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Report on
Preliminary Site Investigation (Contamination)

Proposed UNSW Biomedical Science Building
Wagga Wagga Base Hospital, Wagga Wagga

Prepared for
University of New South Wales

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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1. Introduction

Douglas Partners Pty Ltd (DP) was commissioned by University of New South Wales (UNSW) to undertake a Preliminary Site Investigation (PSI) for contamination for the proposed UNSW Biomedical Science Building located at the corner of Edward Street and Lewis Drive, Wagga Wagga (the site as shown on Drawing 1, Appendix A). The site forms part of the Wagga Wagga Base Hospital (WWBH). The investigation was carried out with reference to DP's Proposal SYD191324.Rev1 issued January 2020.

The site is currently occupied by a car park, and it is understood that the land is proposed to be transferred from WWBH to UNSW, thus requiring a PSI to be completed. Based on architectural drawings provided to DP, the proposed development is to comprise a three-level biomedical science building (including ground level). Copies of the architectural plans are included in Appendix A.

DP has previously completed contamination and geotechnical investigations for the broader WWBH site (see Section 5 for further details). The current investigation comprised a review of relevant previous investigations and limited site history information, a site walkover, intrusive sampling, laboratory analysis for contaminants of concern and interpretation of results with reference to current NSW EPA guidelines. The purpose of this investigation is to evaluate the contamination status of the site and its suitability, from a contamination standpoint, for the proposed development, and to provide recommendations for further works, if deemed necessary.

2. Scope of Work

DP carried out the following scope of works:

- Review of published geological, topographic, hydrogeological and acid sulfate soil (ASS) risk maps;
- Review of relevant previous investigations;
- Review of key site history information including:
  - Available historical aerial photographs;
  - Recent aerial imagery obtained through Nearmap; and
  - NSW EPA public registers for notices and licences issued under the Contaminated Land Management Act 1997 (CLM Act) and the Protection of the Environment Operations Act 1997 (PEOA Act).
- A site walkover to observe current land use and assess the potential for contaminating activities;
- Drilling of seven boreholes (BH501 to BH507) and four test pits (TP501 to TP504) across the site using a 3T excavator, to a minimum depth of 0.5 m into natural soils;

- Collection of soil samples from the boreholes / test pits at regular depth intervals, typically at the surface, and changes in the soil strata, where observed;
- Screening of soil samples with a photo-ionisation detector (PID) to assess the possible presence or absence of volatile organic compounds (VOC);
- Laboratory analysis of selected soil samples by a National Association of Testing Authorities (NATA) accredited laboratory for contaminants of potential concern (COPC) and parameters including:
  - Eight priority metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc);
  - Total recoverable hydrocarbons (TRH);
  - Monocyclic aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylenes - BTEX);
  - Polycyclic aromatic hydrocarbons (PAH);
  - Organochlorine pesticides (OCP)
  - Organophosphorus pesticides (OPP);
  - Polychlorinated biphenyls (PCB);
  - Total phenols;
  - Asbestos (presence / absence); and
  - pH and cation exchange capacity (CEC) for determination of ecological investigation levels (EIL).
- Field sampling and laboratory analysis with reference to standard environmental protocols, including a data quality assurance and quality control (QA / QC) plan; and
- Preparation of this report detailing the findings of the investigation; as well as recommendations for further works, if deemed necessary.

3. Site Description

3.1 Site Identification

The site is located at the corner of Edward Street and Lewis Drive, and is currently identified as Part Lot 334, Deposited Plan 1190643 within the local government area of Wagga Wagga City Council. The site is rectangular in shape and has a surveyed area of 1603 m^3. The site boundary is shown on Drawing 1, Appendix A.

3.2 Site Description

A site walkover was conducted by a DP environmental scientist on 13 February 2020. At the time of the walkover, the site was being used as a car park, with entrance from Lewis Drive. The site was covered in asphaltic concrete with minimal landscaped areas. Photographs of the site are presented in Appendix B.

The surrounding land use is summarised as follows:

- North - Edward Street and residential land use further north;
- East: - Heritage Motor Inn / Econo Lodge Heritage Inn Wagga;
- South: - Doris Roy Lane and a car park further south; and
- West: - Lewis Drive and a car park / buildings associated with WWBH further west.

4. Geology, Hydrogeology and Acid Sulphate Soil Potential

4.1 Geology

Reference to the NSW Wagga Wagga 250k Geology Sheet indicates the site is underlain by unconsolidated clay, silt, sand and gravel (flood plain sediments), and includes high-level terrace sediments of the Murray Valley (clay silt, sand and gravel).

4.2 Hydrogeology

Previous investigations for the greater WWBH site have reported that the WWBH site generally slopes from the north to the north east. Regional groundwater and surface water is expected to flow in the north-east direction towards Murrumbidgee River which is located approximately 1.6 km from the site. Groundwater was observed at depths of > 5 m below ground level (bgl) in previous investigations within the greater hospital site. It should be noted that groundwater levels are affected by factors such as climatic conditions and soil permeability and will therefore vary with time.

A search of the groundwater bore database maintained by the Department of Primary Industry indicates that there are at least 20 registered groundwater bores within approximately 500 m of the site, 11 groundwater bores to the south, five to the south west, two to the west and two to the north west. There are no bores located hydraulically downgradient and within 500 m of the site.

4.3 Acid Sulphate Soil Potential

Reference to ASS risk maps indicates the site is mapped as no known occurrence of acid sulfate soils.

5. Summary of Previous Investigations

The following contamination investigations have been prepared previously for the greater WWBH site:

- DP Report *Preliminary Contamination Assessment, Proposed Redevelopment, Wagga Wagga Base Hospital, Edward Street, Wagga Wagga,* Project 72320.01 dated May 2011 (DP, 2011a);
- DP Report *Summary of Contamination, Proposed Phase 1 Redevelopment Area, Wagga Wagga Base Hospital, Edward Street, Wagga Wagga NSW,* Project 72320.05 dated May 2012 (DP, 2012a);
- DP Report *Preliminary Contamination Assessment, Wagga Wagga Base Hospital Redevelopment, Phase 2/3, Portion A and Proposed Loading Dock, Edward Street, Wagga Wagga,* Project 72320.06.Rev1 dated December 2012 (DP, 2012b); and
- DP Report *Preliminary Site Investigation (Contamination), Wagga Wagga Base Hospital - Stage 3, Edward Street, Wagga Wagga (Draft)*, Project 72320.09 dated August 2014 (DP, 2014).

The DP (2012a), (2012b) and DP (2014) reports do not cover the current site area, therefore were not reviewed as part of the current investigation.

The following geotechnical investigation which covers the current site was also reviewed:

- DP Report *Supplementary Geotechnical Investigation, Proposed Redevelopment, Wagga Wagga Base Hospital, Edward Street, Wagga Wagga,* Project 72320.03 dated October 2011 (DP, 2011b).

5.1 DP (2011a)

DP prepared a preliminary contamination assessment (PCA) for the proposed WWBH redevelopment which incorporates part of the current site. The assessment comprised a review of site history information, a site walkover, limited soil and groundwater sampling and laboratory analysis. The investigation was undertaken concurrently with a geotechnical investigation.

The site history review identified that the majority of the DP (2011a) site was developed into a hospital in the early 1900s, and based on an archaeological assessment report, the site was unoccupied prior to construction of the hospital. A portion of the DP (2011a) site along the eastern boundary (i.e. the current site) was used for residential purposes since the 1940s, with some of the structures being demolished between the 1980s to 2001. The PCA also identified the following potential sources of contamination to the greater DP (2011a) site:

- Caltex service station located along Docker Street;
- Workshop and associated spillage / inappropriate disposal of products; and
- Old boiler and laundry house.

A total of ten boreholes were drilled as part of the geotechnical investigation, and contamination sampling was undertaken from eight of the locations. Two of the bores were converted into groundwater monitoring wells for groundwater sampling purposes. It should be noted that none of the boreholes are located within the current site boundary.

Overall, DP (2011) considered that the site was generally suitable for the proposed hospital redevelopment, from a contamination perspective. However, given the limited nature of the assessment, the extent of the works proposed, and the areas of potential contamination identified, it was recommended that further assessment of the site be undertaken prior to construction. Furthermore, additional investigation was recommended following demolition of the existing buildings that were present at the time.

DP comments

DP note that the service station is approximately 200 m away from the current site, therefore is not considered to be a source of contamination to the site. Likewise, the location of the former boiler / laundry house and workshop (as annotated in the DP (2011a) aerial photograph) is over 150 m away from the site, therefore is unlikely to be a source of contamination to the subject site.

5.2 (DP, 2011b)

DP prepared a geotechnical investigation for the proposed WWBH redevelopment, which included a borehole (BH204) drilled within the current site. It should be noted that no contamination sampling was undertaken from this borehole.

Review of the BH204 borehole log indicated the following soil profile:

- ASPHALT: To a depth of 0.02 m; underlain by
- ROADBASE: To a depth of 0.2 m; underlain by
- FILL: Silty clay fill with some sand and gravel to a depth of 0.5 m; underlain by
- SITLY CLAY: Very stiff, then hard silty clay to depths of 3.0 m.

Although the borehole was not drilled for contamination investigation purposes, there were no obvious indications of contamination within the soil profile logged in Borehole 204 (i.e. no indication of staining, odours or anthropogenic inclusions).

6. Site History Information

6.1 Historical Aerial Photographs

Historical aerial photographs from 1944 to 2019 were reviewed to identify possible former land uses and hence the potential for contaminating activities to have impacted the site. The aerial photographs are presented in Appendix C. For the period 2014 to 2019, Nearmap aerials were reviewed. A summary of the aerial photograph review is given below.

1944 - The site appears to comprise of residential lots. Edward Street and Doris Roy Lane can be seen to the north and south of the site, respectively. To the west of the site, the hospital has been constructed. The surrounding land use to the north, east and south appears to be residential.

1953 - The site and immediate surrounds appear much the same as in 1944. Lewis Drive can be seen immediately west of the site. It appears that the northern portion of the hospital (to the west of the site) is predominately open space, with a few trees / shrubs evident.

1971 - The site appears much the same as in 1953. The hospital to the west has undergone development, with the construction of new buildings / extensions to existing buildings. Within the northern portion of the hospital, there is an increase in vegetation, and the buildings observed in the 1953 aerial have been demolished.

1980 - This aerial photograph is of poor resolution; however, it appears that the site and surrounds are much the same as in 1971.

1985 - Some of the residential properties within the site, adjacent Lewis Drive have been demolished. The surrounding land use appears much the same as in 1980. Buildings have been constructed within the southern portion of the hospital.

1990 - All the residential properties within the site have been demolished, and it appears the site is being used as a car park. Immediately east of the site, the existing Motor Inn / Lodge has been constructed.

2001 - The aerial photograph clearly identifies that the site is being used as a car park. The residential houses to the south of the site have been demolished, and the land also forms part of the car park. The hospital has undergone further development.

2014 - The site appears much the same as in 2001. The hospital has undergone significant change / re-development. The northern portion (immediately west of the site), which was open space since at least 1953 has been converted into a car parking area. The hospital has also expanded to the east, and some buildings have also been demolished.

August 2014 - **November 2019** - The site has remained much the same over this period. The hospital has undergone significant demolition and construction works over this period.

It is noted that data obtained from aerial photos was limited due to the relatively small scale and poor resolutions.

6.2 EPA Public Register

The EPA maintains a public database of contaminated sites under Section 58 of the CLM Act. The notices relate to investigation and / or remediation of site contamination considered to be significantly contaminated under the definition in the CLM Act.

A site will appear on the Contaminated Land: Record of Notices if the site has been issued a regulatory notice by the EPA. Sites appearing in the List of NSW Contaminated Sites Notified to the EPA indicate that the site is considered to be contaminated by the notifier and warrant reporting to the EPA. However, the contamination may or may not be significant enough to warrant regulation and is subject to further review by the EPA. The NSW EPA also issues environmental protection licenses under Section 308 of the POEO Act.

Based on the review of the EPA website on 2 March 2020, the following is indicated:

- No notices or orders made under the CLM Act have been issued for the site or immediately adjacent properties;
- No licences under Schedule 1 of the POEO Act have been issued for the site or immediately adjacent properties; and
- The site and immediately adjacent properties have not been included in the list of NSW contaminated sites notified to EPA.

7. Conceptual Site Model

A Conceptual Site Model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or in the future i.e., it enables an assessment of the potential source - pathway - receptor linkages (complete pathways).

