.4	0.1	Asb for 0.1 only	
	0.5			more gravelly ↓	D	St	0.5	0.5	ins. sample for Asb	
	1.0			ref. @ 0.8.						
	1.5									
	2.0									
	2.5									
	3.0									
	3.5									
	4.0									
	4.5									
	5.0									

Produced By: _____

Checked By: _____

REFER TO WORK INSTRUCTION GRP-FWW005

CONSULTING EARTH SCIENTISTS

FIELD DATA SHEET : Surface-Water Monitoring

Client:	~~Sydney Zoo~~ Penrith Build	CES Project Code:	CES150404-EXC
Project:	~~Baseline Surface Water Sampling – Eastern Creek~~ Raymond Terrace	Date:	25/8/20
Sampler (s):	Signature(s):	Project Manager:	~~E-Millar~~ °A -CAnn

Sample ID	Site	Date	Time	DO mg.l^{-1}	EC uS.cm^{-1}	pH -	Eh mV	Temp. °C	Turbidity NTU	Comments (flow conditions, water odour, algal growth, debris, etc.)
SW1		25/8/20	10[illegible]	9.64	368.1	7.79	165.7	13.5	–	Stagnant, no algal, light body, low turb.
SW2		" "	1020	9.72	366.3	7.75	158.8	13.4	–	" "
SW3		" "	1040	9.68	363.8	7.66	158.0	13.4	–	" Filter at the rate only (not dosed)
SW4			1055	9.76	363.0	7.63	154.2	13.5	–	" "
SW5			1105	9.53	362.9	7.62	116.9	13.4	–	" "
SW6			1120	9.46	363.2	7.67	128.3	13.6	–	" "
SW7			1130	9.59	363.4	7.60	119.3	13.6	–	" "
SW8			1140	9.34	363.2	7.64	124.2	13.6	–	" "
SW9			1150	9.69	363.1	7.53	100.5	13.8	–	" "
SW10			1200	9.91	365.8	7.54	84.3	14.1		" "
SW11			13:00	11.30	488	7.00	135.2	12.0	–	Slightly turbid, low flow, light grey ~~no odour~~
SW12			13:15	8.65	488.1	6.77	150.6	12.8	–	clear, low flow, no anaerobic odours
SW13		↓	1330	5.06	509	6.41	89.6	13.5	–	" "

CONSULTING EARTH SCIENTISTS

GROUNDWATER FIELD DATA SHEET

Client:	**Breen Resources Pty Ltd**	**CES Project Code:**	[redacted]
Project:	**Quarterly Groundwater**	**Location:**	[redacted]
Sampler (s):	AR **Signature(s):**	**Project Manager:**	T. Stanton
BH ID:	MW1	**Sample ID:**	MW1
		Sampling Date:	29/10/20

Well Status

Well damaged:	YES/NO	Well locked:	YES/NO
Cement footing damaged:	YES/NO	Cap on PVC casing:	YES/NO
Internal obstructions in casing:	YES/NO	Well ID visible:	YES/NO
Standing water, vegetation around monument:	YES/NO	Monument damaged:	YES/NO
Water between PVC and protective casing:	YES/NO	Odours from groundwater:	YES/NO

Standing Water Level (SWL):	17.27 2.96	(mBTOC)	Weather Conditions Temperature:	17 °C
Well volume:		(L)		
Volume of water purged:		(L)	Clear / Partly Cloudy / Overcast	
Purging equipment:		Pump / micro-Purging / Bailer / ~~Foot Valve~~	Calm / Light breeze / Moderate Breeze / Windy	
Sampling equipment:		Pump / Bailer / foot valve / micro-Purge	Fine / Showers / Rain	

Purging Details

Elapsed time (min)	Cumulative volume (L)	DO (mg.L^{-1})	EC (uS.cm^{-1})	pH -	Eh mV	Temp. (°C)	Comments
1021	0	2.76	2217	6.88	-94.8	20.6	Black / dark grey, high turb, no odour
+3	5	1.18	2177	6.42	-68.8	19.5	" " light grey, low turb, no odour
+6	10	1.19	2174	6.41	-64.0	19.4	" "
+9	15	1.18	2171	6.39	-63.7	~~19.3~~ 19.1	" "
+12	20	1.19	2169	6.58	-62.8	19.3	" "
							Sample taken.

Groundwater field parameters at the end of purging to be marked "Field Measurements".

MW @ 4.0

SW @

Fail Ben Fail.

BP @ 3.70

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GROUNDWATER FIELD DATA SHEET

Client:	**Breen Resources Pty Ltd**	**CES Project Code:**	[redacted]
Project:	Quarterly Groundwater	**Location:**	[redacted]
Sampler (s):	AC **Signature(s):**	**Project Manager:**	T. Stanton
BH ID:	MW2	**Sample ID:**	MW2
		Sampling Date:	29/10/20

Well Status

Well damaged:	YES/NO	Well locked:	YES/NO
Cement footing damaged:	YES/NO	Cap on PVC casing:	YES/NO
Internal obstructions in casing:	YES/NO	Well ID visible:	YES/NO
Standing water, vegetation around monument:	YES/NO yes.	Monument damaged:	YES/NO
Water between PVC and protective casing:	YES/NO	Odours from groundwater:	YES/NO

Standing Water Level (SWL):	18.04 0.21	(mBTOC)	Weather Conditions Temperature: 15	°C
Well volume:		(L)		
Volume of water purged:		(L)	Clear / Partly Cloudy / Overcast	
Purging equipment:		Pump / ~~micro-Purging~~ / Bailer / Foot Valve	Calm / Slight breeze / Moderate Breeze / Windy	
Sampling equipment:		Pump / Bailer / foot valve ~~micro-Purge~~	raining previously / Fine / Showers / Rain	

Purging Details

Elapsed time (min)	Cumulative volume (L)	DO ($mg.L^{-1}$)	EC ($uS.cm^{-1}$)	pH -	Eh mV	Temp. (°C)	Comments
757	0	1.02	1746	6.27	-56.8	18.2	Light silt, mod turb, no odour.
+3	5	0.40	1755	6.13	-51.7	18.2	" "
+6	10	0.36	1756	6.11	-51.0	18.2	" "
+9	15	0.42	1741	6.05	-53.2	18.3	" "
+12	20	0.39	1739	6.05	-55.2	18.3	" "
							Sample taken

Groundwater field parameters at the end of purging to be marked "Field Measurements".

WL @ 4m

IP @ 3.5m → WL = 0.94 from 0.21

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GROUNDWATER FIELD DATA SHEET

Client:	**Breen Resources Pty Ltd**	**CES Project Code:**	[redacted]
Project:	**Quarterly Groundwater**	**Location:**	[redacted]
Sampler (s):	**Signature(s):**	**Project Manager: T. Stanton**	
BH ID:	MW3	**Sample ID:**	MW3
		Sampling Date:	25/10/20

Well Status

Well damaged:	YES/NO	Well locked:	YES/NO
Cement footing damaged:	YES/NO	Cap on PVC casing:	YES/NO
Internal obstructions in casing:	YES/NO	Well ID visible:	YES/NO
Standing water, vegetation around monument:	YES/NO	Monument damaged:	YES/NO
Water between PVC and protective casing:	YES/NO	Odours from groundwater:	YES/NO

Standing Water Level (SWL):	13.9 2.3 (mBTOC)	Weather Conditions		
Well volume:	(L)	Temperature:	17	°C
Volume of water purged:	(L)	Clear	Partly Cloudy	Overcast
Purging equipment:	Pump / micro-Purging / Bailer / Foot Valve	Calm	Slight breeze	Moderate Breeze
Sampling equipment:	Pump / Bailer / foot valve micro-Purge	Windy		
		Fine	Showers	Rain

Purging Details

Elapsed time (min)	Cumulative volume (L)	DO ($mg.L^{-1}$)	EC ($uS.cm^{-1}$)	pH -	Eh mV	Temp. (°C)	Comments
926	0	2.93	610	6.10	-92.3	19.7	Grey, mod turb, no odour
+3	5	1.32	609	5.48	-68.0	18.5	" "
+6	10	1.20	609	5.47	-67.7	18.5	" "
+9	15	1.13	607	5.46	-67.6	18.5	" "
+12	20	1.10	607	5.46	-67.7	18.5	" "
							sample taken.

Groundwater field parameters at the end of purging to be marked "Field Measurements".

1st WL @ 4m SW @ 2.34

IP @ 3.70m

2nd WL @ 4m

IP @ 3.70m

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GROUNDWATER FIELD DATA SHEET

Client:	**Breen Resources Pty Ltd**	**CES Project Code:**	[redacted]
Project:	**Quarterly Groundwater**	**Location:**	[redacted]
Sampler (s):	**Signature(s):**	**Project Manager:** T. Stanton	
BH ID:	MW4	**Sample ID:**	
		Sampling Date:	22/10/12

Well Status

Well damaged:	YES/NO	Well locked:	YES/NO
Cement footing damaged:	YES/NO	Cap on PVC casing:	YES/NO
Internal obstructions in casing:	YES/NO	Well ID visible:	YES/NO
Standing water, vegetation around monument:	YES/NO	Monument damaged:	YES/NO
Water between PVC and protective casing:	YES/NO	Odours from groundwater:	YES/NO

0.65 mBMP

11.81

Standing Water Level (SWL):	0.35	(mBTOC)	Weather Conditions		
Well volume:		(L)	Temperature:	21	°C
Volume of water purged:		(L)	Clear	Partly Cloudy	Overcast
Purging equipment:		Pump / micro-Purging / Bailer / Foot Valve	Calm	Slight breeze	Moderate Breeze
			Windy		
Sampling equipment:		Pump / Bailer / foot valve micro-Purge	Fine	Showers	Rain

Purging Details

Elapsed time (min)	Cumulative volume (L)	DO ($mg.L^{-1}$)	EC ($uS.cm^{-1}$)	pH -	Eh mV	Temp. (°C)	Comments
1317	0	4.37	1071	5.33	158.4	19.8	Light grey, low turb, no odour.
	2	1.24	977	5.59	37.8	18.7	"
	4	1.29	977	5.58	31.6	18.3	"
	6	1.25	977	5.57	30.3	18.3	"
	8	1.15	979	5.55	29.1	18.5	"
	10	1.15	980	5.52	28.6	18.5	sample taken

Groundwater field parameters at the end of purging to be marked "Field Measurements".

