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**From:** Johns, Peter  
**Sent:** Thursday, 26 February 2015 2:48 PM  
**To:** Sayers, Caroline  
**Subject:** FW: Block 2 section 28 Greenway - Traffic Report  
**Attachments:** B2, S28, Greenway Ph1 + 2 Contam.pdf; B2 S28 Greenway Geotechnical.pdf

Caroline

Information for the Greenway site.

Peter

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**From:** Walker, Graeme  
**Sent:** Monday, 23 February 2015 3:41 PM  
**To:** Johns, Peter  
**Subject:** Block 2 section 28 Greenway - Traffic Report

Peter

For your information the Phase 1 and 2 Contamination Assessment and Preliminary Geotechnical Investigation for Block 2 Section 28 Greenway, ACT

*Graeme Walker*

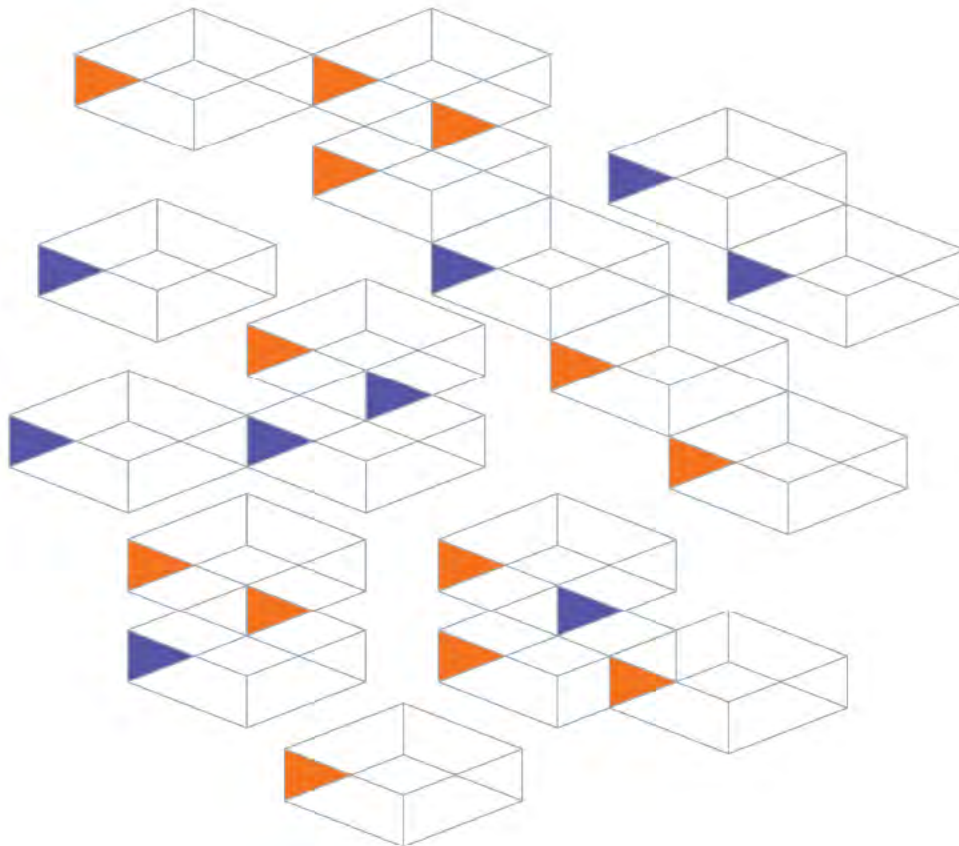
Graeme Walker  
Land Development Agency  
Level 7 TransACT House, 470 Northbourne Avenue, Dickson ACT 2602  
Phone: 02 6207 5431 | Fax: 02 6207 6110 |  
Web: [www.lda.act.gov.au](http://www.lda.act.gov.au)

**Land Development Agency**

**Phase 1 and 2 Contamination Assessment**

Block 2, Section 28, Greenway, ACT

18 February 2015



Boundaries  
are set by those  
who are afraid  
to push them

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# Phase 1 and 2 Contamination Assessment

Prepared for  
Land Development Agency

Prepared by  
Coffey Environments Australia Pty Ltd  
118 Auburn St  
Wollongong NSW 2500 Australia  
t: +61 2 4201 1471 f: +61 2 4201 1401  
ABN: 65 140 765 902

<b>Project Director</b>	[Redacted] Principal Environmental Engineer
<b>Project Manager</b>	[Redacted] Senior Environmental Scientist

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## Executive summary

Land Development Agency (LDA) is the current leaseholder of Block 2, Section 28, Greenway, ACT. LDA requires an assessment of the contamination status and preliminary geotechnical conditions of the subsurface prior to divestment. Coffey was subsequently commissioned by LDA to undertake a Phase 1 and 2 contamination assessment, and a geotechnical investigation. The geotechnical component is presented in a separate report.

The objective of the contamination assessment was to assess the likelihood for contamination to exist on the site from past or present activities and to make recommendations on the need for further investigation and/or remediation (as required).

The scope of work developed to meet this objective included a review of site history information, site walkover, intrusive investigations at fifteen locations, collecting soil samples within the identified areas of environmental concern (AECs) and laboratory analysis. The results of field and laboratory investigations were interpreted and reported with respect to the above objectives.