Based on the review of the site history information and the site walkover, the following potential sources of contamination and associated contaminants of potential concern (COPC) have been identified and are summarised in Table 1 below.

Table 1: Potential Contamination Sources and Associated Contaminants of Potential Concern

Potential Source	Description of Potential Contaminating Activity	Contaminants of Potential Concern
Fill and surficial soil (S1)	Fill is likely to have been placed on the site to achieve the current design levels. The DP (2011b) investigation indicated shallow fill at the site. Since the source of the fill is unknown, there is potential for contaminants to be present in the fill. Furthermore, based on review of the historical aerials, the site was previously occupied by residential properties. Considering the age of the former structures, it is considered likely that hazardous building materials, including asbestos-containing material (ACM) were used in the construction materials. The demolition / deterioration of the structures over time may have impacted the surrounding soil.	Heavy metals, TPH, BTEX, PAH, PCB, OCP, OPP, phenols, and asbestos
Current and former offsite activities part of WWBH (S2)	The main hospital buildings and activities are located up-gradient of the current site, therefore, there is a potential for migration of contamination from upgradient sources.	Heavy metals, TPH, BTEX, PAH, VOC

Notes:
TPH - total petroleum hydrocarbon
BTEX - benzene, toluene, ethylbenzene, xylene
PAH - polycyclic aromatic hydrocarbons
PCB - polychlorinated biphenyls
OCP - organochlorine pesticides
OPP - organophosphorus pesticides
VOC - volatile organic compounds

7.1 Potential Receptors

The following potential receptors (R) have been identified:

Human Health Receptors:

R1 - Construction workers (during site redevelopment);

R2 - Future site users; and

R3 - Land users in adjacent areas.

Environmental Receptors:

R4 - Local groundwater;

R5 - Nearby surface water bodies (acquatic ecosystems); and

R6 - Terrestrial ecosystems.

Environmental receptors have been included as a conservative approach, allowing for landscaped areas to be incorporated into the proposed design. DP understands that the proposed building footprint only covers part of the site.

7.2 Potential Pathways

The following potential exposure pathways are primarily relevant to human receptors:

- P1 - Ingestion and dermal contact; and
- P2 - Inhalation of fibres/dust and/or vapours.

The following potential exposure pathways are primarily relevant to environmental receptors:

- P3 - Leaching of contaminants and vertical migration into groundwater;
- P4 - Surface water run-off;
- P5 - Lateral migration of groundwater; and
- P6 - Contact with terrestrial ecology.

7.3 Summary of CSM

A ‘source - pathway - receptor’ approach has been used to assess the potential risks of harm being caused to the identified receptors from contamination sources on or in the vicinity of the site, via exposure pathways (complete pathways). The possible pathways between the above sources (S1 and S2) and receptors are provided in Table 2 below.

Table 2: Conceptual Site Model

Source	Transport Pathway	Receptor	Risk Management Action Recommended
S1: Fill and surficial soil.	P1 - Ingestion and dermal contact.	R1 - Construction workers. R2 - Future site users.	An intrusive investigation of site soils is recommended to assess possible contamination issues as detailed in this report.
	P2 - Inhalation of fibres / dust and / or vapours.	R1 - Construction workers. R2 - Future site users. R3 - Land users in adjacent areas.	
	P3 - Leaching of contaminants and vertical migration into groundwater.	R4 - Local groundwater.	
	P4 - Surface water run-off. P5 - Lateral migration of groundwater.	R5 - Surface water bodies.	
	P6 - Contact with terrestrial ecology.	R6 - Terrestrial ecosystems.	
S2: Current and former offsite activities part of WWBH	P3 - Leaching of contaminants and vertical migration into groundwater.	R1 - Construction workers. R2 - Future site users.	Should results of the soil testing indicate signs of contamination, groundwater testing may be recommended.

8. Fieldwork

8.1 Fieldwork Methods and Rationale

Field investigations were undertaken on 13 February 2020 by a DP environmental scientist. The field investigation was designed with reference to the seven step data quality objectives (DQO) process provided in Appendix B, Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended 2013 (NEPC, 2013). The DQO adopted for this investigation are provided in Appendix F.

The field work comprised the drilling of seven boreholes, and an additional four test pits as requested by the client, which exceeds the sampling density recommended for a 0.2 ha site as per the NSW EPA Sampling Design Guidelines (1995). Sampling locations were positioned to provide overall site coverage, both within and outside the proposed building footprint. Locations were generally positioned within car parking spaces, given the car park was in use at the time of the investigation. Boreholes and test pits were drilled / excavated to a minimum depth of 0.5 m into natural, typically to a depth of 1 m bgl. The borehole and test pit locations are shown on Drawing 1, Appendix A. A plan showing the previous contamination and geotechnical locations for the greater WWBH site, extracted from DP (2019)[1] is also presented in Appendix A.

Soil samples were collected from all boreholes / test pits at regular depth intervals, targeting fill layers and any change in the soil profile. Logs were completed for all boreholes and test pits indicating the geological profile observed (refer to Appendix E). Logs included, where relevant, sample identification, coordinates, date of collection, a description of the substrate conditions encountered, visual or olfactory evidence of contamination, the depth of samples and QA / QC samples collected, the sampler and equipment used.

8.2 General Sampling Procedure

Sampling data was recorded to comply with routine chain-of-custody requirements and DP's standard operating procedures outlined in the DP Field Procedures Manual. The general sampling, handling, transport and tracking procedures are detailed below:

- Soils were sampled from the tip of the auger, or from the excavator bucket. Disposable nitrile gloves were used to collect all samples. Gloves were replaced prior to the collection of each sample in order to minimise the risk of cross-contamination;
- Samples collected for laboratory analysis were transferred into a new laboratory prepared glass jar, with minimal headspace, and sealed with a Teflon lined lid. Each jar was individually sealed to reduce the potential for cross contamination during transportation to the laboratory;
- Field screening of replicate soil samples collected in sealed plastic bags for Total Photoionisable Compounds (TOPIC) using a calibrated photoionisation detector (PID);
- Sample containers were labelled with individual and unique identification including project number, sample ID, depth and date of sampling;

[1] DP Report *Geotechnical Desktop Study, Proposed Multi-Deck Car Park, Wagga Wagga Base Hospital,* Project 72320.10 dated November 2019 (DP, 2019)

- Placement of sample containers and bags into a cooled, insulated and sealed container for transport to the laboratory; and
- Use of chain of custody documentation so that sample tracking and custody could be cross-checked at any point in the transfer of samples from the field to the laboratory. Copies of completed chain of custody forms are included in Appendix G.

8.3 Analytical Rationale

Based on site observations and the location of soil samples within the subsoil strata, selected samples were analysed for the primary contaminants of concern as identified in Section 7. The potential for VOC was measured using PID screening. The analytical scheme was designed to obtain an indication of the potential presence and possible distribution of identified contaminants of concern, as outlined below:

- Fill samples from varying depth (0.1 m to 0.45 m);
- Two samples from natural soil were analysed for a reduced contaminant suite; and
- Three samples were analysed for pH and CEC for derivation of the EIL.

All samples collected were submitted to Envirolab Services Pty Ltd (Envirolab). Envirolab is accredited by the NATA and are required to conduct in - house QA / QC procedures. These are normally incorporated into every analytical run and include assessment of reagent blanks, spike recovery, surrogate recovery and laboratory duplicates. The analytical methods and the in-house QA / QC procedures used are summarised in the laboratory certificates of analysis, included in Appendix G.

9. Site Assessment Criteria

9.1 Soils Site Assessment Criteria

The Site Assessment Criteria (SAC) applied in the current investigation is informed by the CSM, which identified human and ecological receptors to potential contamination on the site (refer to Section 7), as well as consideration of the proposed development. The laboratory analytical results have been assessed against the investigation and screening levels in Schedule B1 of the National Environment Protection Council (NEPC) National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 1999) amended 2013 (NEPC, 2013).

The NEPC guidelines are endorsed by the EPA under the CLM Act 1997. Schedule B1, NEPC (2013) provides investigation and screening levels for commonly encountered contaminants which are applicable to generic land uses, and where relevant, also include consideration of soil type and the depth of contamination. It should be highlighted that the investigation and screening levels are not intended to be used as clean up levels, and any contaminants which have concentrations that exceed the investigation / screening levels should be further assessed using a Tier 2 risk assessment.

9.1.1 Health Investigation and Screening Levels

The Health Investigation Levels (HIL) are scientifically-based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential human health risk from chronic exposure to contaminants. HIL are intentionally conservative, based on a reasonable worst-case scenario for four generic land use settings. HIL establish the concentration of a contaminant above which further investigation and evaluation is required.

HIL are applicable to assessing health risk arising via all relevant pathways of exposure for a range of soil contaminants. The HIL are generic to all soil types and apply generally to a depth of 3 m below the surface. Site-specific conditions may determine the depth to which HILs apply for other land uses.

Health Screening Levels (HSL) are applicable to selected petroleum compounds and fractions (BTEX, Naphthalene, F1 and F2) to assess the risk to human health via inhalation and direct contact pathways. HSL apply to the same land use settings as the HIL, however, also take into consideration soil types and depths to contamination.

The HIL and HSL are considered to be appropriate for the assessment of contamination at the site. As the site is proposed to be developed into a biomedical science building as part of the UNSW campus, the HIL C (secondary schools) criteria, and the HSL A&B criteria has been adopted as a more conservative approach. In summary, the SAC is as follows:

- HIL C; and
- HSL A&B.

Based on borehole and test pit logs, the dominant soil type encountered was found to be silt / silty clay, therefore, the HSL criteria for silt has been selected as this is more conservative than the criteria values for clay. Furthermore, considering that the potential contamination sources are likely to impact surface soils, a depth range of 0 m to <1 m has been targeted. The selected HSL inputs are summarised in Table 3, and the HIL / HSL values are given in Table 4.

Table 3: Inputs to the Derivation of HSLs

Variable	Input	Rationale
Potential exposure pathway	Inhalation of vapours	Potential exposure pathways
Soil Type	Silt	Based on soil type encountered (see logs)
Depth to contamination	0 m to <1 m	Potential contamination sources likely to impact surface soils

Table 4: Soil Health Investigation and Screening Levels

Contaminants		HIL – C	HSL A&B silt
			0 m to <1 m
Metals	Arsenic	300	-
	Cadmium	90	-
	Chromium (VI)	300	-
	Copper	17000	-
	Lead	600	-
	Mercury (inorganic)	80	-
	Nickel	1200	-
	Zinc	30 000	-
PAH	Benzo(a)pyrene TEQ[1]	3	-
	Total PAH	300	-
	Naphthalene	-	4
Phenols	Phenol (Pentachlorophenol as initial screen)	120	-
TRH	C6 – C10 (less BTEX) [F1]	-	40
	>C10-C16 (less Naphthalene) [F2]	-	230
BTEX	Benzene	-	0.6
	Toluene	-	390
	Ethylbenzene	-	NL
	Xylenes	-	95
OCP	DDT+DDE+DDD	400	-
	Aldrin and dieldrin	10	-
	Chlordane	70	-
	Endosulfan	340	-
	Endrin	20	-
	Heptachlor	10	-
	HCB	10	-
	Methoxychlor	400	-
OPP	Chlorpyrifos	250	-
PCB	PCBs	1	-

9.1.2 Ecological Investigation and Screening Levels

The EIL are applicable for assessing risk to terrestrial ecosystems and have been derived for As, Cr III, Cu, Pb, Ni, Zn, naphthalene and DDT for three generic land use scenarios. EIL generally apply to the top 2 m of soil, which corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant based on the sum of the ambient background concentration (ABC) and an added contaminant limit (ACL) as follows:

EIL = ABC + ACL

The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g., motor vehicle emissions). The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required. ACL are based on soil characteristics including pH, CEC and clay content.

There are different methods for determining the ABC, the preferred method being through direct measurement at an appropriate reference site. In situations where an appropriate reference point cannot be determined, the methods detailed in Olszowy et al. (1995) or Hamon et al. (2004) may be used.

The EIL (and ACL where appropriate) for As, Pb, naphthalene and DDT are generic in that they are not dependent on soil properties, whereas the EIL for Cr III, Cu, Ni and Zn are site specific. To derive these site specific EIL, an *Interactive (Excel) Calculation Spreadsheet* was used. (SCEW (Standing Council on Environment and Water) website (http://www.scew.gov.au/node/941)).

The site-specific data and assumptions used to determine the EIL is summarised in Table 5 below, and the adopted EILs are shown in Table 6.