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GROUNDWATER FIELD DATA SHEET

Client:	Breen Resources Pty Ltd	**CES Project Code:**	[redacted]
Project:	Quarterly Groundwater	**Location:**	[redacted]
Sampler (s):	AC	**Signature(s):**	AC
BH ID:	MW5	**Project Manager:**	T. Stanton
		Sample ID:	MW5
		Sampling Date:	28/11/2016

Well Status

Well damaged:	YES/NO	Well locked:	YES/NO
Cement footing damaged:	YES/NO	Cap on PVC casing:	YES/NO
Internal obstructions in casing:	YES/NO	Well ID visible:	YES/NO
Standing water, vegetation around monument:	YES/NO – vege	Monument damaged:	YES/NO
Water between PVC and protective casing:	YES/NO	Odours from groundwater:	YES/NO

0.79 stick up

Standing Water Level (SWL):	18.35 / 1.15 (mBTOC)	Weather Conditions Temperature:		°C
Well volume:	(L)			
Volume of water purged:	(L)	Clear	Partly Cloudy	Overcast
Purging equipment:	Pump / micro-Purging / Bailer / Foot Valve	Calm	Slight breeze	Moderate Breeze
		Windy		
Sampling equipment:	Pump / Bailer / foot valve / micro-Purge	Fine	Showers	Rain

Purging Details

Elapsed time (min)	Cumulative volume (L)	DO (mg.L^{-1})	EC (uS.cm^{-1})	pH -	Eh mV	Temp. (°C)	Comments
12:19	0.25	2.87	5785	3.84	121.7	18.4	brown, turbid, cuttings
12:24	0.4	3.59	5467	3.66	170.5	18.2	"
12:26	0.6	3.19	5469	3.64	185.1	18.2	"
12:28	0.8	2.82	5411	3.65	216.9	18.1	"
12:30	1	2.85	5401	3.65	218.5	18.1	taken

Groundwater field parameters at the end of purging to be marked "Field Measurements".

WL @ 3.0m
TD @ 2.5m

SW @ 1.13

FAIL GEN Fail.

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 17C102195

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		330737	pH 7.02
2. pH 4.00		pH 4.00		330734	pH 4.10
3. pH 10.00		pH 10.00		352607	pH 9.65
3. mV		229.6mV		342074/346052	230.0mV
4. EC		2.76mS		333787	2.76mS
5. D.O		0.00ppm		329994	0.01ppm
6. Temp		21.0°C		MultiTherm	21.0°C

Calibrated by: Eloise Carroll

Calibration date: 24/08/2020

Next calibration due: 23/09/2020

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18J104319

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 10.00		pH 10.00		355386	pH 9.82
2. pH 7.00		pH 7.00		330737	pH 7.01
3. pH 4.00		pH 4.00		351412	pH 4.04
4. mV		231.8mV		357172/357173	231.8mV
5. EC		2.76mS		350510	2.76mS
6. D.O		0.00ppm		10959	0.00pm
7. Temp		21.1°C		MultiTherm	21.2°C

Calibrated by: **Kylie Rawlings**

Calibration date: **28/10/2020**

Next calibration due: **27/11/2020**

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 3969

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Ashok Hettigama**

Calibration date: **27/10/2020**

Next calibration due: **26/12/2020**

Oil / Water Interface Meter

Instrument **Geotech Interface Meter (30M)**
Serial No. **4357**

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Chris Edwards**

Calibration date: **10/11/2020**

Next calibration due: **9/01/2021**

Calibration & Service Report
Gas Monitor

Company:	Active Environmental Solutions Hire	**Manufacturer:**	RAE Systems	**Serial #:**	592-914571
Contact:	Aleks Todorovic	**Instrument:**	MiniRAE 3000	**Asset #:**	-
Address:	2 Merchant Avenue Thomastown Vic 3074	**Model:**	PGM 7320	**Part #:**	-
		Configuration:	VOC	**Sold:**	-
Phone:	03 9464 2300 | **Fax**: 03 9464 3421	**Wireless:**	-	**Last Cal:**	-
Email:	Hire@aesolutions.com.au	**Network ID:**	-	**Job #:**	-
		Unit ID:	-	**Cal Spec:**	Std

Item	Test	Pass/Fail	Comments
Battery	Li Ion	✓	
Charger	Charger, Power supply	✓	
	Cradle	✓	
Pump	Flow	✓	>500 mL/min
Filter	Filter, fitting, etc	✓	
Alarms	Audible, visual, vibration	✓	
Display	Operation	✓	
PCB	Operation	✓	
Connectors	Condition	✓	
Firmware	Version	✓	2.16
Datalogger	Operation	✓	
Monitor Housing	Condition	✓	
Case	Condition/Type	✓	
Sensors			
Oxygen		-	
LEL		-	
PID	10.6eV	✓	
Toxic 1		-	
Toxic 2		-	
Toxic 3		-	
Toxic 4		-	
Toxic 5		-	

Engineer's Report

Setup, service and calibration for hire

Calibration Certificate

Sensor	Type	Serial No:	Span Gas	Concentration	Traceability Lot #	CF	Reading	
							Zero	Span
Oxygen								
LEL								
PID	10.6eV	2R000773	Isobutylene	100 PPM	3075-2-1	1	0	100 PPM
Toxic 1								
Toxic 2								
Toxic 3								
Toxic 4								
Toxic 5								

Calibrated/Repaired by: Milenko Sisic

Date: 03/08/2020

Next due: 03/02/2021

Appendix C – Lotsearch Historical Photographs

Date: 04 Sep 2020

Reference: LS014560 EA

Address: 251 Adelaide Street, Raymond Terrace, NSW 2324

Aerial Imagery 2020

251 Adelaide Street, Raymond Terrace, NSW 2324

Scale: 0 80 160 240 320 Meters	Data Sources: Aerial Imagery © Aerometrex Pty Ltd	Coordinate System: GDA 1994 MGA Zone 56	Date: 03 September 2020

Aerial Imagery 2015

251 Adelaide Street, Raymond Terrace, NSW 2324

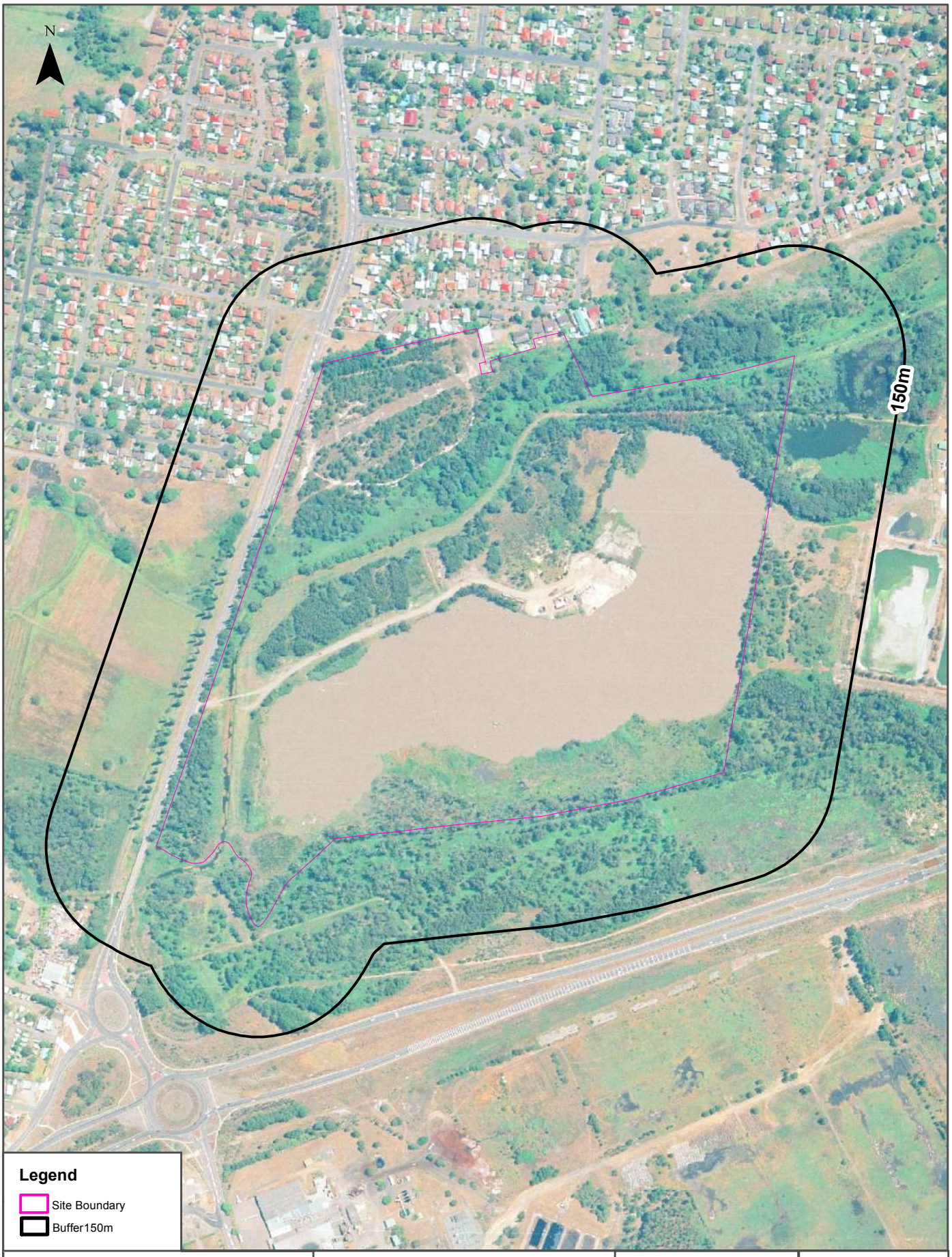
Scale: 0 80 160 240 320 Meters	Data Sources: Aerial Imagery © Aerometrex Pty Ltd	Coordinate System: GDA 1994 MGA Zone 56	Date: 03 September 2020