Table 5: Inputs to the Derivation of EIL

Variable	Input	Rationale
Depth of EIL application	Top 2 m of the soil profile	The top 2 m depth below ground level corresponds to the root zone and habitation zone of many species.
Contamination type	Aged	Given the likely source of soil contaminants, i.e., historical site use / fill), the contamination is considered as “aged” (>2 years).
Input Parameters	state = NSW traffic volume = high	The site is in NSW and is located adjacent a main road.
Land Use	Urban residential and Public Open Space	This land use is broadly equivalent to the HIL-C land use scenario. A protection level of 80% for urban residential areas and public open space has been adopted.

Table 6: Ecological Investigation Levels (EIL) in mg/kg

Analyte		EIL Residential Open Space	Comments
Metals	Arsenic	100	Generic value
	Chromium III	200[a]	Adopted values: pH = 8.2 CEC = 5.7 Clay content:1%
	Copper	130[b]	
	Lead	1100	Generic value
	Nickel	50[c]	Adopted values: pH = 8.2 CEC = 5.7 Clay content:1%
	Zinc	380[b]	
OCP	DDT	180	Generic value
PAH	Naphthalene	170	Generic value

Notes to Table 6:

[a] – EIL value based on clay content

[b] – EIL value based on pH and CEC

[c] – EIL value based on CEC

The Ecological Screening Levels (ESL) have also been developed for assessing risk to terrestrial ecosystems. ESL broadly apply to coarse and fine-grained soils and have been derived for the same three land-use settings as the EIL. The ESL are generally applicable to the top 2 m of the soil profile and have been derived for petroleum fractions F1 to F4 as well as BTEX and benzo(a)pyrene. The inputs to the derivation of the ESL is shown in Table 7, and the adopted ESL, extracted from Table 1B (6), Schedule B1 of NEPC (2013) are shown in Table 8.

Table 7: Inputs to the Derivation of ESL

Variable	Input	Rationale
Depth of ESL application	Top 2 m of the soil profile	The top 2 m depth below ground level corresponds to the root zone and habitation zone of many species.
Land use	Urban Residential and Public Open Space	This land use is broadly equivalent to the HIL-C land use scenario.
Soil Texture	Fine	Based on soil type at the site (see Logs).

Table 8: Ecological Screening Levels (ESL) in mg/kg

Analyte		ESL (fine)	Comments
TRH	C6 - C10 (less BTEX) [F1]	180*	ESLs are of low reliability except where indicated by an asterisk (*) which are of moderate reliability.
	>C10-C16 (less Naphthalene) [F2]	120*	
	>C16-C34 [F3]	1300	
	>C34-C40 [F4]	5600	
BTEX	Benzene	65	
	Toluene	105	
	Ethylbenzene	125	
	Xylenes	45	
PAH	Benzo(a)pyrene	0.7	

9.1.3 Management Limits

In addition to the application of HSL and ESL, a further screening measure is applicable to petroleum hydrocarbons, which takes into account policy considerations and reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosive hazards; and
- Effects on buried infrastructure e.g., penetration of, or damage to, in-ground services.

Management Limits have been adopted in NEPC (2013) as interim Tier 1 guidance to avoid or minimise these potential effects. The criteria have been developed for petroleum fractions F1 to F4. The adopted Management Limits, extracted from Table 1B (7), Schedule B1 of NEPC (2013) are shown in Table 9 below. A fine soil texture has been adopted, consistent with the dominant soil type.

Table 9: Management Limits in mg/kg

Analyte		Management Limit (fine)
TRH	$C_6 – C_{10}$ (F1)	800
	$>C_{10}-C_{16}$ (F2)	1000
	$>C_{16}-C_{34}$ (F3)	3500
	$>C_{34}-C_{40}$ (F4)	10 000

9.1.4 Asbestos in Soil

Bonded asbestos-containing material (ACM) is the most common form of asbestos contamination across Australia, generally arising from:

- Inadequate removal and disposal practices during demolition of buildings containing asbestos products;
- Widespread dumping of asbestos products and asbestos containing fill on vacant land and development sites; and
- Commonly occurring in historical fill containing unsorted demolition materials.

Asbestos only poses a risk to human health when asbestos fibres are made airborne and inhaled. If asbestos is bound in a matrix such as cement or resin, it is not readily made airborne except through substantial physical damage. Bonded ACM in sound condition represents a low human health risk, whilst both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres. Consequently, FA and AF must be carefully managed to prevent the release of asbestos fibres into the air.

A detailed asbestos assessment was not undertaken as part of these works therefore the presence or absence of asbestos at a limit of reporting of 0.1 g/kg has been adopted for this assessment as an initial screen.

10. Fieldwork Results

Details of the subsurface conditions encountered are given in the borehole and test pit logs in Appendix E, together with notes defining classification methods and descriptive terms. A summary of the ground profile encountered in the current investigation is given below:

ASPHALTIC CONCRETE: Asphaltic concrete was encountered at all sampling locations to depths of up to 0.05 m;

FILL: Brown, gravelly silt fill was encountered at all sampling locations to depths of up to 0.45 m. Brown silt fill with trace igneous gravel was encountered in BH2 from depths of 0.35 m to 0.9 m, and in BH3 from depths of 0.3 m to 0.8 m; and

SILTY CLAY: Red and brown silty clay was encountered at all sampling locations underlying fill, to borehole / test pit termination at depths of approximately 1 m.

There were no obvious indications of gross contamination (i.e. staining, odours or anthropogenic inclusions) within the bore / pits.

No free groundwater was observed during test pitting or drilling of boreholes. It should be noted that groundwater levels are variable and can be affected by soil permeability and recent weather conditions.

11. Laboratory Results

The analytical results for the soil samples are summarised in Tables D1 to D2, Appendix D together with the adopted SAC. Laboratory certificates of analysis are provided in Appendix G.

- The recorded concentrations of BTEX, phenol, OCP, OPP and PCB were below the laboratory limit of reporting (LOR) in all samples;
- The recorded concentrations of metals, TRH and PAH were below the SAC for all soil samples with the exception of a concentration of benzo(a)pyrene in sample BH504/0.1-0.2 (1.6 mg/kg) which exceeded the ESL (0.7 mg/kg). It is also noted that this sample recorded a detection of the F3 and F4 fraction, which is likely attributed to the asphalt from the overlying asphaltic concrete.

  DP notes that the NEPM ESL of 0.7 mg/kg is based on a single invertebrate species referenced in the 1999 Canadian Soil Quality Guidelines (since updated) and is considered conservative in the Australian context. These guidelines were updated in 2010 and now suggest a B(a)P concentration of 20 mg/kg for the protection of environmental health based on the soil contact exposure pathway. In addition, given the low reliability of B(a)P ESL, NEPC (2013) makes reference to Table 11 of the CRC (2017). CRC (2017) indicates a high reliability ecological guideline for fresh B(a)P of 33 mg/kg (and a range of 21 mg/kg to 135 mg/kg). As the concentration of B(a)P recorded in sample BH504 is well below 20 mg/kg, no further investigation or remediation is considered to be warranted at this location; and
- Asbestos was not detected at the reporting limit of 0.1 g/kg in the soil samples analysed for asbestos.

12. Discussion

Based on the site history review, it is evident that the site was occupied by residential houses in the 1940s, which were later demolished. The site has been used as a car park since at least 2001, and possibly since the 1990s.

The current investigation involved the drilling of seven boreholes and excavation of four test pits. Relatively shallow fill to depths of approximately 0.5 m were observed at the majority of sampling locations, underlying the asphaltic concrete surface, with deeper fill to depths of up to 0.9 m observed at two locations. The fill typically comprised brown, silt fill with varying amount of gravel.

The soil laboratory results indicated that concentrations of all contaminants were below the SAC, therefore the soils tested at the site are considered to be suitable for the intended landuse with respect to contamination. On the basis of the field observations and laboratory results, no further investigation is considered to be warranted. Overall, the site is considered suitable for the proposed land use, subject to the conditions outlined in Section 13 below.

13. Conclusions

Based on the limited review of site history information, field observations and laboratory results, the site is considered suitable for the proposed land use, subject to the following recommendations:

- **Waste Classification** - A detailed waste classification assessment should be undertaken during construction works to classify fill material and natural soils for off-site disposal or potential re-use, should these materials be surplus to the development needs; and
- **Unexpected Finds** - DP recommends the incorporation of an unexpected finds protocol (UFP) to establish a strategy / management procedure to be followed during construction works, should unexpected finds of contamination be uncovered.

14. Limitations

Douglas Partners (DP) has prepared this report for this project at WWBH located at the corner of Edward Street and Lewis Drive, Wagga Wagga with reference to DP's Proposal SYD191324.Rev1 issued January 2020. This report is provided for the exclusive use of UNSW for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. It is therefore considered possible that hazardous building materials, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present in other areas of the site.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the environmental components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

Drawing 1

Drawing extracted from DP (2019)

Client-Supplied Architectural Plans

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

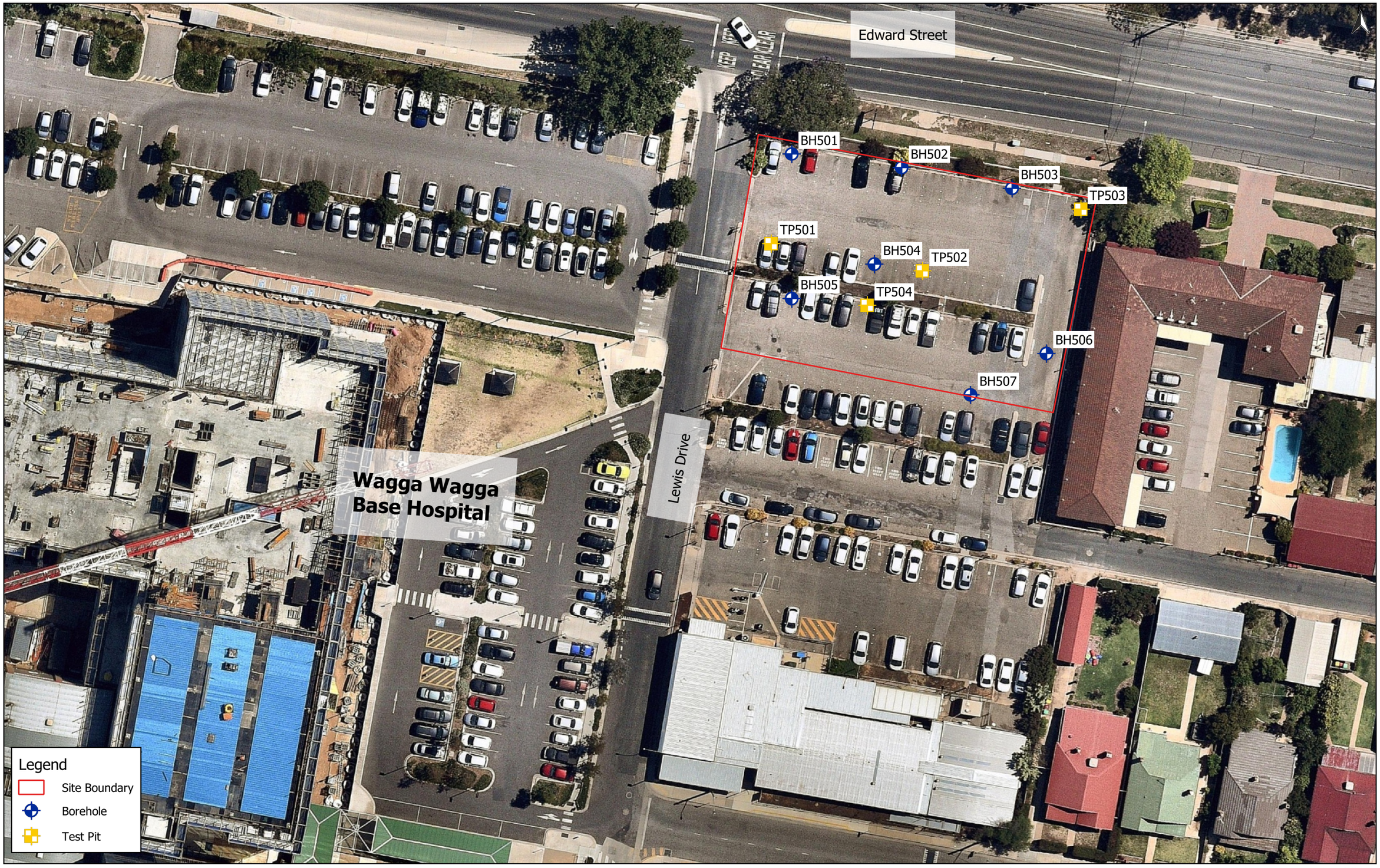
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Drawing adapted from Nearmap Image, dated 17 November 2019

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	UNSW		
OFFICE:	Central Coast	DRAWN BY:	CLN
SCALE:	As Shown	DATE:	9.03.2020

TITLE: **Site Boundary and Test Location Plan**
Preliminary Site Investigation
Wagga Wagga Base Hospital

N

PROJECT No:	72320.12
DRAWING No:	1
REVISION:	0

APPROXIMATE OUTLINE OF
PROPOSED MULTIDECK CARPARK

EDWARD STREET

STREET

DOCKER

BH106
BH401
BH201
BH202
BH203
BH204
BH402
BH105
BH403
BH205
BH404
BH405
BH108
BH104
BH103
306
BH107
BH107A
BH209
BH109
CPT1
CPT3
307
BH207
BH210
BH101
CPT4
BH206
303
CPT2
BH407

0 10 20 30 40 50 75 100m
1:1000 @ A3

Locality Plan

LEGEND

- Previous Borehole Location (August 2014)
- Previous CPT & Borehole (November 2012)
- Previous Borehole Location (April 2011)
- Previous CPT Location (September 2011)
- Previous Borehole Location (September 2011)
- Indicates test locations included in this report
- Approximate Hospital Boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Health Infrastructure		TITLE: **Previous Test Location Plan** **Proposed Multi-Deck Car Park** **Wagga Wagga Base Hospital**
OFFICE: Sydney	DRAWN BY: LJH	
SCALE: 1:1000 @ A3	DATE: 05.11.2019	

PROJECT No: 72320.10
DRAWING No: 1
REVISION: 0

issue	amendment	date
E	FOR INFORMATION	25/2/20

EDWARD STREET

180.84

181.02

31.40

LEWIS DRIVE

33 000mm B O U N D A R Y

5800 APROX.

48 600mm. B O U N D A R Y

COUNCIL'S FUTURE FOOT PATH

1604 SQ.METRES

181.05

181.39

POTENTIAL STORM WATER RETENTION TANK CONCEAL IN PLANTER

7000

7800

PLANTER

PLANTER

RAMP

POTENTIAL SUBSTATION LOCATION

AWNING OVER

STAFF OFFICE
24 WORKSTATIONS
CPT

RECEPTION
2 STAFF
CPT

BOOKSHELF

BOOKSHELF

LAYOUT & STORAGE

COPIER

1 LAYOUT & STORAGE

Sliding door to enclose kitchenette

VIN

COMMS RISER

BUILDING OVER

CPT

KITCHENETTE ALSO FUNCTIONS AS SERVERY

STAFF LUNCH / CASUAL DISCUSSION AREA

KITCHENETTE

PLANTER

ENTRY FOYER/ FUNCTION SPACE

RL: 181.950

TILE

LIFT

LIFT

MALE WC
CT

ACC WC & SHOWER
CT

FEMALE WC
CT

CLNR
CT

PHASE CO-ORDINATOR OFFICE
CPT

MECHANICAL RISER

PIPE RISER WITH FIRE COLLAR TO SLAB PENETRATION.

INTERVIEW 1
CPT

PROJECTOR SCREENS WHEN IN COMBINED LECTURE MODE

CPT

TUTORIAL 1
50 & 2 WHEELCHAIR SPACES

TUTORIAL 2
51 & 2 WHEELCHAIR SPACES

54 & 4 WHEELCHAIR SPACES

STUDENT WAITING
CPT

INTERVIEW 2
CPT

BUILDING OVER

181.43

DISCUSSION MODE THEATRE

VIDEO CONFERNCE FACILITY

BOARDROOM
CPT

181.65

LARGE FLAT FLOOR LECTURE SPACE WHEN COMBINED

48 600mm. B O U N D A R Y

FIRE RATED BOUNDARY WALL - FUTURE COMMON WALL

EXISTING STORM WATER EASEMENT

A

A

N

LEGEND:

A

EASEMENT

BNMH ARCHITECTS

Budden Nangle Michael & Hudson Architects
17/130 Pacific Highway
Greenwich NSW 2065
T (61 2) 9906 5599
F (61 2) 9906 8220

project

UNSW BIOMEDICAL SCIENCE CENTRE

drawing

GROUND FLOOR PLAN

scale: 1:100 @ A1; 1:200@A3

drawn: JP

checked

project no.: 957

drawing no.: **SK01**

issue: **E**

25/2/20

issue	amendment	date
E	FOR INFORMATION	25/2/20

EDWARD STREET

180.84

181.02

31.40

LEWIS DRIVE

33 000mm B O U N D A R Y

5800 APROX.

COUNCIL'S FUTURE FOOT PATH

48 600mm. B O U N D A R Y

1604 SQ.METRES

181.05

181.39

7000

7800

AV Work Bench

SCENARIO ROOM 01
CPT

SCENARIO ROOM 02
CPT

TUTORIAL 03
CPT

Tutorial furniture is all loose - any preferred bench / desk type can be provided.

COMMS RISER

CPT

BENCH

VIN

I.T. / COMMS ROOM
WALL MOUNTED SECURITY EQUIPMENT

AWNING BELOW

VOID

STUDENT CASUAL WORK TABLES

LIFT

LIFT

MALE WC
CT

ACC WC
CT

FEMALE WC
CT

CLNR
CT

MALE SH

Ambulant Toilet

PATHOLOGY POT DISPLAY

4 SIDED GLASS DISPLAY

MECHANICAL RISER

PIPE RISER WITH FIRE COLLAR TO SLAB PENETRATION.

STUDENT LOCKERS (OPEN)

LVL 1 FOYER
RL: 185.950

TILE

CPT

EDB

Interactive LCD Screen

Projector Screen

LOOSE FURNITURE FOR 50 STUDENTS - CAN RELOCATE IN GROUPS TO VIEW LCD SCREENS AND SECTRA SCREENS OR IN SPECIAL OR GROUP TABLES TO VIEW ANATOMY MODELS OR PATHOLOGY POTS.

CURRENT SECTRA LAB

MEDICAL SCIENCE PREP LAB
VIN

COMPACTUS STORAGE UNIT

White Board

LCD

WB

SECTRA

Mobile interactive LCD for sectra system

Projector

Mobile White Board

BIO-SCIENCES (DRY ANATOMY LABORATORY)

181.43

181.65

MEDICAL SCIENCES LABORATORY

VIN

GLASS DISPLAY CASE OVER

FUME CUPBOARD

AV

STORE
VIN

White board to full length of wall

Projector Screen

Interactive LCD Screen

Storage under bench to full length of wall

White Board

White Board

48 600mm. B O U N D A R Y

FIRE RATED BOUNDARY WALL - FUTURE COMMON WALL

ALTERNATIVE ANATOMY CLASS CONFIGURATION

A

A

N

LEGEND:

A

EASEMENT

Budden Nangle Michael & Hudson Architects
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project

UNSW BIOMEDICAL SCIENCE CENTRE

drawing

LEVEL 1 PLAN

scale: 1:100 @ A1; 1:200@A3

drawing no.: **SK02**

drawn: JP

checked

issue: **E**

project no.: 957

25/2/20

EDWARD STREET

180.84

181.02

31.40

LEWIS DRIVE

33 000mm B O U N D A R Y

5800 APROX.

COUNCIL'S FUTURE FOOT PATH

48 600mm. B O U N D A R Y

1604 SQ.METRES

181.05

181.39

7000

7800

181.43

181.65

33 000mm B O U N D A R Y

AWNING BELOW

VOID

LVL 2 FOYER
RL: 189.750

STUDENT CASUAL
WORK TABLES

TILE

STAIR ACCESS TO
PLANT ROOM OVER

STORAGE

STORAGE

RURAL RESEARCH & ILP CENTRE

PRINTER

KITCHEN / MEAL
BENCH

WORK BENCH

STUDENT
KITCHENETTE

CPT

PERIODICAL

VIN

Fridge

COMMS

CPT

NOTE: ALSO FUNCTION AS 'PATIENT'
WAITING AREA FOR CLINICAL SKILLS
TRIALS CONFIGURATION.

STUDENT
LOUNGE AREA

TERRACE

LIFT

LIFT

MALE
WC
CT

ACC
WC
CT

FEMALE
WC
CT

CLNR
CT

FEMALE SH

Ambulant
Toilet

PHASE COORDINATOR
OFFICE

COMPACTUS
STORAGE
UNIT

PIPE RISER WITH FIRE COLLAR
TO SLAB PENETRATION.

MECHANICAL RISER

PLANT AREA OVER

CPT

Lockers

DISPLAY

DISPLAY

Lockers

EDB

LCD SCREEN

HAND WASH TROUGH & PLASTER BENCH

VIN

STORE

SIMULATION
SUITE

SIMULATION LAB 01

VIN

ELECTRIC
BED

ELECTRIC
BED

CONTROL
ROOM

VIN

LCD SCREEN

SMALL TUTORIAL
/ DEBRIEF 1

VIN

SMALL TUTORIAL
/ DEBRIEF 2

VIN

LCD SCREEN

CONSULT 1

VIN

CONSULT 2

VIN

DEMONSTRATION BENCH
CLINICAL SKILLS

VIN

BED 01

BED 02

BED 03

BED04

STORAGE CUPBOARD UNDER WINDOW

48 600mm. B O U N D A R Y

FIRE RATED BOUNDARY WALL - FUTURE COMMON WALL

A

A

N

LEGEND:

A

EASEMENT

BNM&H ARCHITECTS

Do not scale drawings. Verify all dimensions on site

issue	amendment	date
E	FOR INFORMATION	25/2/20

Budden Nangle Michael & Hudson Architects
17/130 Pacific Highway
Greenwich NSW 2065
T (61 2) 9906 5599
F (61 2) 9906 8220

project

UNSW BIOMEDICAL SCIENCE CENTRE

drawing

LEVEL 2 PLAN

scale: 1:100 @ A1; 1:200@A3

drawn: JP

checked

project no.: 957

drawing no.: **SK03**

issue: **E**

25/2/20

Appendix B

Site Photographs

Photo 1 – General Site Photograph. Photograph facing east.

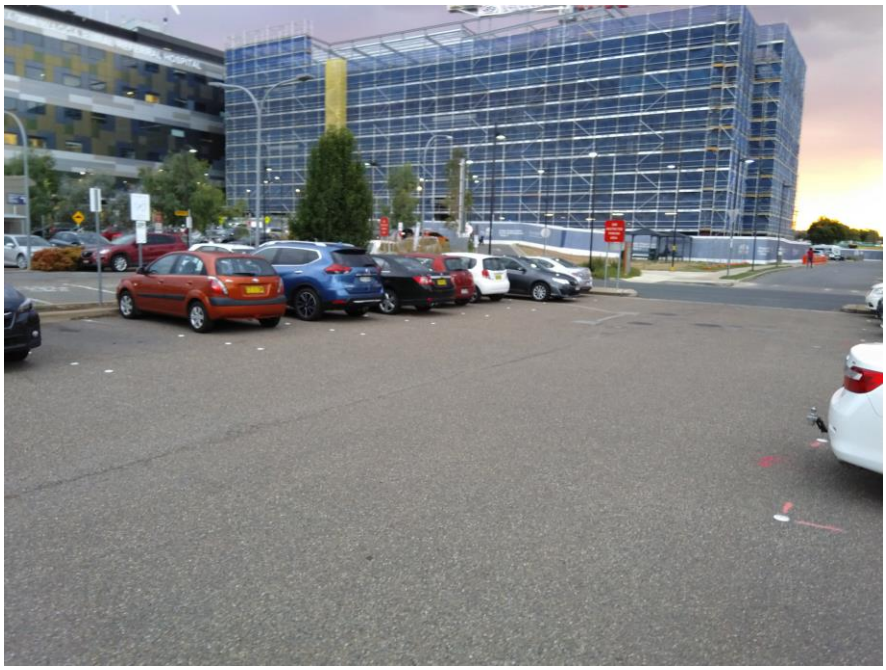

Photo 2 – General Site Photograph. Photograph facing south west.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Preliminary Site Investigation** **Wagga Wagga Base Hospital**	PROJECT:	72320.12
		PLATE No:	1
		REV:	A
	CLIENT: UNSW	DATE:	13 February 2020