Aerial Imagery 2010

251 Adelaide Street, Raymond Terrace, NSW 2324

Aerial Imagery 2001

251 Adelaide Street, Raymond Terrace, NSW 2324



Aerial Imagery 1993

251 Adelaide Street, Raymond Terrace, NSW 2324

Aerial Imagery 1984

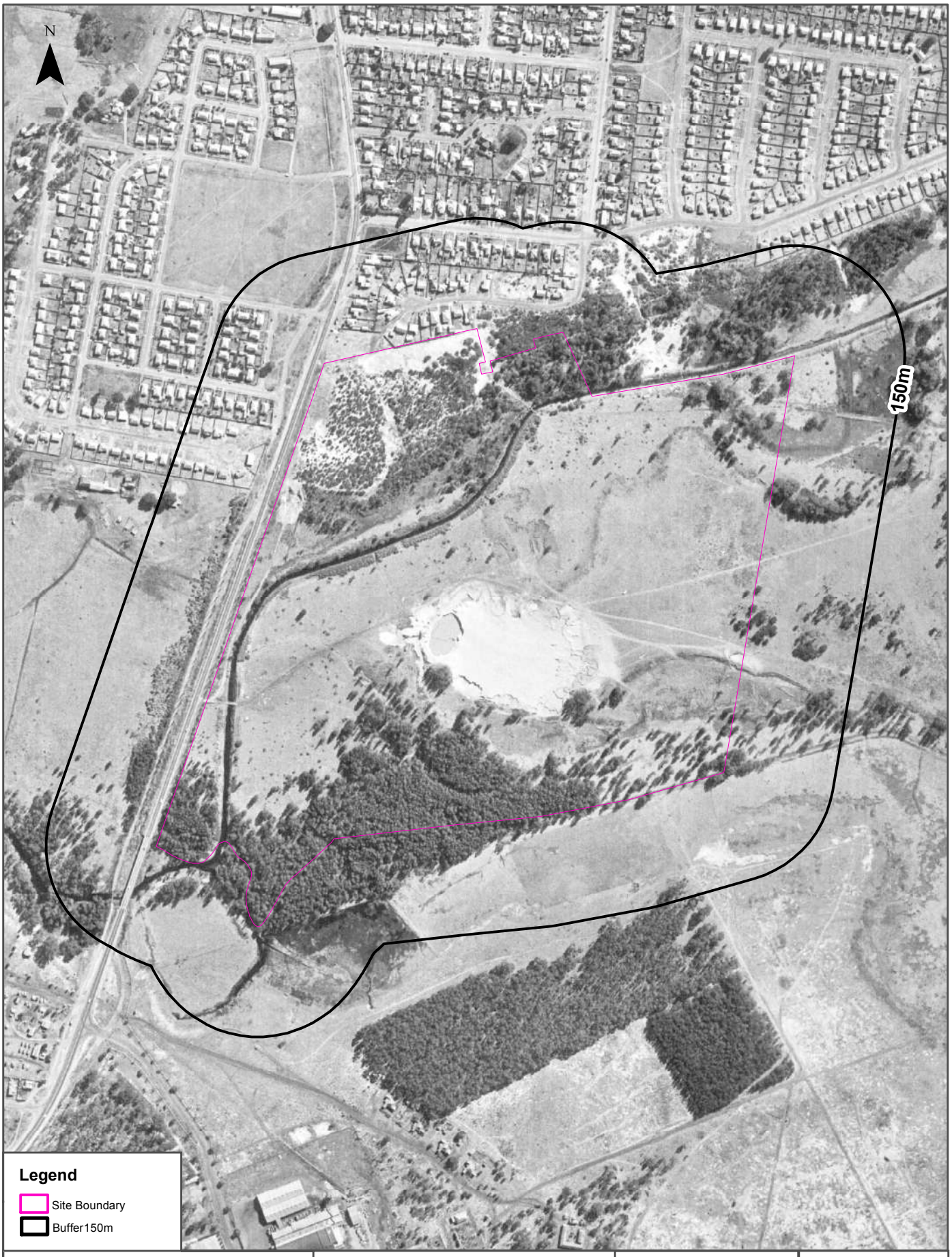
251 Adelaide Street, Raymond Terrace, NSW 2324

Aerial Imagery 1976

251 Adelaide Street, Raymond Terrace, NSW 2324

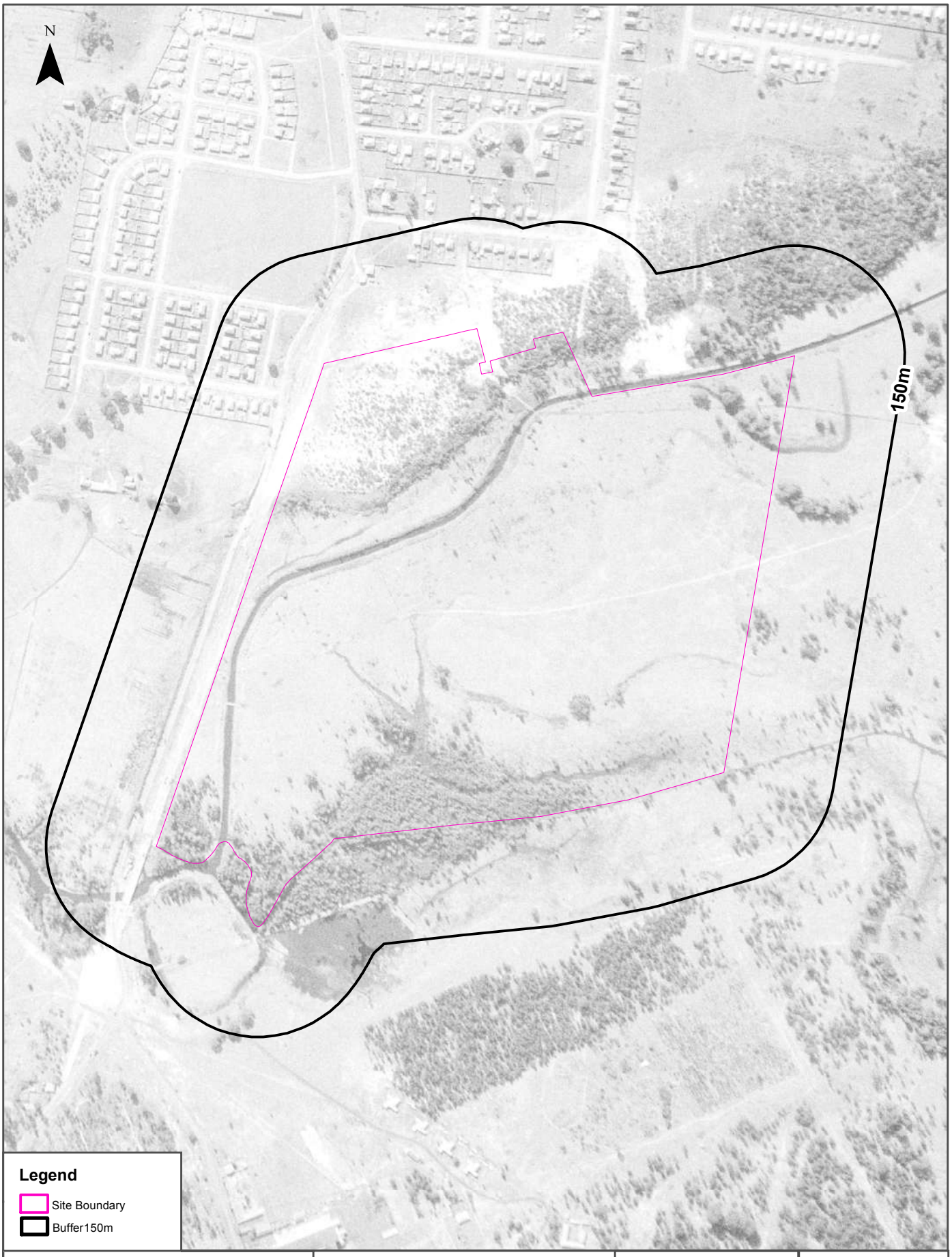
Aerial Imagery 1966

251 Adelaide Street, Raymond Terrace, NSW 2324



Aerial Imagery 1954

251 Adelaide Street, Raymond Terrace, NSW 2324



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Appendix D – Beresfield Acid Sulfate Soil Map

DEPARTMENT OF LAND AND WATER CONSERVATION

BERESFIELD

ACID SULFATE SOIL RISK MAP — EDITION TWO

151°30'00" 32°45'00" — 151°45'00" 32°45'00"

EAST MAITLAND · GILLIESTON HEIGHTS · METFORD · THORNTON · BERESFIELD · MILLERS FOREST · RAYMOND TERRACE · MOTTO FARM · HEDDON GRETA · HEXHAM · TOMAGO · KOORAGANG ISLAND · STOCKRINGTON · SHORTLAND

Wallis Creek · Hunter River · Pacific Highway · New England Highway · Cessnock Road · Mount Vincent Road · Raymond Terrace Road