Appendix C

Historical Aerial Photographs

Photo 1 - 1944

Photo 2 - 1953

Douglas Partners Geotechnics / Environment / Groundwater	**Historical Aerial Photographs** **Preliminary Site Investigation** **Wagga Wagga Base Hospital**	PROJECT: 72320.12 PLATE No: 1 REV: 0
	CLIENT: UNSW	DATE: 9-Mar-20

Photo 3 - 1971

Photo 4 - 1980

Douglas Partners Geotechnics / Environment / Groundwater	**Historical Aerial Photographs** **Preliminary Site Investigation** **Wagga Wagga Base Hospital**	PROJECT: 72320.12 PLATE No: 2 REV: 0
	CLIENT: UNSW	DATE: 9-Mar-20

Photo 5 - 1985

Photo 6 - 1990

Douglas Partners Geotechnics / Environment / Groundwater	**Historical Aerial Photographs** **Preliminary Site Investigation** **Wagga Wagga Base Hospital**	PROJECT: 72320.12 PLATE No: 3 REV: 0
	CLIENT: UNSW	DATE: 9-Mar-20

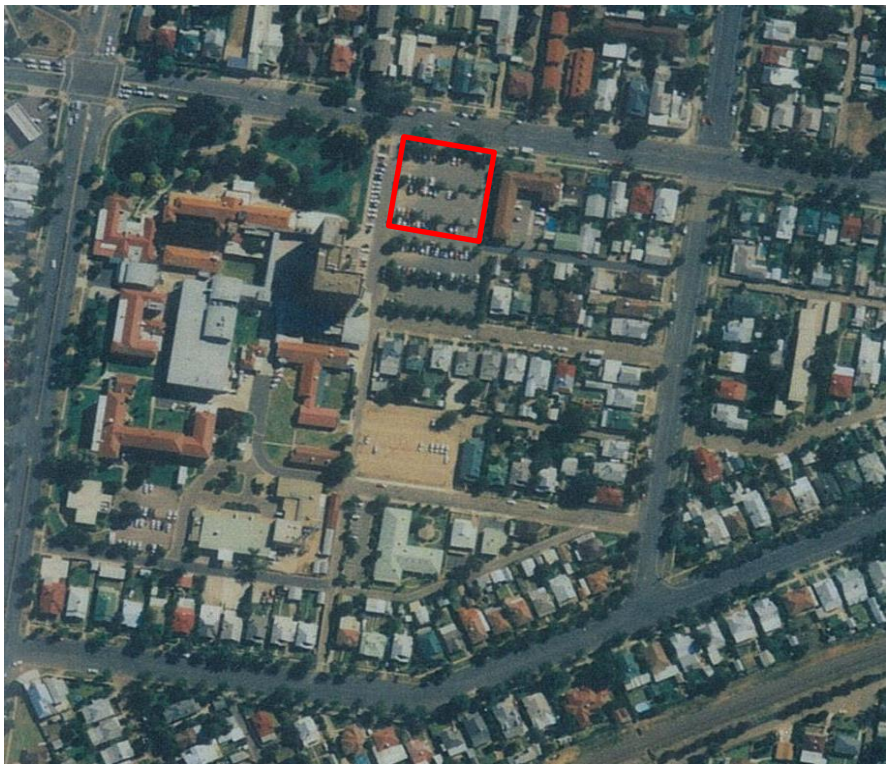

Photo 7 - 2001

Photo 8 - 2014

Douglas Partners Geotechnics / Environment / Groundwater	**Historical Aerial Photographs** **Preliminary Site Investigation** **Wagga Wagga Base Hospital**	PROJECT: 72320.12 PLATE No: 4 REV: 0
	CLIENT: UNSW	DATE: 9-Mar-20

Appendix D

Laboratory Summary Tables

Douglas Partners
Geotechnics / Environment / Groundwater

Table D1: Summary of Laboratory Results – Metals, TRH, BTEX, PAH

			Metals								TRH						BTEX				PAH			
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs
		PQL	4	0.4	1	1	1	0.1	1	1	25	50	25	50	100	100	0.2	0.5	1	1	1	0.05	0.5	0.05
Sample ID[a]	Strata	Sampled Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BH501/0.1-0.2	FILL	13/02/2020	11	<0.4	27	23	15	<0.1	28	47	<25	<50	<25	<50	170	220	<0.2	<0.5	<1	<1	<1	0.1	<0.5	1.3
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
BH502/0.35-0.45	FILL	13/02/2020	19	<0.4	33	64	15	<0.1	22	49	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
BD3/20200213	FILL	13/02/2020	18	<0.4	32	54	12	<0.1	13	42	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	NT	NT	NT
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
BH503/0.1-0.2	FILL	13/02/2020	19	<0.4	31	48	14	<0.1	21	46	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
BH503/0.9-1.0	NATURAL	13/02/2020	9	<0.4	31	23	14	<0.1	15	32	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
BH504/0.1-0.2	FILL	13/02/2020	12	<0.4	25	19	12	<0.1	20	38	<25	<50	<25	<50	910	1200	<0.2	<0.5	<1	<1	<1	1.6	2.6	19
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
BH505/0.1-0.2	FILL	13/02/2020	16	<0.4	34	26	12	<0.1	32	54	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
BH506/0.1-0.2	FILL	13/02/2020	22	<0.4	37	26	12	<0.1	36	55	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
BH507/0.1-0.2	FILL	13/02/2020	17	<0.4	31	22	12	<0.1	30	50	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
TP501/0.1-0.2	FILL	13/02/2020	6	<0.4	21	14	21	<0.1	12	44	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0.07	<0.5	0.07
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
TP502/0.1-0.2	FILL	13/02/2020	17	<0.4	27	21	8	<0.1	22	40	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
TP502/0.7-0.8	NATURAL	13/02/2020	7	<0.4	32	19	14	<0.1	15	26	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	0.62	0.9	5.9
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
TP503/0.3-0.4	FILL	13/02/2020	17	<0.4	30	29	23	<0.1	30	60	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	0.2
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC
TP504/0.1-0.2	FILL	13/02/2020	16	<0.4	25	31	14	<0.1	19	39	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			300 100	90 NC	300 200	17000 130	600 1100	80 NC	1200 50	30000 380	NC NC	NC NC	40 180	230 120	NC 1300	NC 5600	0.6 65	390 105	NL 125	95 45	4 170	NC 0.7	3 NC	300 NC

Lab result
HIL/HSL value EIL/ESL value

HIL/HSL exceedance EIL/ESL exceedance HIL/HSL and EIL/ESL exceedance ML exceedance ML and HIL/HSL or EIL/ESL exceedance

Indicates that asbestos has been detected by the lab below the PQL, refer to the lab report **Blue** = DC exceedance

Bold = Lab detections NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable NAD = No asbestos detected

Notes:

HIL/HSL/DC	NEPC, Schedule B1 - HIL C (Recreational / Open Space), HSL A/B (Residential / Low - High Density), DC HSL B (Direct contact HSL B Residential (High density))
EIL/ESL	NEPC, Schedule B1 - EIL UR/POS (Urban Residential and Public Open Space), ESL UR/POS (Urban Residential and Public Open Space)
ML	NEPC, Schedule B1 - ML R/P/POS (Residential, Parkland and Public Open Space)
a	QA/QC replicate of sample listed directly below the primary sample
b	reported naphthalene laboratory result obtained from BTEXN suite

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Table D2: Summary of Laboratory Results – Phenol, OCP, OPP, PCB, Asbestos

			Phenol	OCP												OPP	PCB	Asbestos	
			Phenol	DDT+DDE+DDD c	DDD	DDE	DDT	Aldrin & Dieldrin	Total Chlordane	Total Endosulfan	Endrin	Heptachlor	HCB	Methoxychlor		Chlorpyriphos	Total PCB	Asbestos ID in soil >0.1g/kg	Trace Analysis
		PQL	5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1		
Sample ID[a]	Strata	Sampled Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	-	-
BH501/0.1-0.2	FILL	13/02/2020	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
BH502/0.35-0.45	FILL	13/02/2020	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
BD3/20200213	FILL	13/02/2020	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
BH503/0.1-0.2	FILL	13/02/2020	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
BH503/0.9-1.0	NATURAL	13/02/2020	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
BH504/0.1-0.2	FILL	13/02/2020	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
BH505/0.1-0.2	FILL	13/02/2020	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
BH506/0.1-0.2	FILL	13/02/2020	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
BH507/0.1-0.2	FILL	13/02/2020	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
TP501/0.1-0.2	FILL	13/02/2020	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
TP502/0.1-0.2	FILL	13/02/2020	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
TP502/0.7-0.8	NATURAL	13/02/2020	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
TP503/0.3-0.4	FILL	13/02/2020	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		
TP504/0.1-0.2	FILL	13/02/2020	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NAD	NAD
			120 NC	400 180	NC NC	NC NC	NC 180	10 NC	70 NC	340 NC	20 NC	10 NC	10 NC	400 NC		250 NC	1 NC		

Lab result
HIL/HSL value EIL/ESL value

HIL/HSL exceedance EIL/ESL exceedance HIL/HSL and EIL/ESL exceedance ML exceedance ML and HIL/HSL or EIL/ESL exceedance

Indicates that asbestos has been detected by the lab below the PQL, refer to the lab report **Blue** = DC exceedance

Bold = Lab detections NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable NAD = No asbestos detected

Notes:

HIL/HSL/DC	NEPC, Schedule B1 - HIL C (Recreational / Open Space), HSL A/B (Residential / Low - High Density), DC HSL B (Direct contact HSL B Residential (High density))
EIL/ESL	NEPC, Schedule B1 - EIL UR/POS (Urban Residential and Public Open Space), ESL UR/POS (Urban Residential and Public Open Space)
ML	NEPC, Schedule B1 - ML R/P/POS (Residential, Parkland and Public Open Space)
a	QA/QC replicate of sample listed directly below the primary sample
c	criteria applies to DDT only

Appendix E

Borehole and Test Pit Logs

BOREHOLE LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.1 AHD
EASTING: 532638
NORTHING: 6113862
DIP/AZIMUTH: 90°/--

BORE No: BH501
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
181	0.03	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL			0.1				
				E			PID < 1ppm		
					0.2				
	0.25	Silty CLAY Cl: medium plasticity, red and brown, apparently stiff, w<PL			0.25				
				E			PID < 1ppm		
					0.35				
					0.9				
				E			PID < 1ppm		
	1 1.0	Bore discontinued at 1.0mTarget Depth Acheived			1.0				1
180									

RIG: 3T Excavator, SK35SR **DRILLER:** KD **LOGGED:** TG **CASING:** Uncased
TYPE OF BORING: 150 mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed during drilling
REMARKS: Approximate surface level interpolated from survey plan

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.3 AHD
EASTING: 532654
NORTHING: 6113860
DIP/AZIMUTH: 90°/--

BORE No: BH502
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
181	0.03	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL		E	0.05		PID < 1ppm		
					0.15				
	0.35	FILL/SILT: low plasticity, brown, trace igneous gravel, apparently stiff, w<PL		E*	0.35		PID < 1ppm		
					0.45				
	0.9	Silty CLAY CI: medium plasticity, red and brown, apparently stiff, w<PL		E	0.9		PID < 1ppm		
	1				1.0				1
180	1.2	Bore discontinued at 1.2mTarget Depth Acheived							

RIG: 3T Excavator, SK35SR **DRILLER:** KD **LOGGED:** TG **CASING:** Uncased

TYPE OF BORING: 150 mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Approximate surface level interpolated from survey plan BD3/20200213 taken at 0.35-0.45m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.4 AHD
EASTING: 532670
NORTHING: 6113857
DIP/AZIMUTH: 90°/--

BORE No: BH503
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
181	0.03	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL		E	0.1		PID < 1ppm		
					0.2				
	0.3	FILL/SILT: low plasticity, brown, trace igneous gravel, apparently stiff, w<PL		E	0.3		PID < 1ppm		
					0.4				
	0.8	Silty CLAY CI: medium plasticity, red and brown, apparently stiff, w<PL							
	1			E	0.9		PID < 1ppm		1
					1.0				
180	1.2	Bore discontinued at 1.2mTarget Depth Acheived							

RIG: 3T Excavator, SK35SR **DRILLER:** KD **LOGGED:** TG **CASING:** Uncased

TYPE OF BORING: 150 mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Approximate surface level interpolated from survey plan

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.3 AHD
EASTING: 532650
NORTHING: 6113846
DIP/AZIMUTH: 90°/--

BORE No: BH504
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.03	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL		E	0.1		PID < 1ppm		
					0.2				
181	0.3	Silty CLAY CI: medium plasticity, red and brown, apparently stiff, w<PL		E	0.3		PID < 1ppm		
					0.4				
					0.8				
				E			PID < 1ppm		
	0.9	Bore discontinued at 0.9mTarget Depth Acheived			0.9				
	1								1
180									

RIG: 3T Excavator, SK35SR **DRILLER:** KD **LOGGED:** TG **CASING:** Uncased
TYPE OF BORING: 150 mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed during drilling
REMARKS: Approximate surface level interpolated from survey plan

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.3 AHD
EASTING: 532638
NORTHING: 6113841
DIP/AZIMUTH: 90°/--

BORE No: BH505
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
181	0.05	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL		E	0.1		PID < 1ppm		
					0.2				
	0.4	Silty CLAY CI: medium plasticity, red and brown, apparently stiff, w<PL		E	0.4		PID < 1ppm		
					0.5				
				E	0.9		PID < 1ppm		
180	1 1.0	Bore discontinued at 1.0mTarget Depth Acheived			1.0				1

RIG: 3T Excavator, SK35SR **DRILLER:** KD **LOGGED:** TG **CASING:** Uncased
TYPE OF BORING: 150 mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed during drilling
REMARKS: Approximate surface level interpolated from survey plan

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.4 AHD
EASTING: 532675
NORTHING: 6113833
DIP/AZIMUTH: 90°/--

BORE No: BH506
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
181	0.05	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL		E	0.1		PID < 1ppm		
					0.2				
	0.45	Silty CLAY (CI): medium plasticity, red and brown, apparently stiff, w<PL		E	0.5		PID < 1ppm		
					0.6				
				E	0.9		PID < 1ppm		
180	1.0	Bore discontinued at 1.0mTarget Depth Acheived			1.0				1

RIG: 3T Excavator, SK35SR **DRILLER:** KD **LOGGED:** TG **CASING:** Uncased
TYPE OF BORING: 150 mm diameter solid flight auger
WATER OBSERVATIONS: No free groundwater observed during drilling
REMARKS: Approximate surface level interpolated from survey plan

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.4 AHD
EASTING: 532664
NORTHING: 6113827
DIP/AZIMUTH: 90°/--

BORE No: BH507
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL			0.1				
				E*			PID < 1ppm		
					0.2				
181									
	0.45	Silty CLAY CI: medium plasticity, red and brown, apparently stiff, w<PL			0.5				
				E			PID < 1ppm		
					0.6				
					0.9				
				E			PID < 1ppm		
	1 1.0	Bore discontinued at 1.0mTarget Depth Acheived			1.0				1
180									

RIG: 3T Excavator, SK35SR **DRILLER:** KD **LOGGED:** TG **CASING:** Uncased

TYPE OF BORING: 150 mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Approximate surface level interpolated from survey plan BD4/20200213 taken at 0.1-0.2m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.3 AHD
EASTING: 532635
NORTHING: 6113849

PIT No: TP501
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		ASPHALTIC CONCRETE							
	0.05	FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL		E	0.1		PID < 1ppm		
					0.2				
181	0.25	Silty CLAY CI: medium plasticity, red and brown, apparently stiff, w<PL		E	0.25		PID < 1ppm		
					0.35				
				E	0.7		PID < 1ppm		
	0.8	Pit discontinued at 0.8mTarget Depth Acheived			0.8				
	1								1
180									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: 3T Excavator fitted with a 300mm bucket

LOGGED: TG

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed during test pitting

REMARKS: Approximate surface level interpolated from survey plan

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.3 AHD
EASTING: 532657
NORTHING: 6113845

PIT No: TP502
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.05	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL		E	0.1		PID < 1ppm		
181	0.3	Silty CLAY CI: medium plasticity, red and brown, apparently stiff, w<PL		E	0.3		PID < 1ppm		
				E	0.7		PID < 1ppm		
	0.8	Pit discontinued at 0.8mTarget Depth Acheived			0.8				
180	1								1

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: 3T Excavator fitted with a 300 mm bucket

LOGGED: TG

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed during test pitting

REMARKS: Approximate surface level interpolated from survey plan

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.4 AHD
EASTING: 532680
NORTHING: 6113854

PIT No: TP503
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
181	0.03	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w<PL		E*	0.1		PID < 1ppm		
					0.2				
				E	0.3		PID < 1ppm		
					0.4				
	0.45	Silty CLAY (CI): medium plasticity, red and brown, apparently stiff, w<PL		E	0.5		PID < 1ppm		
					0.6				
				E	0.9		PID < 1ppm		
180	1.0	Pit discontinued at 1.0mTarget Depth Acheived			1.0				1

RIG: 3T Excavator fitted with a 300 mm bucket

LOGGED: TG

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed during test pitting

REMARKS: Approximate surface level interpolated from survey plan BD1/20200213 taken at 0.1-0.2m

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: University of New South Wales
PROJECT: Proposed UNSW Biomedical Science Building
LOCATION: Wagga Wagga Base Hospital, Wagga Wagga

SURFACE LEVEL: 181.3 AHD
EASTING: 532649
NORTHING: 6113840

PIT No: TP504
PROJECT No: 72320.12
DATE: 13/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.03	ASPHALTIC CONCRETE							
		FILL/Gravelly SILT: low plasticity, brown, with siltstone gravels, apparently stiff, w < PL		*E	0.1		PID < 1ppm		
					0.2				
181	0.3	Silty CLAY CI: medium plasticity, red and brown, apparently stiff, w<PL		E	0.3		PID < 1ppm		
					0.4				
				E	0.7		PID < 1ppm		
	0.8	Pit discontinued at 0.8mTarget Depth Acheived			0.8				
	1								1
180									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: 3T Excavator fitted with a 300 mm bucket

LOGGED: TG

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed during test pitting

REMARKS: Approximate surface level interpolated from survey plan BD2/20200213 taken at 0.1-0.2m

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Sampling Methods

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Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with ‘Mix of Soil and Cobbles/Boulders’ with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- ‘Moist, dry of plastic limit’ or ‘w <PL’ (i.e. hard and friable or powdery).
- ‘Moist, near plastic limit’ or ‘w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- ‘Moist, wet of plastic limit’ or ‘w >PL’ (i.e. soils usually weakened and free water forms on the hands when handling).
- ‘Wet’ or ‘w ≈LL’ (i.e. near the liquid limit).
- ‘Wet’ or ‘w >LL’ (i.e. wet of the liquid limit).

Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $Is_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Abbreviation	Unconfined Compressive Strength MPa	Point Load Index * $Is_{(50)}$ MPa
Very low	VL	0.6 - 2	0.03 - 0.1
Low	L	2 - 6	0.1 - 0.3
Medium	M	6 - 20	0.3 - 1.0
High	H	20 - 60	1 - 3
Very high	VH	60 - 200	3 - 10
Extremely high	EH	>200	>10

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured , usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

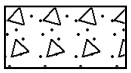
Symbols & Abbreviations

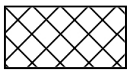
Graphic Symbols for Soil and Rock

General

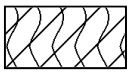

Asphalt

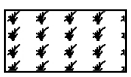

Road base

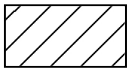

Concrete

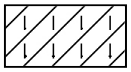

Filling

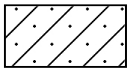
Soils


Topsoil

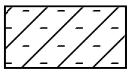

Peat

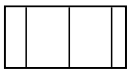

Clay

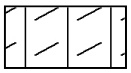

Silty clay

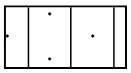

Sandy clay

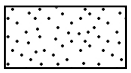

Gravelly clay

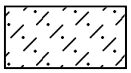

Shaly clay

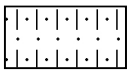

Silt


Clayey silt


Sandy silt

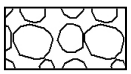

Sand

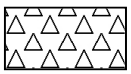

Clayey sand


Silty sand


Gravel

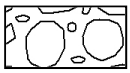

Sandy gravel


Cobbles, boulders

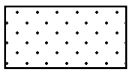

Talus

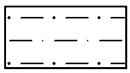
Sedimentary Rocks

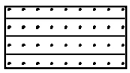

Boulder conglomerate

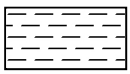

Conglomerate


Conglomeratic sandstone

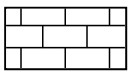

Sandstone


Siltstone

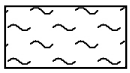

Laminite

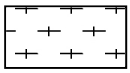

Mudstone, claystone, shale

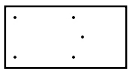

Coal


Limestone

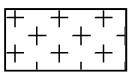
Metamorphic Rocks

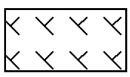

Slate, phyllite, schist

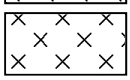

Gneiss

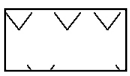

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Appendix F

Data Quality Objectives and QA / QC

DATA QUALITY ASSESSMENT

Q1. Data Quality Objectives

The PSI was prepared with reference to the seven step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of the *National Environment Protection (Assessment of Site Contamination) Measure* 1999 as amended 2013 (NEPC, 2013). The DQO process is outlined as follows:

- Stating the Problem;
- Identifying the Decision;
- Identifying Inputs to the Decision;
- Defining the Boundary of the Assessment;
- Developing a Decision Rule;
- Specifying Acceptable Limits on Decision Errors; and
- Optimising the Design for Obtaining Data.

The DQOs that have been addressed within the report are shown in Table Q1.

Table Q1: Data Quality Objectives

Data Quality Objective	Report Section where Addressed
State the Problem	S1 Introduction
Identify the Decision	S13 Conclusions
Identify Inputs to the Decision	S1 Introduction S2 Scope of Works S3 Site Description S4 Geology, Hydrogeology and Acid Sulphate Soil Potential S5 Review of previous investigations S6 Site History Information S7 Conceptual Site Model S10 Fieldwork Results S11 Laboratory Results
Define the Boundary of the Assessment	S3 Site Description S8 Fieldwork (vertical extent of investigation) Drawing 1 (Appendix A)
Develop a Decision Rule	S9 Site Assessment Criteria
Specify Acceptable Limits on Decision Errors	S9 Site Assessment Criteria Data Quality Assessment – Sections Q2, Q3
Optimise the Design for Obtaining Data	S2 Scope of Works S8 Fieldwork Data Quality Assessment – Sections Q2, Q3

Q2. Field and Laboratory Quality Control

The field and laboratory quality control (QC) procedures and results are summarised in Tables Q2 and Q3. Reference should be made to the data quality indicators in Table Q5 and the laboratory results certificates in Appendix G for further details.

Table Q2: Field QC

Item	Frequency	Acceptance Criteria	Achievement
Intra-laboratory replicates	10% primary samples	RPD <30% inorganics), <50% (organics)	yes[1]

Note: 1 qualitative assessment of RPD results overall; refer Section Q2.1

Table Q3: Laboratory QC

Item	Frequency	Acceptance Criteria	Achievement
Analytical laboratories used		NATA accreditation	yes
Holding times		In accordance with NEPC (2013) which references various Australian and international standards	Partial (see Section Q5)
Laboratory / Reagent Blanks	1 per lab batch	<PQL	yes
Laboratory duplicates	10% primary samples	Laboratory specific	yes
Matrix Spikes	1 per lab batch	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes
Surrogate Spikes	organics by GC	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes
Control Samples	1 per lab batch	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes

A 10% intra-laboratory analysis frequency was achieved for soils.

In summary, the QC data is considered to be of sufficient quality to be acceptable for the assessment.

Q2.1 Intra-Laboratory Replicates

Intra-laboratory replicates were analysed as an internal check of the reproducibility within the primary laboratory Envirolab Services Pty Ltd (ELS) and as a measure of consistency of sampling techniques. The comparative results of analysis between original and intra-laboratory replicate samples are summarised in Table Q4-1.

Note that, where both samples are below LOR/PQL the difference and RPD has been given as zero. Where one sample is reported below LOR/PQL, but a concentration is reported for the other, the LOR/PQL value has been used for calculation of the RPD for the less than LOR/PQL sample.

The calculated RPD values for soils were within the acceptable range of ± 30 for inorganic analytes and ± 50% for organics with the exception of the results shown in bold. However, this is not considered to be significant because:

- The typically low actual differences in the concentrations of the replicate pairs where some RPD exceedances occurred. High RPD values reflect the small differences between two small numbers;
- The number of replicate pairs being collected from fill soils which were heterogeneous in nature;
- Soil replicates, rather than homogenised duplicates, were used to minimise the risk of volatile loss, hence greater variability can be expected;
- Most of the recorded concentrations being relatively close to the LOR/PQL. High RPD values reflect the low concentrations;
- The majority of RPDs within a replicate pair being within the acceptable limits, aand
- All other QA/QC parameters met the DQIs.