63 62000 m N — 361000m E — 32°52'30" 151°30'00" — 32°52'30" 151°45'00"

KEY

Map Class Description	Depth to Acid Sulfate Soil Materials		Environmental Risk	Typical Landform Types
HIGH PROBABILITY High probability of occurrence of acid sulfate soil materials within the soil profile. The environment of deposition has been suitable for the formation of acid sulfate soil materials. Acid sulfate soil materials are widespread or sporadic and may be buried by alluvium or windblown sediments.	Below water level	Bottom sediments.	Severe environmental risk if bottom sediments are disturbed by activities such as dredging.	Bottom sediments of lakes, lagoons, tidal creeks, rivers and estuaries.
		At or near the ground surface.	Severe environmental risk if acid sulfate soil materials are disturbed by activities such as shallow drainage, excavation or clearing.	Estuarine swamps, intertidal flats and supratidal flats.
		Within 1 metre of the ground surface.	Severe environmental risk if acid sulfate soil materials are disturbed by activities such as shallow drainage, excavation or clearing.	Low alluvial plains, estuarine sandplains, estuarine swamps, backswamps and supratidal flats.
		Between 1 and 3 metres below the ground surface.	Environmental risk if acid sulfate soil materials are disturbed by activities such as deep excavation for pipelines, dams or deep drains.	Alluvial plains, alluvial swamps, alluvial levees and sandplains.
		Greater than 3 metres below the ground surface.*	Environmental risk if acid sulfate soil materials are disturbed by activities such as deep excavations, –e.g., large structure foundations or deep dams.	Elevated levees and sandplains, alluvial plains and alluvial swamps in estuarine reaches of catchments.
LOW PROBABILITY Low probability of occurrence of acid sulfate soil materials within the soil profile. The environment of deposition has generally not been suitable for the formation of acid sulfate soil materials. Soil materials are often Pleistocene in age. Acid sulfate soil materials, if present, are sporadic and may be buried by alluvium or windblown sediments.	Below water level	Bottom sediments.	The majority of these landforms are not expected to contain acid sulfate soil materials. Therefore, land management is generally not affected by acid sulfate soils. However, highly localised occurrences may be found, especially near boundaries with environments with a high probability of occurrence. Disturbance of these soil materials will result in an environmental risk that will vary with elevation and depth of disturbance.	Elevated alluvial plains and levees dominated by fluvial sediments. Plains and dunes dominated by aeolian soils. Pleistocene plains. Lacustrine and alluvial bottom sediments.
		At or near the ground surface.		
		Within 1 metre of the ground surface.		
		Between 1 and 3 metres below the ground surface.		
		Greater than 3 metres below the ground surface.*		
NO KNOWN OCCURRENCE Acid sulfate soils are not known or expected to occur in these environments.		No known occurrences of acid sulfate soil materials.	Land management activities not likely to be effected by acid sulfate soil materials.	Bedrock slopes, elevated Pleistocene and Holocene dunes, and elevated alluvial plains.
DISTURBED TERRAIN		Disturbed terrain may include filled areas, which often occur during reclamation of low lying swamps for urban development. Other disturbed terrain includes areas which have been mined or dredged, or have undergone heavy ground disturbance through general urban development or construction of dams or levees. Soil investigations re required to assess these areas for acid sulfate potential.		

*Deep occurrences of acid sulfate soil materials not able to be confirmed by field inspection and sampling.

SCALE 1:25000

metres 500 0 1 2 kilometres

G N

TRANSVERSE MERCATOR PROJECTION
Numbered grid lines are 1000 metre intervals of the Australian Map Grid, Zone 56. Grid values are shown in full only at the south-west corner of the map.

Cadastral information based on the Digital Cadastral Data Base courtesy of the Surveyor Generals Department of N.S.W. Waterbody boundaries are dynamic and show slight differences between cadastral and topographic information.

THIS MAP IS TO BE USED AS A GENERAL GUIDE FOR REGIONAL AND LOCAL SCALE LAND USE PLANNING AND LAND MANAGEMENT ONLY AND NOT FOR THE ASSESSMENT OF SPECIFIC SITES WHICH CAN ONLY BE ASSESSED BY A SITE SPECIFIC SOIL INVESTIGATION. THIS MAP HAS BEEN PREPARED ON THE BASIS OF CURRENT INDICATORS WHICH MAY VARY AS THE PROCESS OF DETECTING THE OCCURRENCE OF ACID SULFATE SOILS IS FURTHER DEVELOPED. ACID SULFATE SOILS MAY OCCUR IN AREAS SPECIFICALLY IDENTIFIED ON THE MAP AS NO KNOWN OCCURRENCE.

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THIS MAP IS ONLY RELIABLE AT THE PUBLISHED SCALE OF 1:25000

LANDFORM CODES

Landform Process Class	Landform Element				Elevation#
W.....Aeolian	b.....Backplain		t.....Levee Toe		0.....0–1 m
A.....Alluvial	k.....Backswamp		o.....Ox–bow		1.....1–2 m
B.....Beach	m.....Bottom Sediments		p.....Plain		2.....2–4 m
E.....Estuarine	n.....Channel		a.....Sandplain		4.....>4 m
L.....Lacustrine	d.....Dune		s.....Swamp		
S.....Swamp	r.....Interbarrier Swamp		y.....Spivy		Additiond Descriptive Codes
	i.....Intertidal Flat		u.....Supratidal Flat		(p).....Pleistocene
X.....Disturbed Terrain*	g.....Lagoon		w.....Swale		(s).....Acidic Scald
	l.....Levee		c.....Tidal Creek		

*Elevation levels given on the map refer to the elevation of the ground surface at the time of mapping. Depending on the nature of the disturbance, these elevation levels may or may not represent the original ground surface elevation.

#Approximate AHD

EDITION TWO

MAP PREPARED BY CLMURPHY REVIEWED BY CLMURPHY

MAP COMPILED BY GIS OPERATIONS FROM DIGITISED FIELD INFORMATION AND DATA HELD IN THE DEPARTMENT OF LAND AND WATER CONSERVATIONS GEOGRAPHIC INFORMATION SYSTEM.

THIS MAP SHOULD BE USED IN CONJUNCTION WITH THE *GUIDELINES FOR THE USE OF ACID SULFATE RISK MAPS* SSNAYLOR et.al. (1995). DEPARTMENT OF LAND AND WATER CONSERVATION

THIS MAP IS PART OF A SERIES OF ACID SULFATE SOIL RISK MAPS ALONG THE ENTIRE NEW SOUTH WALES COAST. THE MAPPING HAS BEEN UNDERTAKEN BY A TEAM OF EXPERIENCED AND QUALIFIED SOIL SURVEYORS. THE MAPPING IS BASED ON THE ASSESSMENT OF GEOMORPHIC PROCESSES AND ENVIRONMENTS. ASSESSMENT METHODS INCLUDE, INTERPRETATION OF AERIAL PHOTOGRAPHY AND SATELLITE IMAGERY, EXTENSIVE FIELD WORK AND LABORATORY SOIL TESTING.

LEGEND

LANDFORM BOUNDARY.....
APPROXIMATE LANDFORM BOUNDARY.....
SOIL PROFILE DESCRIPTION SITE.....#7
RIVER or CREEK.....
CADASTRE.....

KEY TO ADJOINING MAPS IN THIS SERIES

GRETA 9132SI	MAITLAND 9232SW	KARUAH 9232SX
CESSNOCK 9132NE	BERESFIELD 9232NO	WILLIAMTOWN 9232NP
	WALLSEND 9232SO	NEWCASTLE 9232SP

Appendix E – Laboratory Certificates

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 254589

Client Details

Client	Consulting Earth Scientists Pty Ltd
Attention	Andrew Carras
Address	Suite 3, Level 1, 55 Grandview Street, Pymble, NSW, 2073

Sample Details

Your Reference	**CES200502**
Number of Samples	5 water
Date samples received	29/10/2020
Date completed instructions received	29/10/2020

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	05/11/2020
Date of Issue	05/11/2020

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Dragana Tomas, Senior Chemist
Hannah Nguyen, Senior Chemist
Josh Williams, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

vTRH in Water (C6-C9) NEPM						
Our Reference	UNITS	254589-1	254589-2	254589-3	254589-4	254589-5
Your Reference		MW1	MW2	MW3	MW4	MW5
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Type of sample		water	water	water	water	water
Date extracted	-	30/10/2020	30/10/2020	30/10/2020	30/10/2020	30/10/2020
Date analysed	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
TRH C_6 - C_9	µg/L	<10	<10	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10	<10	<10
Surrogate Dibromofluoromethane	%	110	108	104	104	105
Surrogate toluene-d8	%	100	100	98	100	100
Surrogate 4-BFB	%	100	102	101	101	102

svTRH (C10-C40) in Water						
Our Reference		254589-1	254589-2	254589-3	254589-4	254589-5
Your Reference	UNITS	MW1	MW2	MW3	MW4	MW5
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Type of sample		water	water	water	water	water
Date extracted	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Date analysed	-	04/11/2020	04/11/2020	04/11/2020	04/11/2020	04/11/2020
TRH C_{10} - C_{14}	µg/L	<50	220	<50	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	270	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100	<100	<100
TRH >C_{10} - C_{16}	µg/L	<50	250	<50	<50	<50
TRH >C_{16} - C_{34}	µg/L	<100	180	<100	<100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	103	94	86	74	88

PAHs in Water						
Our Reference		254589-1	254589-2	254589-3	254589-4	254589-5
Your Reference	UNITS	MW1	MW2	MW3	MW4	MW5
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Type of sample		water	water	water	water	water
Date extracted	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Date analysed	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Naphthalene	µg/L	<1	1	<1	<1	<1
Acenaphthylene	µg/L	<1	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	<1	<1	<1
Phenanthrene	µg/L	<1	<1	<1	<1	<1
Anthracene	µg/L	<1	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5	<5
Total +ve PAH's	µg/L	NIL (+)VE	1.4	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	88	80	84	85	109

HM in water - dissolved						
Our Reference		254589-1	254589-2	254589-3	254589-4	254589-5
Your Reference	UNITS	MW1	MW2	MW3	MW4	MW5
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Type of sample		water	water	water	water	water
Date prepared	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Date analysed	-	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020
Arsenic-Dissolved	µg/L	7	2	<1	1	13
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	0.9
Chromium-Dissolved	µg/L	1	<1	1	<1	29
Copper-Dissolved	µg/L	28	33	17	42	70
Lead-Dissolved	µg/L	2	<1	3	1	4
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	8	4	9	6	590
Zinc-Dissolved	µg/L	250	230	160	77	2,900

Miscellaneous Inorganics						
Our Reference		254589-1	254589-2	254589-3	254589-4	254589-5
Your Reference	UNITS	MW1	MW2	MW3	MW4	MW5
Date Sampled		29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Type of sample		water	water	water	water	water
Date prepared	-	29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
Date analysed	-	29/10/2020	29/10/2020	29/10/2020	29/10/2020	29/10/2020
pH	pH Units	6.6	6.0	6.0	5.8	3.7
Chloride, Cl	mg/L	270	320	86	220	740
Sulphate, SO4	mg/L	290	<1	65	67	2,700
Total Organic Carbon	mg/L	200	11	9	3	20

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-079	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-020	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-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	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.