Overall, the intra-laboratory replicate comparisons indicate that the sampling techniques were generally consistent and repeatable.

Q2.3 Field Instrument Calibration

The photoionisation detector (PID) fitted with a 10.7 volt lamp was calibrated and serviced prior to use on the field.

Table Q4-1: Relative Percentage Difference Results Intra-laboratory Replicates (Soil)

			Metals								TRH						BTEX			
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes
Sample ID	Depth	Sampled Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BD3/20200213	0m	13/02/2020	18	<0.4	32	54	12	<0.1	13	42	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
BH502/0.35-0.45	0.35 - 0.45m	13/02/2020	19	<0.4	33	64	15	<0.1	22	49	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1
		Difference	1	0	1	10	3	0	9	7	0	0	0	0	0	0	0	0	0	0
		RPD	5%	0%	3%	17%	22%	0%	**51%**	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Q3. Data Quality Indicators

The reliability of field procedures and analytical results was assessed against the following data quality indicators (DQIs):

- Completeness - A measure of the amount of usable data from a data collection activity;
- Comparability - The confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness - The confidence (qualitative) of data representativeness of media present on-site;
- Precision - A measure of variability or reproducibility of data; and
- Accuracy - A measure of closeness of the data to the 'true' value.

The DQIs were assessed as outlined in the following Table Q5.

Table Q5: Data Quality Indicators

Data Quality Indicator	Method(s) of Achievement
Completeness	Preparation of field logs, sample location plan and chain-of-custody (COC) records; Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the chain of custody; Samples analysed for the primary contaminants of potential concern (COPC) identified in the Conceptual Site Model (CSM); NATA endorsed laboratory certificates provided by the laboratory; and Satisfactory frequency and results for field and laboratory QC samples as discussed in Section Q2.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project; Works undertaken by appropriately experienced and trained DP environmental scientist / engineer or geotechnical engineer; Use of NATA registered laboratory; and Satisfactory results for field and laboratory QC samples.
Representativeness	Samples were extracted and generally analysed within holding times. It is noted that pH analysis was outside the recommended holding times. Samples were analysed in accordance with the analysis request. It is noted that sample BD1/2002002 was broken, therefore, sample BD3 was analysed instead. It is noted that a report comment is made by ELS with respect to sub-sampled asbestos from soil bags. This is expected and acceptable for analytical requirements.

Data Quality Indicator	Method(s) of Achievement
Precision	Acceptable RPD between original samples and replicates. It is noted that the laboratory RPD acceptance criteria was marginally exceeded for nickel in sample 236993-1, therefore a triplicate result was issued; and Overall, satisfactory results were achieved for all other field and laboratory QC samples.
Accuracy	Satisfactory results for all field and laboratory QC samples.

Based on the above, it is considered that the DQIs have been complied with. As such, it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

Appendix G

Laboratory Certificates of Analysis
and Chain of Custody Documentation

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 236993

Client Details

Client	Douglas Partners Tuggerah
Attention	Chamali Nagodavithane
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**72320.12, Wagga Wagga**
Number of Samples	38 Soil
Date samples received	18/02/2020
Date completed instructions received	18/02/2020

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	02/03/2020
Date of Issue	02/03/2020

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

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

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Jaimie Loa-Kum-Cheung, Metals Supervisor
Josh Williams, Senior Chemist
Loren Bardwell, Senior Chemist
Lucy Zhu, Asbestos Supervisor
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		236993-1	236993-5	236993-7	236993-9	236993-10
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH503/0.1-0.2	BH503/0.9-1.0	BH504/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.9-1.0	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
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	%	103	113	108	112	101

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		236993-13	236993-16	236993-19	236993-22	236993-25
Your Reference	UNITS	BH505/0.1-0.2	BH506/0.1-0.2	BH507/0.1-0.2	TP501/0.1-0.2	TP502/0.1-0.2
Depth		0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
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	%	106	112	87	86	111

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		236993-27	236993-29	236993-32	236993-37
Your Reference	UNITS	TP502/0.7-0.8	TP503/0.3-0.4	TP504/0.1-0.2	BD3/20200213
Depth		0.7-0.8	0.3-0.4	0.1-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	26/02/2020
Date analysed	-	25/02/2020	25/02/2020	25/02/2020	26/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	87	112	114	115

svTRH (C10-C40) in Soil						
Our Reference		236993-1	236993-5	236993-7	236993-9	236993-10
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH503/0.1-0.2	BH503/0.9-1.0	BH504/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.9-1.0	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	27/02/2020	26/02/2020	26/02/2020	26/02/2020	27/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	240
TRH C_{29} - C_{36}	mg/kg	110	<100	<100	<100	910
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	170	<100	<100	<100	910
TRH >C_{34} -C_{40}	mg/kg	220	<100	<100	<100	1,200
Total +ve TRH (>C10-C40)	mg/kg	390	<50	<50	<50	2,100
Surrogate o-Terphenyl	%	92	94	95	99	85

svTRH (C10-C40) in Soil						
Our Reference		236993-13	236993-16	236993-19	236993-22	236993-25
Your Reference	UNITS	BH505/0.1-0.2	BH506/0.1-0.2	BH507/0.1-0.2	TP501/0.1-0.2	TP502/0.1-0.2
Depth		0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
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	%	92	96	94	96	95

svTRH (C10-C40) in Soil					
Our Reference		236993-27	236993-29	236993-32	236993-37
Your Reference	UNITS	TP502/0.7-0.8	TP503/0.3-0.4	TP504/0.1-0.2	BD3/20200213
Depth		0.7-0.8	0.3-0.4	0.1-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	26/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50
Surrogate o-Terphenyl	%	97	90	93	91

PAHs in Soil						
Our Reference		236993-1	236993-5	236993-7	236993-9	236993-10
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH503/0.1-0.2	BH503/0.9-1.0	BH504/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.9-1.0	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
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	0.2
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.3
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.2	<0.1	<0.1	<0.1	2.2
Pyrene	mg/kg	0.2	<0.1	<0.1	<0.1	3.5
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	0.7
Chrysene	mg/kg	0.1	<0.1	<0.1	<0.1	1.2
Benzo(b,j+k)fluoranthene	mg/kg	0.5	<0.2	<0.2	<0.2	5.8
Benzo(a)pyrene	mg/kg	0.1	<0.05	<0.05	<0.05	1.6
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	1.3
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.3
Benzo(g,h,i)perylene	mg/kg	0.1	<0.1	<0.1	<0.1	1.8
Total +ve PAH's	mg/kg	1.3	<0.05	<0.05	<0.05	19
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	2.6
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	2.6
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	2.6
Surrogate p-Terphenyl-d14	%	99	97	101	103	93

PAHs in Soil						
Our Reference		236993-13	236993-16	236993-19	236993-22	236993-25
Your Reference	UNITS	BH505/0.1-0.2	BH506/0.1-0.2	BH507/0.1-0.2	TP501/0.1-0.2	TP502/0.1-0.2
Depth		0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
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	0.07	<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	0.07	<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	%	96	96	96	97	98

PAHs in Soil				
Our Reference		236993-27	236993-29	236993-32
Your Reference	UNITS	TP502/0.7-0.8	TP503/0.3-0.4	TP504/0.1-0.2
Depth		0.7-0.8	0.3-0.4	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.2	0.2	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.9	<0.1	<0.1
Pyrene	mg/kg	1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.6	<0.1	<0.1
Chrysene	mg/kg	0.5	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	1	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.62	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.4	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.6	<0.1	<0.1
Total +ve PAH's	mg/kg	5.9	0.2	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	0.9	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	0.9	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	0.9	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	102	90	91

Organochlorine Pesticides in soil						
Our Reference		236993-1	236993-5	236993-10	236993-13	236993-19
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH504/0.1-0.2	BH505/0.1-0.2	BH507/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	108	108	104	109	97

Organochlorine Pesticides in soil		
Our Reference		236993-29
Your Reference	UNITS	TP503/0.3-0.4
Depth		0.3-0.4
Date Sampled		13/02/2020
Type of sample		Soil
Date extracted	-	25/02/2020
Date analysed	-	26/02/2020
alpha-BHC	mg/kg	<0.1
HCB	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	95

Organophosphorus Pesticides in Soil						
Our Reference		236993-1	236993-5	236993-10	236993-13	236993-19
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH504/0.1-0.2	BH505/0.1-0.2	BH507/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	108	108	104	109	97

Organophosphorus Pesticides in Soil		
Our Reference		236993-29
Your Reference	UNITS	TP503/0.3-0.4
Depth		0.3-0.4
Date Sampled		13/02/2020
Type of sample		Soil
Date extracted	-	25/02/2020
Date analysed	-	26/02/2020
Dichlorvos	mg/kg	<0.1
Dimethoate	mg/kg	<0.1
Diazinon	mg/kg	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1
Ronnel	mg/kg	<0.1
Fenitrothion	mg/kg	<0.1
Malathion	mg/kg	<0.1
Chlorpyriphos	mg/kg	<0.1
Parathion	mg/kg	<0.1
Bromophos-ethyl	mg/kg	<0.1
Ethion	mg/kg	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1
Surrogate TCMX	%	95

PCBs in Soil						
Our Reference		236993-1	236993-5	236993-10	236993-13	236993-19
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH504/0.1-0.2	BH505/0.1-0.2	BH507/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	108	108	104	109	97

PCBs in Soil		
Our Reference		236993-29
Your Reference	UNITS	TP503/0.3-0.4
Depth		0.3-0.4
Date Sampled		13/02/2020
Type of sample		Soil
Date extracted	-	25/02/2020
Date analysed	-	26/02/2020
Aroclor 1016	mg/kg	<0.1
Aroclor 1221	mg/kg	<0.1
Aroclor 1232	mg/kg	<0.1
Aroclor 1242	mg/kg	<0.1
Aroclor 1248	mg/kg	<0.1
Aroclor 1254	mg/kg	<0.1
Aroclor 1260	mg/kg	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1
Surrogate TCMX	%	95

Misc Soil - Inorg						
Our Reference		236993-1	236993-5	236993-10	236993-13	236993-19
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH504/0.1-0.2	BH505/0.1-0.2	BH507/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Misc Soil - Inorg		
Our Reference		236993-29
Your Reference	UNITS	TP503/0.3-0.4
Depth		0.3-0.4
Date Sampled		13/02/2020
Type of sample		Soil
Date prepared	-	25/02/2020
Date analysed	-	25/02/2020
Total Phenolics (as Phenol)	mg/kg	<5

Acid Extractable metals in soil						
Our Reference		236993-1	236993-5	236993-7	236993-9	236993-10
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH503/0.1-0.2	BH503/0.9-1.0	BH504/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.9-1.0	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
Arsenic	mg/kg	11	19	19	9	12
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	27	33	31	31	25
Copper	mg/kg	23	64	48	23	19
Lead	mg/kg	15	15	14	14	12
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	28	22	21	15	20
Zinc	mg/kg	47	49	46	32	38

Acid Extractable metals in soil						
Our Reference		236993-13	236993-16	236993-19	236993-22	236993-25
Your Reference	UNITS	BH505/0.1-0.2	BH506/0.1-0.2	BH507/0.1-0.2	TP501/0.1-0.2	TP502/0.1-0.2
Depth		0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
Arsenic	mg/kg	16	22	17	6	17
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	34	37	31	21	27
Copper	mg/kg	26	26	22	14	21
Lead	mg/kg	12	12	12	21	8
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	32	36	30	12	22
Zinc	mg/kg	54	55	50	44	40

Acid Extractable metals in soil						
Our Reference		236993-27	236993-29	236993-32	236993-37	236993-39
Your Reference	UNITS	TP502/0.7-0.8	TP503/0.3-0.4	TP504/0.1-0.2	BD3/20200213	BH501/0.1-0.2 - [TRIPLICATE]
Depth		0.7-0.8	0.3-0.4	0.1-0.2	-	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
Arsenic	mg/kg	7	17	16	18	17
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	32	30	25	32	31
Copper	mg/kg	19	29	31	54	21
Lead	mg/kg	14	23	14	12	15
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	15	30	19	13	27
Zinc	mg/kg	26	60	39	42	46

Moisture						
Our Reference		236993-1	236993-5	236993-7	236993-9	236993-10
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH503/0.1-0.2	BH503/0.9-1.0	BH504/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.9-1.0	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
Moisture	%	9.9	13	16	16	9.6

Moisture						
Our Reference		236993-13	236993-16	236993-19	236993-22	236993-25
Your Reference	UNITS	BH505/0.1-0.2	BH506/0.1-0.2	BH507/0.1-0.2	TP501/0.1-0.2	TP502/0.1-0.2
Depth		0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020	26/02/2020
Moisture	%	12	15	13	18	11

Moisture					
Our Reference		236993-27	236993-29	236993-32	236993-37
Your Reference	UNITS	TP502/0.7-0.8	TP503/0.3-0.4	TP504/0.1-0.2	BD3/20200213
Depth		0.7-0.8	0.3-0.4	0.1-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	25/02/2020	25/02/2020	25/02/2020	25/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020	26/02/2020
Moisture	%	23	9.3	15	12

Asbestos ID - soils						
Our Reference		236993-1	236993-5	236993-7	236993-10	236993-13
Your Reference	UNITS	BH501/0.1-0.2	BH502/0.35-0.45	BH503/0.1-0.2	BH504/0.1-0.2	BH505/0.1-0.2
Depth		0.1-0.2	0.35-0.45	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	02/03/2020	02/03/2020	02/03/2020	02/03/2020	02/03/2020
Sample mass tested	g	Approx. 65g	Approx. 70g	Approx. 80g	Approx. 65g	Approx. 80g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	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
Asbestos comments	-	NO	NO	NO	NO	NO
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		236993-16	236993-19	236993-22	236993-25	236993-29
Your Reference	UNITS	BH506/0.1-0.2	BH507/0.1-0.2	TP501/0.1-0.2	TP502/0.1-0.2	TP503/0.3-0.4
Depth		0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.3-0.4
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	02/03/2020	02/03/2020	02/03/2020	02/03/2020	02/03/2020
Sample mass tested	g	Approx. 60g	Approx. 75g	Approx. 50g	Approx. 70g	Approx. 90g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	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
Asbestos comments	-	NO	NO	NO	NO	NO
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils		
Our Reference		236993-32
Your Reference	UNITS	TP504/0.1-0.2
Depth		0.1-0.2
Date Sampled		13/02/2020
Type of sample		Soil
Date analysed	-	02/03/2020
Sample mass tested	g	Approx. 75g
Sample Description	-	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Asbestos comments	-	NO
Trace Analysis	-	No asbestos detected

Misc Inorg - Soil				
Our Reference		236993-5	236993-13	236993-29
Your Reference	UNITS	BH502/0.35-0.45	BH505/0.1-0.2	TP503/0.3-0.4
Depth		0.35-0.45	0.1-0.2	0.3-0.4
Date Sampled		13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	26/02/2020	26/02/2020	26/02/2020
Date analysed	-	26/02/2020	26/02/2020	26/02/2020
pH 1:5 soil:water	pH Units	8.3	8.3	8.1

CEC				
Our Reference		236993-5	236993-13	236993-29
Your Reference	UNITS	BH502/0.35-0.45	BH505/0.1-0.2	TP503/0.3-0.4
Depth		0.35-0.45	0.1-0.2	0.3-0.4
Date Sampled		13/02/2020	13/02/2020	13/02/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	27/02/2020	27/02/2020	27/02/2020
Date analysed	-	27/02/2020	27/02/2020	27/02/2020
Exchangeable Ca	meq/100g	1.7	2.0	1.8
Exchangeable K	meq/100g	<0.1	<0.1	<0.1
Exchangeable Mg	meq/100g	1.4	4.8	4.9
Exchangeable Na	meq/100g	0.11	<0.1	0.13
Cation Exchange Capacity	meq/100g	3.3	7.0	6.9

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.
AT-008	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
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-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.

Method ID	Methodology Summary
Org-012/017	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS and/or GC-MS/MS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-012/017	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-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236993-5
Date extracted	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	94	90
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	94	90
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	95	90
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	86	81
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	94	89
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	97	94
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	93	88
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	128	1	103	111	7	115	107

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]	29	25/02/2020	25/02/2020		[NT]	[NT]
Date analysed	-			[NT]	29	25/02/2020	25/02/2020		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	[NT]	29	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	[NT]	29	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-016	[NT]	29	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-016	[NT]	29	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-016	[NT]	29	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-016	[NT]	29	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-016	[NT]	29	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-014	[NT]	29	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	[NT]	29	112	110	2	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236993-5
Date extracted	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			26/02/2020	1	27/02/2020	27/02/2020		26/02/2020	26/02/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	92	99
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	105	112
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	110	230	71	124	97
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	92	99
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	170	210	21	105	112
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	220	320	37	124	97
Surrogate o-Terphenyl	%		Org-003	86	1	92	87	6	108	82

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	29	25/02/2020	25/02/2020		[NT]	[NT]
Date analysed	-			[NT]	29	26/02/2020	26/02/2020		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	[NT]	29	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	[NT]	29	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	[NT]	29	<100	<100	0	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	[NT]	29	<50	<50	0	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	[NT]	29	<100	<100	0	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	[NT]	29	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-003	[NT]	29	90	90	0	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236993-5
Date extracted	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			26/02/2020	1	26/02/2020	26/02/2020		26/02/2020	26/02/2020
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	94	79
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	98	80
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	99	85
Anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	1	0.2	0.1	67	98	90
Pyrene	mg/kg	0.1	Org-012/017	<0.1	1	0.2	0.1	67	99	86
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	1	0.1	<0.1	0	88	124
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	1	0.5	0.3	50	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	1	0.1	0.09	11	94	90
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	1	0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	95	1	99	94	5	105	100

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	29	25/02/2020	25/02/2020		[NT]	[NT]
Date analysed	-			[NT]	29	26/02/2020	26/02/2020		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-012/017	[NT]	29	0.2	<0.1	67	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	[NT]	29	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	[NT]	29	<0.05	<0.05	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	[NT]	29	90	105	15	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236993-5
Date extracted	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			26/02/2020	1	26/02/2020	26/02/2020		26/02/2020	26/02/2020
alpha-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	87	93
HCB	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	88	97
gamma-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	94	84
delta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	108
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	94	107
gamma-Chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	111
Dieldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	74	112
Endrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	79	115
Endosulfan II	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	94	110
Endrin Aldehyde	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	87	70
Methoxychlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	91	1	108	110	2	101	105

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	29	25/02/2020	25/02/2020		[NT]	[NT]
Date analysed	-			[NT]	29	26/02/2020	26/02/2020		[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
HCB	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Endrin	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	[NT]	29	95	94	1	[NT]	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236993-5
Date extracted	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			26/02/2020	1	26/02/2020	26/02/2020		26/02/2020	26/02/2020
Dichlorvos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	105	88
Dimethoate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	99
Fenitrothion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	97	79
Malathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	102
Chlorpyriphos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	94	105
Parathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	94	92
Bromophos-ethyl	mg/kg	0.1	AT-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	88	115
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	91	1	108	110	2	101	105

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	29	25/02/2020	25/02/2020		[NT]	[NT]
Date analysed	-			[NT]	29	26/02/2020	26/02/2020		[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Dimethoate	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Fenitrothion	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Malathion	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Parathion	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	AT-008	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	[NT]	29	95	94	1	[NT]	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236993-5
Date extracted	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			26/02/2020	1	26/02/2020	26/02/2020		26/02/2020	26/02/2020
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	99	98
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-006	91	1	108	110	2	101	105

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	29	25/02/2020	25/02/2020		[NT]	[NT]
Date analysed	-			[NT]	29	26/02/2020	26/02/2020		[NT]	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-006	[NT]	29	95	94	1	[NT]	[NT]

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236993-5
Date prepared	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	1	<5	<5	0	101	98

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236993-5
Date prepared	-			25/02/2020	1	25/02/2020	25/02/2020		25/02/2020	25/02/2020
Date analysed	-			26/02/2020	1	26/02/2020	26/02/2020		26/02/2020	26/02/2020
Arsenic	mg/kg	4	Metals-020	<4	1	11	12	9	108	89
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	103	87
Chromium	mg/kg	1	Metals-020	<1	1	27	26	4	111	86
Copper	mg/kg	1	Metals-020	<1	1	23	20	14	108	92
Lead	mg/kg	1	Metals-020	<1	1	15	13	14	115	87
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	83	98
Nickel	mg/kg	1	Metals-020	<1	1	28	45	47	106	84
Zinc	mg/kg	1	Metals-020	<1	1	47	41	14	110	77

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	29	25/02/2020	25/02/2020		[NT]	[NT]
Date analysed	-			[NT]	29	26/02/2020	26/02/2020		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	29	17	14	19	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	29	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	29	30	30	0	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	29	29	24	19	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	29	23	16	36	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	29	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	29	30	27	11	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	29	60	53	12	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	[NT]
Date prepared	-			26/02/2020	[NT]	[NT]	[NT]	[NT]	26/02/2020	[NT]
Date analysed	-			26/02/2020	[NT]	[NT]	[NT]	[NT]	26/02/2020	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			27/02/2020	5	27/02/2020	27/02/2020		27/02/2020	[NT]
Date analysed	-			27/02/2020	5	27/02/2020	27/02/2020		27/02/2020	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	5	1.7	1.7	0	98	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	5	<0.1	<0.1	0	101	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	5	1.4	1.4	0	95	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	5	0.11	0.11	0	99	[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

Samples received in good order: Holding time exceedance

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 236993-1 for Ni. Therefore a triplicate result has been issued as laboratory sample number 236993-39.

pH
Samples were out of the recommended holding time for this analysis.

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples 236993-1, 5, 7, 10, 13, 16, 19, 22, 25, 29, 32 were sub-sampled from bags provided by the client.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Updated COC 24/02/2020 16:00

Project No:	72320.12	**Suburb:** Wagga Wagga	**To:** Envirolab Services Sydney
Project Name:	Wagga Wagga.	**Order Number**	
Project Manager:	Chamali Nagodavithane	**Sampler:** Tom Graham	**Attn:** Aileen Hie
Emails:	Chamali.Nagodavithane@douglaspartners.com.au		**Phone:**
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐ ✓		**Email:** ahie@envirolab.com.au
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)	

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8a	Combo 3a	Combo 3	pH / CEC	TRH/BTEX					Notes/preservation
														236993
BH1/0.1-0.2	1	13/02/20	S	G	x									
BH2/0.35-0.45	5	13/02/20	S	G	x			x						
BH3/0.1-0.2	7	13/02/20	S	G		x								
BH3/0.9-1.0	9	13/02/20	S	G			x							
BH4/0.1-0.2	10	13/02/20	S	G	X									
BH5/0.1-0.2	13	13/02/20	S	G	x			x						
BH6/0.1-0.2	16	13/02/20	S	G		x								
BH7/0.1-0.2	19	13/02/20	S	G	x									
TP1/0.1-0.2	22	13/02/20	S	G		x								
TP2/0.7-0.8	27	13/02/20	S	G			x							
TP3/0.3-0.4	29	13/02/20	S	G	x			x						
TP4/0.1-0.2	32	13/02/20	S	G		x								
TP4/0.3-0.4	33	13/02/20	S	G						(82)				HOLD
BD1/202002 (broken)	35	13/02/20	S	G			x		→ test BD3 20200213 for metals, TRH BTEX instead per Chamili -AH					
TP2/0.1-0.2	25	13/02/20	S	G		x								
PQL (S) mg/kg														ANZECC PQLs req'd for all water analytes ☐

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No: 236993

Metals to Analyse: 8HM unless specified here:

Total number of samples in container: | **Relinquished by:** | **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd | **Address** | **Phone:** | **Fax:**

Signed: CLN | **Received by:** Ming Yan To | **Date & Time:**

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Updated COC 25/02/2021 16:00.

Project No:	72320.12	**Suburb:** Wagga Wagga	**To:** Envirolab Services Sydney
Project Name:	Wagga Wagga.	**Order Number**	
Project Manager:	Chamali Nagodavithane	**Sampler:** Tom Graham	**Attn:** Aileen Hie
Emails:	Chamali.Nagodavithane@douglaspartners.com.au		**Phone:**
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐ ✓		**Email:** ahie@envirolab.com.au
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)	

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8a	Combo 3a	Combo 3	pH / CEC	TRH/BTEX					Notes/preservation
TS	N/R		S	G					x					
TB	N/R		S	G					x					
PQL (S) mg/kg														ANZECC PQLs req'd for all water analytes ☐

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No: 236993

Metals to Analyse: 8HM unless specified here:

Total number of samples in container: **Relinquished by:** **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address** **Phone:** **Fax:**

Signed: **Received by:** Ming Yan To. **Date & Time:**