QUALITY CONTROL: vTRH in Water (C6-C9) NEPM						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			30/10/2020	[NT]	[NT]	[NT]	[NT]	30/10/2020	[NT]
Date analysed	-			02/11/2020	[NT]	[NT]	[NT]	[NT]	02/11/2020	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	84	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	84	[NT]
Surrogate Dibromofluoromethane	%		Org-023	100	[NT]	[NT]	[NT]	[NT]	102	[NT]
Surrogate toluene-d8	%		Org-023	98	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate 4-BFB	%		Org-023	100	[NT]	[NT]	[NT]	[NT]	103	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	254589-2
Date extracted	-			02/11/2020	1	02/11/2020	02/11/2020		02/11/2020	02/11/2020
Date analysed	-			03/11/2020	1	04/11/2020	04/11/2020		03/11/2020	03/11/2020
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	1	<50	<50	0	104	89
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	1	<100	<100	0	88	85
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	1	<100	<100	0	82	77
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	1	<50	<50	0	104	89
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	1	<100	<100	0	88	85
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	1	<100	<100	0	82	77
Surrogate o-Terphenyl	%		Org-020	96	1	103	88	16	115	94

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	254589-2
Date extracted	-			02/11/2020	1	02/11/2020	02/11/2020		02/11/2020	02/11/2020
Date analysed	-			02/11/2020	1	02/11/2020	02/11/2020		02/11/2020	02/11/2020
Naphthalene	µg/L	1	Org-022/025	<1	1	<1	<1	0	98	111
Acenaphthylene	µg/L	1	Org-022/025	<1	1	<1	<1	0	[NT]	[NT]
Acenaphthene	µg/L	1	Org-022/025	<1	1	<1	<1	0	100	107
Fluorene	µg/L	1	Org-022/025	<1	1	<1	<1	0	105	121
Phenanthrene	µg/L	1	Org-022/025	<1	1	<1	<1	0	102	106
Anthracene	µg/L	1	Org-022/025	<1	1	<1	<1	0	[NT]	[NT]
Fluoranthene	µg/L	1	Org-022/025	<1	1	<1	<1	0	90	105
Pyrene	µg/L	1	Org-022/025	<1	1	<1	<1	0	95	111
Benzo(a)anthracene	µg/L	1	Org-022/025	<1	1	<1	<1	0	[NT]	[NT]
Chrysene	µg/L	1	Org-022/025	<1	1	<1	<1	0	108	132
Benzo(b,j+k)fluoranthene	µg/L	2	Org-022/025	<2	1	<2	<2	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-022/025	<1	1	<1	<1	0	100	120
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-022/025	<1	1	<1	<1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-022/025	<1	1	<1	<1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-022/025	<1	1	<1	<1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	84	1	88	90	2	89	85

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			02/11/2020	1	02/11/2020	02/11/2020		02/11/2020	[NT]
Date analysed	-			02/11/2020	1	02/11/2020	02/11/2020		02/11/2020	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	7	7	0	94	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	89	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	1	1	0	97	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	28	29	4	109	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	106	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	93	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	8	8	0	97	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	250	230	8	105	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	254589-2
Date prepared	-			29/10/2020	1	29/10/2020	29/10/2020		29/10/2020	29/10/2020
Date analysed	-			29/10/2020	1	29/10/2020	29/10/2020		29/10/2020	29/10/2020
pH	pH Units		Inorg-001	[NT]	1	6.6	[NT]		101	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	270	270	0	89	#
Sulphate, SO4	mg/L	1	Inorg-081	<1	1	290	300	3	110	75
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	200	190	5	105	116

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

MISC_INORG
Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Envirolab Services Pty Ltd
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customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Consulting Earth Scientists Pty Ltd
Attention	Andrew Carras

Sample Login Details

Your reference	CES200502
Envirolab Reference	254589-A
Date Sample Received	29/10/2020
Date Instructions Received	11/11/2020
Date Results Expected to be Reported	18/11/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	6 water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	15.4
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	vTRH in Water (C6-C9) NEPM	svTRH (C10-C40) in Water	PAHsin Water	HM in water - dissolved	pH	Chloride, Cl	Sulphate, SO4	Total Organic Carbon	On Hold
MW1									✓
MW2									✓
MW3	✓	✓	✓	✓	✓	✓	✓	✓	
MW4									✓
MW5									✓
MW3 - [DUPLICATE]	✓	✓	✓	✓	✓	✓	✓	✓	

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

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Andrew (Fitzy) Fitzsimons

From: Nancy Zhang
Sent: Wednesday, 11 November 2020 5:42 PM
To: Andrew (Fitzy) Fitzsimons
Cc: Samplereceipt Distribution
Subject: FW: Results for Registration 254589 CES200502

Follow Up Flag: Follow up
Flag Status: Flagged

254589 - A
Due: 18/11/20

A job, please.

From: andrew.carras@consultingearth.com.au <andrew.carras@consultingearth.com.au>
Sent: Wednesday, 11 November 2020 3:18 PM
To: Nancy Zhang <NZhang@envirolab.com.au>
Cc: Mark Challoner <mark.challoner@consultingearth.com.au>
Subject: RE: Results for Registration 254589 CES200502

Hi Nancy,

As discussed could you please split MW3 and run both for all analytes in 254589?

Kind regards,
Andrew

From: Nancy Zhang <NZhang@envirolab.com.au>
Sent: Thursday, 5 November 2020 4:27 PM
To: andrew.carras@consultingearth.com.au; kay.lowe@consultingearth.com.au
Subject: Results for Registration 254589 CES200502

Please refer to attached for:
a copy of the Certificate of Analysis
a copy of the COC/paperwork received from you
ESDAT Extracts
an Excel or .csv file containing the results
a copy of the Invoice

Please note that a hard copy will not be posted.

Enquiries should be made directly to:
customerservice@envirolab.com.au

How did we do? Send Feedback

Kind Regards,

Nancy Zhang | Laboratory Manager, Sydney | Envirolab Services

Celebrating 15 years of **Great Science. Great Service.**

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CERTIFICATE OF ANALYSIS 250828

Client Details

Client	Consulting Earth Scientists Pty Ltd
Attention	Andrew Carras
Address	Suite 3, Level 1, 55 Grandview Street, Pymble, NSW, 2073

Sample Details

Your Reference	**CES200502-PHB**
Number of Samples	46 Soil, 1 Water
Date samples received	09/09/2020
Date completed instructions received	10/09/2020

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	16/09/2020
Date of Issue	16/09/2020

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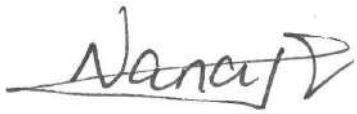
Asbestos Approved By
Analysed by Asbestos Approved Identifier: Nyovan Moonean
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Dragana Tomas, Senior Chemist
Hannah Nguyen, Senior Chemist
Jaimie Loa-Kum-Cheung, Metals Supervisor
Josh Williams, Senior Chemist
Lucy Zhu, Asbestos Supervisor
Nick Sarlamis, Inorganics Supervisor
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		250828-2	250828-3	250828-4	250828-6	250828-7
Your Reference	UNITS	SB7/0.5	SB8/0.1	SB9/0.1	SB10/0.1	SB11/0.1
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	93	93	88	88	84

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		250828-11	250828-15	250828-21	250828-24	250828-29
Your Reference	UNITS	SB12/1.5	SB13/1.0	SB14/1.0	SB15/0.5	SB16/1.0
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	89	91	87	94	84

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		250828-32	250828-39	250828-40	250828-41	250828-42
Your Reference	UNITS	SB17/0.1	G2	G3	G4	MW2/1.0
Date Sampled		08/09/2020	07/08/2020	08/09/2020	08/09/2020	07/08/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	95	92	92	89	91

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		250828-43	250828-46	250828-47
Your Reference	UNITS	MW3/3.0	TS	TB
Date Sampled		08/09/2020	07/08/2020	07/08/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020
TRH C_6 - C_9	mg/kg	<25	[NA]	<25
TRH C_6 - C_{10}	mg/kg	<25	[NA]	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	[NA]	<25
Benzene	mg/kg	<0.2	116%	<0.2
Toluene	mg/kg	<0.5	112%	<0.5
Ethylbenzene	mg/kg	<1	100%	<1
m+p-xylene	mg/kg	<2	99%	<2
o-Xylene	mg/kg	<1	100%	<1
naphthalene	mg/kg	<1	[NA]	<1
Total +ve Xylenes	mg/kg	<3	[NA]	<3
Surrogate aaa-Trifluorotoluene	%	90	90	94

svTRH (C10-C40) in Soil						
Our Reference		250828-2	250828-3	250828-4	250828-6	250828-7
Your Reference	UNITS	SB7/0.5	SB8/0.1	SB9/0.1	SB10/0.1	SB11/0.1
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	12/09/2020	12/09/2020	12/09/2020	12/09/2020	12/09/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	90	83	81	93	82

svTRH (C10-C40) in Soil						
Our Reference		250828-11	250828-15	250828-21	250828-24	250828-29
Your Reference	UNITS	SB12/1.5	SB13/1.0	SB14/1.0	SB15/0.5	SB16/1.0
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	12/09/2020	12/09/2020	12/09/2020	12/09/2020	12/09/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	77	74	77	75	84

svTRH (C10-C40) in Soil						
Our Reference		250828-32	250828-39	250828-40	250828-41	250828-42
Your Reference	UNITS	SB17/0.1	G2	G3	G4	MW2/1.0
Date Sampled		08/09/2020	07/08/2020	08/09/2020	08/09/2020	07/08/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	12/09/2020	12/09/2020	12/09/2020	12/09/2020	12/09/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	85	74	83	88	79

svTRH (C10-C40) in Soil			
Our Reference		250828-43	250828-47
Your Reference	UNITS	MW3/3.0	TB
Date Sampled		08/09/2020	07/08/2020
Type of sample		Soil	Soil
Date extracted	-	11/09/2020	11/09/2020
Date analysed	-	12/09/2020	12/09/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	87	82

PAHs in Soil						
Our Reference		250828-2	250828-3	250828-4	250828-6	250828-7
Your Reference	UNITS	SB7/0.5	SB8/0.1	SB9/0.1	SB10/0.1	SB11/0.1
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	101	96	95	96	95

PAHs in Soil						
Our Reference		250828-11	250828-15	250828-21	250828-24	250828-29
Your Reference	UNITS	SB12/1.5	SB13/1.0	SB14/1.0	SB15/0.5	SB16/1.0
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	0.3	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	0.3	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	0.3	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	0.2	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	1.9	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	98	96	100	94	102

PAHs in Soil						
Our Reference		250828-32	250828-39	250828-40	250828-41	250828-42
Your Reference	UNITS	SB17/0.1	G2	G3	G4	MW2/1.0
Date Sampled		08/09/2020	07/08/2020	08/09/2020	08/09/2020	07/08/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	0.08	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	0.4	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	99	98	101	99	99

PAHs in Soil			
Our Reference		250828-43	250828-47
Your Reference	UNITS	MW3/3.0	TB
Date Sampled		08/09/2020	07/08/2020
Type of sample		Soil	Soil
Date extracted	-	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	99	103

Acid Extractable metals in soil						
Our Reference		250828-2	250828-3	250828-4	250828-6	250828-7
Your Reference	UNITS	SB7/0.5	SB8/0.1	SB9/0.1	SB10/0.1	SB11/0.1
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	5	2	5	6	10
Copper	mg/kg	14	<1	2	4	5
Lead	mg/kg	10	<1	2	3	4
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	3	<1	2	4	6
Zinc	mg/kg	30	2	8	17	14
Iron	mg/kg	3,600	570	1,700	4,400	7,100

Acid Extractable metals in soil						
Our Reference		250828-11	250828-15	250828-21	250828-24	250828-29
Your Reference	UNITS	SB12/1.5	SB13/1.0	SB14/1.0	SB15/0.5	SB16/1.0
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	5	6	35	4	22
Copper	mg/kg	3	10	17	5	13
Lead	mg/kg	3	10	11	8	11
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	1	4	8	4	16
Zinc	mg/kg	5	33	13	32	31
Iron	mg/kg	1,100	5,600	8,700	8,000	11,000

Acid Extractable metals in soil						
Our Reference		250828-32	250828-39	250828-40	250828-41	250828-42
Your Reference	UNITS	SB17/0.1	G2	G3	G4	MW2/1.0
Date Sampled		08/09/2020	07/08/2020	08/09/2020	08/09/2020	07/08/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	2	12	21	21	5
Copper	mg/kg	<1	6	12	17	6
Lead	mg/kg	<1	5	11	17	2
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<1	5	10	10	2
Zinc	mg/kg	3	13	47	110	5
Iron	mg/kg	800	7,200	13,000	9,400	4,500

Acid Extractable metals in soil				
Our Reference		250828-43	250828-47	250828-48
Your Reference	UNITS	MW3/3.0	TB	SB7/0.5 - [TRIPLICATE]
Date Sampled		08/09/2020	07/08/2020	08/09/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020
Arsenic	mg/kg	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	21	<1	6
Copper	mg/kg	13	<1	15
Lead	mg/kg	11	<1	8
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	8	<1	3
Zinc	mg/kg	43	<1	24
Iron	mg/kg	8,000	660	3,600

Moisture						
Our Reference		250828-2	250828-3	250828-4	250828-6	250828-7
Your Reference	UNITS	SB7/0.5	SB8/0.1	SB9/0.1	SB10/0.1	SB11/0.1
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Moisture	%	35	14	9.1	15	21

Moisture						
Our Reference		250828-11	250828-15	250828-21	250828-24	250828-29
Your Reference	UNITS	SB12/1.5	SB13/1.0	SB14/1.0	SB15/0.5	SB16/1.0
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Moisture	%	18	12	32	7.6	39

Moisture						
Our Reference		250828-32	250828-39	250828-40	250828-41	250828-42
Your Reference	UNITS	SB17/0.1	G2	G3	G4	MW2/1.0
Date Sampled		08/09/2020	07/08/2020	08/09/2020	08/09/2020	07/08/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Moisture	%	6.8	9.2	25	28	18

Moisture		
Our Reference		250828-43
Your Reference	UNITS	MW3/3.0
Date Sampled		08/09/2020
Type of sample		Soil
Date prepared	-	11/09/2020
Date analysed	-	14/09/2020
Moisture	%	27

sPOCAS + %S w/w			
Our Reference	UNITS	250828-42	250828-43
Your Reference		MW2/1.0	MW3/3.0
Date Sampled		07/08/2020	08/09/2020
Type of sample		Soil	Soil
Date prepared	-	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020
pH $_{kcl}$	pH units	4.1	4.3
TAA pH 6.5	moles H^+ /t	22	30
s-TAA pH 6.5	%w/w S	0.03	0.05
pH $_{Ox}$	pH units	4.2	3.7
TPA pH 6.5	moles H^+ /t	31	100
s-TPA pH 6.5	%w/w S	0.05	0.16
TSA pH 6.5	moles H^+ /t	9	70
s-TSA pH 6.5	%w/w S	0.02	0.11
ANC_E	% $CaCO_3$	NA	NA
a-ANC_E	moles H^+ /t	NA	NA
s-ANC_E	%w/w S	NA	NA
S_{KCl}	%w/w S	0.009	0.02
S_P	%w/w	0.02	0.04
S_{POS}	%w/w	0.009	0.03
a-S_{POS}	moles H^+ /t	5	17
Ca_{KCl}	%w/w	0.005	0.1
Ca_P	%w/w	0.007	0.11
Ca_A	%w/w	<0.005	0.010
Mg_{KCl}	%w/w	<0.005	0.040
Mg_P	%w/w	0.011	0.049
Mg_A	%w/w	0.010	0.009
S_{HCl}	%w/w S	0.019	0.023
S_{NAS}	%w/w S	0.010	0.006
a-S_{NAS}	moles H^+ /t	<5	<5
s-S_{NAS}	%w/w S	<0.01	<0.01
Fineness Factor	-	1.5	1.5
a-Net Acidity	moles H^+ /t	32	50
s-Net Acidity	%w/w S	0.05	0.08
Liming rate	kg $CaCO_3$ /t	2.4	3.8
s-Net Acidity without -ANCE	%w/w S	0.051	0.081
a-Net Acidity without ANCE	moles H^+ /t	32	50
Liming rate without ANCE	kg $CaCO_3$ /t	2.4	3.8

Asbestos ID - soils NEPM - ASB-001						
Our Reference	UNITS	250828-4	250828-6	250828-7	250828-15	250828-29
Your Reference		SB9/0.1	SB10/0.1	SB11/0.1	SB13/1.0	SB16/1.0
Date Sampled		08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Sample mass tested	g	664.15	625.61	686.91	339.17	361.96
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Grey coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–	–
FA and AF Estimation*	g	–	–	–	–	–
ACM >7mm Estimation*	%(w/w)	<0.01	<0.01	<0.01	<0.01	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001	<0.001

Asbestos ID - soils NEPM - ASB-001					
Our Reference		250828-32	250828-39	250828-40	250828-41
Your Reference	UNITS	SB17/0.1	G2	G3	G4
Date Sampled		08/09/2020	07/08/2020	08/09/2020	08/09/2020
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Sample mass tested	g	558.73	515.25	479.11	405.79
Sample Description	-	Brown sandy soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos#1	g/kg	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–
FA and AF Estimation*	g	–	–	–	–
ACM >7mm Estimation*	%(w/w)	<0.01	<0.01	<0.01	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001

vTRH(C6-C10)/BTEXN in Water		
Our Reference	UNITS	250828-45
Your Reference		RB1
Date Sampled		08/09/2020
Type of sample		Water
Date extracted	-	10/09/2020
Date analysed	-	11/09/2020
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	100
Surrogate toluene-d8	%	99
Surrogate 4-BFB	%	97

svTRH (C10-C40) in Water		
Our Reference	UNITS	250828-45
Your Reference		RB1
Date Sampled		08/09/2020
Type of sample		Water
Date extracted	-	16/09/2020
Date analysed	-	16/09/2020
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Surrogate o-Terphenyl	%	97

PAHs in Water		
Our Reference	UNITS	250828-45
Your Reference		RB1
Date Sampled		08/09/2020
Type of sample		Water
Date extracted	-	16/09/2020
Date analysed	-	16/09/2020
Naphthalene	µg/L	<1
Acenaphthylene	µg/L	<1
Acenaphthene	µg/L	<1
Fluorene	µg/L	<1
Phenanthrene	µg/L	<1
Anthracene	µg/L	<1
Fluoranthene	µg/L	<1
Pyrene	µg/L	<1
Benzo(a)anthracene	µg/L	<1
Chrysene	µg/L	<1
Benzo(b,j+k)fluoranthene	µg/L	<2
Benzo(a)pyrene	µg/L	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1
Dibenzo(a,h)anthracene	µg/L	<1
Benzo(g,h,i)perylene	µg/L	<1
Benzo(a)pyrene TEQ	µg/L	<5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	84

Metals in Waters - Acid extractable		
Our Reference		250828-45
Your Reference	UNITS	RB1
Date Sampled		08/09/2020
Type of sample		Water
Date prepared	-	11/09/2020
Date analysed	-	11/09/2020
Arsenic - Total	mg/L	<0.05
Cadmium - Total	mg/L	<0.01
Chromium - Total	mg/L	<0.01
Copper - Total	mg/L	<0.01
Lead - Total	mg/L	<0.03
Mercury - Total	mg/L	<0.0005
Nickel - Total	mg/L	<0.02
Zinc - Total	mg/L	<0.02

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.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
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-020	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-020	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).

Method ID	Methodology Summary
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/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-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	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-023	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-9	250828-4
Date extracted	-			11/09/2020	2	11/09/2020	11/09/2020		11/09/2020	11/09/2020
Date analysed	-			11/09/2020	2	11/09/2020	11/09/2020		11/09/2020	11/09/2020
TRH C_6 - C_9	mg/kg	25	Org-023	<25	2	<25	<25	0	104	97
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	2	<25	<25	0	104	97
Benzene	mg/kg	0.2	Org-023	<0.2	2	<0.2	<0.2	0	102	88
Toluene	mg/kg	0.5	Org-023	<0.5	2	<0.5	<0.5	0	103	89
Ethylbenzene	mg/kg	1	Org-023	<1	2	<1	<1	0	93	112
m+p-xylene	mg/kg	2	Org-023	<2	2	<2	<2	0	112	99
o-Xylene	mg/kg	1	Org-023	<1	2	<1	<1	0	98	88
naphthalene	mg/kg	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	102	2	93	82	13	113	94

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	39	11/09/2020	11/09/2020		[NT]	[NT]
Date analysed	-			[NT]	39	11/09/2020	11/09/2020		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	[NT]	39	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	[NT]	39	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-023	[NT]	39	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-023	[NT]	39	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-023	[NT]	39	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-023	[NT]	39	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-023	[NT]	39	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-023	[NT]	39	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	[NT]	39	92	96	4	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-9	250828-4
Date extracted	-			11/09/2020	2	11/09/2020	11/09/2020		11/09/2020	11/09/2020
Date analysed	-			12/09/2020	2	12/09/2020	12/09/2020		12/09/2020	12/09/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	2	<50	<50	0	105	103
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	2	<100	<100	0	89	89
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	2	<100	<100	0	95	92
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	2	<50	<50	0	105	103
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	2	<100	<100	0	89	89
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	2	<100	<100	0	95	92
Surrogate o-Terphenyl	%		Org-020	86	2	90	91	1	112	115

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	39	11/09/2020	11/09/2020		[NT]	[NT]
Date analysed	-			[NT]	39	12/09/2020	12/09/2020		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	[NT]	39	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	[NT]	39	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	[NT]	39	<100	<100	0	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	[NT]	39	<50	<50	0	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	[NT]	39	<100	<100	0	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	[NT]	39	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-020	[NT]	39	74	74	0	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-9	250828-4
Date extracted	-			11/09/2020	2	11/09/2020	11/09/2020		11/09/2020	11/09/2020
Date analysed	-			11/09/2020	2	11/09/2020	11/09/2020		11/09/2020	11/09/2020
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	108	103
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	91	86
Fluorene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	98	93
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	99	95
Anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	100	95
Pyrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	104	98
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	112	106
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	2	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	2	<0.05	<0.05	0	102	97
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	95	2	101	98	3	102	97

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	39	11/09/2020	11/09/2020		[NT]	[NT]
Date analysed	-			[NT]	39	11/09/2020	11/09/2020		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	[NT]	39	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	[NT]	39	<0.05	<0.05	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	[NT]	39	98	97	1	[NT]	[NT]

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-11	250828-4
Date prepared	-			11/09/2020	2	11/09/2020	11/09/2020		11/09/2020	11/09/2020
Date analysed	-			11/09/2020	2	11/09/2020	11/09/2020		11/09/2020	11/09/2020
Arsenic	mg/kg	4	Metals-020	<4	2	<4	<4	0	105	91
Cadmium	mg/kg	0.4	Metals-020	<0.4	2	<0.4	<0.4	0	100	78
Chromium	mg/kg	1	Metals-020	<1	2	5	3	50	91	83
Copper	mg/kg	1	Metals-020	<1	2	14	6	80	93	94
Lead	mg/kg	1	Metals-020	<1	2	10	6	50	91	85
Mercury	mg/kg	0.1	Metals-021	<0.1	2	<0.1	<0.1	0	91	80
Nickel	mg/kg	1	Metals-020	<1	2	3	1	100	92	77
Zinc	mg/kg	1	Metals-020	<1	2	30	17	55	90	83
Iron	mg/kg	10	Metals-020	<10	2	3600	2300	44	93	#

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	39	11/09/2020	11/09/2020		[NT]	[NT]
Date analysed	-			[NT]	39	11/09/2020	11/09/2020		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	39	<4	<4	0	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	39	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	39	12	12	0	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	39	6	6	0	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	39	5	5	0	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	39	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	39	5	5	0	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	39	13	13	0	[NT]	[NT]
Iron	mg/kg	10	Metals-020	[NT]	39	7200	6500	10	[NT]	[NT]

QUALITY CONTROL: sPOCAS + %S w/w						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-9	[NT]
Date prepared	-			14/09/2020	42	14/09/2020	14/09/2020		14/09/2020	[NT]
Date analysed	-			14/09/2020	42	14/09/2020	14/09/2020		14/09/2020	[NT]
pH $_{kcl}$	pH units		Inorg-064	[NT]	42	4.1	4.1	0	97	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-064	<5	42	22	22	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	42	0.03	0.04	29	[NT]	[NT]
pH $_{Ox}$	pH units		Inorg-064	[NT]	42	4.2	3.8	10	105	[NT]
TPA pH 6.5	moles H^+ /t	5	Inorg-064	<5	42	31	45	37	86	[NT]
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	42	0.05	0.07	33	[NT]	[NT]
TSA pH 6.5	moles H^+ /t	5	Inorg-064	<5	42	9	23	88	[NT]	[NT]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	42	0.02	0.04	67	[NT]	[NT]
ANC_E	% $CaCO_3$	0.05	Inorg-064	<0.05	42	NA	NA		[NT]	[NT]
a-ANC_E	moles H^+ /t	5	Inorg-064	<5	42	NA	NA		[NT]	[NT]
s-ANC_E	%w/w S	0.05	Inorg-064	<0.05	42	NA	NA		[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-064	<0.005	42	0.009	0.009	0	[NT]	[NT]
S_P	%w/w	0.005	Inorg-064	<0.005	42	0.02	0.02	0	[NT]	[NT]
S_{POS}	%w/w	0.005	Inorg-064	<0.005	42	0.009	0.009	0	[NT]	[NT]
a-S_{POS}	moles H^+ /t	5	Inorg-064	<5	42	5	5	0	[NT]	[NT]
Ca_{KCl}	%w/w	0.005	Inorg-064	<0.005	42	0.005	0.007	33	[NT]	[NT]
Ca_P	%w/w	0.005	Inorg-064	<0.005	42	0.007	0.007	0	[NT]	[NT]
Ca_A	%w/w	0.005	Inorg-064	<0.005	42	<0.005	<0.005	0	[NT]	[NT]
Mg_{KCl}	%w/w	0.005	Inorg-064	<0.005	42	<0.005	<0.005	0	[NT]	[NT]
Mg_P	%w/w	0.005	Inorg-064	<0.005	42	0.011	0.012	9	[NT]	[NT]
Mg_A	%w/w	0.005	Inorg-064	<0.005	42	0.010	0.011	10	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-064	<0.005	42	0.019	0.019	0	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-064	<0.005	42	0.010	0.010	0	[NT]	[NT]
a-S_{NAS}	moles H^+ /t	5	Inorg-064	<5	42	<5	<5	0	[NT]	[NT]
s-S_{NAS}	%w/w S	0.01	Inorg-064	<0.01	42	<0.01	<0.01	0	[NT]	[NT]
Fineness Factor	-	1.5	Inorg-064	<1.5	42	1.5	1.5	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-064	<5	42	32	33	3	[NT]	[NT]
s-Net Acidity	%w/w S	0.01	Inorg-064	<0.01	42	0.05	0.05	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-064	<0.75	42	2.4	2.5	4	[NT]	[NT]
s-Net Acidity without -ANCE	%w/w S	0.01	Inorg-064	<0.01	42	0.051	0.052	2	[NT]	[NT]

QUALITY CONTROL: sPOCAS + %S w/w						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-9	[NT]
a-Net Acidity without ANCE	moles H^+/t	5	Inorg-064	<5	42	32	33	3	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	42	2.4	2.5	4	[NT]	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date extracted	-			11/09/2020	[NT]	[NT]	[NT]	[NT]	10/09/2020	[NT]
Date analysed	-			11/09/2020	[NT]	[NT]	[NT]	[NT]	11/09/2020	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	110	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	110	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	114	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	115	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	108	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	98	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate toluene-d8	%		Org-023	99	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate 4-BFB	%		Org-023	96	[NT]	[NT]	[NT]	[NT]	95	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			16/09/2020	[NT]	[NT]	[NT]	[NT]	16/09/2020	[NT]
Date analysed	-			16/09/2020	[NT]	[NT]	[NT]	[NT]	16/09/2020	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	87	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	87	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]
Surrogate o-Terphenyl	%		Org-020	74	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			16/09/2020	[NT]	[NT]	[NT]	[NT]	16/09/2020	[NT]
Date analysed	-			16/09/2020	[NT]	[NT]	[NT]	[NT]	16/09/2020	[NT]
Naphthalene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	85	[NT]
Acenaphthylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Fluorene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Phenanthrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	89	[NT]
Benzo(a)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Benzo(b,j+k)fluoranthene	µg/L	2	Org-022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	81	[NT]	[NT]	[NT]	[NT]	86	[NT]

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			11/09/2020	[NT]	[NT]	[NT]	[NT]	11/09/2020	[NT]
Date analysed	-			11/09/2020	[NT]	[NT]	[NT]	[NT]	11/09/2020	[NT]
Arsenic - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	95	[NT]
Cadmium - Total	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	94	[NT]
Chromium - Total	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	94	[NT]
Copper - Total	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	101	[NT]
Lead - Total	mg/L	0.03	Metals-020	<0.03	[NT]	[NT]	[NT]	[NT]	101	[NT]
Mercury - Total	mg/L	0.0005	Metals-021	<0.0005	[NT]	[NT]	[NT]	[NT]	100	[NT]
Nickel - Total	mg/L	0.02	Metals-020	<0.02	[NT]	[NT]	[NT]	[NT]	99	[NT]
Zinc - Total	mg/L	0.02	Metals-020	<0.02	[NT]	[NT]	[NT]	[NT]	98	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Note: All samples analysed as received. However, samples 250828-15, 29, 32, 39, 40, 41 are below the minimum 500mL sample volume as per National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.

Acid Extractable Metals in Soil:
-The laboratory RPD acceptance criteria has been exceeded for 250828-2 for Cu,Pb,Zn and Fe. Therefore a triplicate result has been issued as laboratory sample number 250828-48.
-# Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

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SAMPLE RECEIPT ADVICE

Client Details

Client	Consulting Earth Scientists Pty Ltd
Attention	Andrew Carras

Sample Login Details

Your reference	CES200502-PHB
Envirolab Reference	250828
Date Sample Received	09/09/2020
Date Instructions Received	09/09/2020
Date Results Expected to be Reported	16/09/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	46 Soil, 1 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	9.3
Cooling Method	Ice, Ice pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Acid Extractable metalsin soil	sPOCAS + %S w/w	Asbestos ID - soils NEPM - ASB-001	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHsin Water	HM in water - dissolved	On Hold
SB7/0.1											✓
SB7/0.5	✓	✓	✓	✓							
SB8/0.1											✓
SB9/0.1	✓	✓	✓	✓		✓					
SB9/0.5											✓
SB10/0.1	✓	✓	✓	✓		✓					
SB11/0.1	✓	✓	✓	✓		✓					
SB12/0.1											✓
SB12/0.5											✓
SB12/1.0											✓
SB12/1.5	✓	✓	✓	✓							
SB12/2.0											✓
SB13/0.1											✓
SB13/0.5											✓
SB13/1.0	✓	✓	✓	✓		✓					
SB13/1.5											✓
SB13/2.0											✓
SB13/2.5											✓
SB14/0.1											✓
SB14/0.5											✓
SB14/1.0	✓	✓	✓	✓							
SB14/1.5											✓
SB15/0.1											✓
SB15/0.5	✓	✓	✓	✓		✓					
SB15/1.0											✓
SB15/2.0											✓
SB16/0.1											✓
SB16/0.5											✓
SB16/1.0	✓	✓	✓	✓		✓					
SB16/1.5											✓
SB16/2.0											✓
SB17/0.1	✓	✓	✓	✓		✓					

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Acid Extractable metalsin soil	sPOCAS + %S w/w	Asbestos ID - soils NEPM - ASB-001	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHsin Water	HM in water - dissolved	On Hold
SB17/0.5											✓
QS3											✓
QS3A											✓
QS4											✓
QS4A											✓
G1											✓
G2	✓	✓	✓	✓		✓					
G3	✓	✓	✓	✓		✓					
G4	✓	✓	✓	✓		✓					
MW2/1.0	✓	✓	✓	✓	✓						
MW3/3.0	✓	✓	✓	✓	✓						
MW3/10.0											✓
RB1							✓	✓	✓	✓	
TS	✓										
TB	✓	✓	✓	✓							

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

Additional Info

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

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

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

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

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP – National phone number 1300 42 43 44

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Client: Consulting Earth Scientists
Contact Person: A.Carras
Project Mgr A.Carras
Sampler: A.Carras
Address: Level 1 Suite 3, 55-65 Grandview Street, Pymble NSW

Phone: (02) 8569 2200 Mob: 0497 018 918
Email: andrew.carras@consultingearth.com.au

Client Project Name / Number / Site etc (to report title): CES200502-PHB
PO No.:
Envirolab Quote No.:
Date results required:
Or choose: **standard** / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
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	Combo 3a (NEPM WA Asb)	Combination 3	VTRH/BTEX	NEPM 2013 - Soil Characterisation	SPOCAS										Hold	Provide as much information about the sample as you can
1	SB7/0.1		8/09/2020	Soil															X	1 chem, 1 asb
2	SB7/0.5		8/09/2020	Soil		X														1 chem
3	SB8/0.1		8/09/2020	Soil															X	1 chem
4	SB8/0.5		8/09/2020	Soil		X														1 chem
5	SB9/0.1		8/09/2020	Soil	X															1 chem, 1asb
6	SB9/0.5		8/09/2020	Soil															X	1 chem
7	SB10/0.1		8/09/2020	Soil	X															1 chem, 1 asb
8	SB11/0.1		8/09/2020	Soil	X															1 chem, 1 asb
9	SB12/0.1		8/09/2020	Soil															X	1 chem, 1 asb
9	SB12/0.5		8/09/2020	Soil															X	1 chem, 1 asb
10	SB12/1.0		8/09/2020	Soil															X	1 chem
11	SB12/1.5		8/09/2020	Soil		X														1 chem
12	SB12/2.0		8/09/2020	Soil															X	1 chem
13	SB13/0.1		8/09/2020	Soil															X	1 chem, 1 asb
14	SB13/0.5		8/09/2020	Soil															X	1 chem, 1 asb
15	SB13/1.0		8/09/2020	Soil	X															1 chem, 1 asb
16	SB13/1.5		8/09/2020	Soil															X	1 chem
17	SB13/2.0		8/09/2020	Soil															X	1 chem
18	SB13/2.5		8/09/2020	Soil															X	1 chem
19	SB14/0.1		8/09/2020	Soil															X	1 cehm, 1 asb
20	SB14/0.5		8/09/2020	Soil															X	1 chem
21	SB14/1.0		8/09/2020	Soil		X														1 chem
22	SB14/1.5		8/09/2020	Soil															X	1 chem
23	SB15/0.1		8/09/2020	Soil															X	1 chem, 1 asb
24	SB15/0.5		8/09/2020	Soil	X															1 chem, 1 asb
25	SB15/1.0		8/09/2020	Soil															X	1 chem, 1 asb
NR	SB15/1.5		8/09/2020	Soil															X	1 chem
26	SB15/2.0		8/09/2020	Soil															X	1 chem
27	SB16/0.1		8/09/2020	Soil															X	1 chem, 1 asb
28	SB16/0.5		8/09/2020	Soil															X	1 chem, 1 asb
29	SB16/1.0		8/09/2020	Soil	X															1 chem, 1 asb
30	SB16/1.5		8/09/2020	Soil															X	1 chem
31	SB16/2.0		8/09/2020	Soil															X	1 chem
32	SB17/0.1		8/09/2020	Soil	X															1 chem, 1 asb
33	SB17/0.5		8/09/2020	Soil															X	1 chem
34	QS3		8/09/2020	Soil															X	1 chem
35	QS3A		8/09/2020	Soil															X	1 chem
36	QS4		8/09/2020	Soil															X	1 chem
37	QS4A		8/09/2020	Soil															X	1 chem
38	G1		7/08/2020	Soil															X	1 chem, 1 asb
39	G2		7/08/2020	Soil	X															1 chem, 1 asb
40	G3		8/09/2020	Soil	X															1 chem, 1 asb
41	G4		8/09/2020	Soil	X															1 chem, 1 asb
42	MW2/1.0		7/08/2020	Soil		X			X											1 chem, 1 ASS
43	MW3/3.0		8/09/2020	Soil		X			X											1 chem, 1 ASS
44	MW3/10.0		8/09/2020	Soil															X	1 ASS
45	RB1		8/09/2020	Water		X														Total Metals
46	TS		7/08/2020	Soil			X													
47	TB		7/08/2020	Soil		X														

Relinquished by (Company):	CES	Received by (Company):	ES
Print Name:	A.Carras	Print Name:	Michael Opie
Date & Time:	9-Sep-20	Date & Time:	9.9.20 1100
Signature:		Signature:	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 9.3 (if applicable)
Transported by: Hand delivered / courier

White - Lab copy / Blue - Client copy / Pink - Retain in Book

Page No:

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

Job No: 25082 P
Date Received: 9.9.20
Time Received: 1100
Received By: MO
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None