Site history information indicated that the site was generally vacant, grassed rural/open space since at least 1975. A walkway pavement was constructed in the northern portion of the site between the 1970's and 1980's, a walkway was constructed to the site, and earthworks occurred in the vicinity of the site during construction of Drakeford Drive, Mortimer Lewis Drive and Lake Tuggeranong.

Fifteen sampling locations were used to assess the one AEC identified (fill of unknown origin and quality).

Concentrations of contaminants of potential concern were less than adopted human health investigation limits for urban redevelopment for the most sensitive generic land use scenario covered under ACT EPA endorsed national guidance (NEPM, 2013) (residential land use with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry)). Therefore, concentrations detected are unlikely to pose an unacceptable risk, from a contamination perspective, to future site users in a residential, commercial or industrial land use scenario.

Concentrations of contaminants of potential concern were less than adopted ecological screening/investigation levels, therefore it is considered that there is a low likelihood that contaminant concentrations would present unacceptable risk to environmental receptors.

Groundwater was not directly assessed as part of this investigation. Impact to groundwater is considered low based on the site history and reported concentrations of the contaminants of potential concern tested in soil.

Based on the information gathered for this assessment, it appears that the site is suitable for rezoning for a proposed residential landuse.

Coffey note that due to the nature of contaminated site investigation and remediation that the degree of variability in site conditions cannot be known completely and no sampling and analysis programme can eliminate all uncertainty concerning the condition of a site, including those statistically based and substantially following guidelines made or approved by the relevant regulatory authorities. Therefore, it is recommended that an unexpected finds protocol is prepared by an appropriately experienced consultant for implementation as part of the recommended remediation works and construction earthworks works associated with the future development of the site. The unexpected finds protocol should include procedures and protocols for managing risks should unexpected finds of contamination be identified at the Site.

The requirements of the unexpected finds protocol should consider the findings of this investigation and where possible, the findings of other works recommended above.

This executive summary must be read in conjunction with the full report and in the context of the attached “Important Information about your Coffey Environmental Report” and to the statement of limitations in Section 13 of this report.

# Abbreviations

<b>ABC</b>	Average Background Concentration
<b>ACL</b>	Added Contaminant Level
<b>ACM</b>	Asbestos Containing Materials
<b>ACT EPA</b>	Australian Capital Territory Environment Protection Authority
<b>AEC</b>	Area of Environmental Concern
<b>AF</b>	Asbestos Fibres
<b>AHD</b>	Australian Height Datum
<b>ASC</b>	Assessment of Site Contamination
<b>bgs</b>	below ground surface
<b>BTEX</b>	Benzene, Toluene, Ethylbenzene and Xylenes
<b>CBR</b>	California Bearing Ratio
<b>CEC</b>	Cation Exchange Capacity
<b>COC</b>	Chain of Custody
<b>COPC</b>	Contaminant of potential concern
<b>CRC CARE</b>	Cooperative Research Council – Contamination Assessment and Remediation
<b>CSM</b>	Conceptual Site model
<b>C6-C36</b>	Hydrocarbon chainlength fraction
<b>DBYD</b>	Dial-Before-You-Dig
<b>DQI/DQO</b>	Data Quality Indicators/Data Quality Objective
<b>EIL</b>	Ecological Investigation Level
<b>EPBC</b>	Environment Protection and Biodiversity Conservation
<b>EPU</b>	Environment Protection Unit
<b>ESDD</b>	Environment and Sustainable Development Directorate
<b>ESA</b>	Environmental Site Assessment
<b>ESL</b>	Ecological Screening Level
<b>ESWMS</b>	Environmental Safe Work Method Statements
<b>Eurofins</b>	Eurofins Environment Testing Australia Pty Ltd, trading as Eurofins MGT
<b>FA</b>	Fibrous Asbestos
<b>HIL</b>	Health-based Investigation Level

<b>HSL</b>	Health-based Screening Level
<b>LDA</b>	Land Development Agency
<b>LOR</b>	Limit of Reporting
<b>mg/kg</b>	milligrams per kilogram
<b>NATA</b>	National Association of Testing Authorities
<b>NEPC</b>	National Environment Protection Council
<b>NEPM</b>	National Environment Protection (Assessment of Site Contamination) Measure
<b>NSW DEC</b>	New South Wales Department of Environment and Conservation
<b>NSW EPA</b>	New South Wales Environment Protection Authority
<b>OCP</b>	Organochlorine Pesticide
<b>OPP</b>	Organophosphorus Pesticide
<b>P2 ESA</b>	Phase 2 Environmental Site Assessment
<b>PAH</b>	Polycyclic Aromatic Hydrocarbon
<b>PID</b>	Photoionisation Detector
<b>ppm</b>	parts per million
<b>PSD</b>	Particle Size Distribution
<b>QA/QC</b>	Quality Assurance/Quality Control
<b>RAP</b>	Remedial Action Plan
<b>RPD</b>	Relative Percentage Difference
<b>SAQP</b>	Sampling Analysis and Quality Plan
<b>SOP</b>	Standard Operating Procedures
<b>SP</b>	Stockpile
<b>TA</b>	Targeted
<b>TDS</b>	Total Dissolved Solids
<b>TP</b>	Test Pit
<b>TPH</b>	Total Petroleum Hydrocarbon
<b>TOC</b>	Total Organic Carbon
<b>TRH</b>	Total Recoverable Hydrocarbon
<b>VOC</b>	Volatile Organic Compound

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## **Appendices**

Appendix A - Site History Information

Appendix B – Site Photographs

Appendix C – Laboratory Analytical Results

Appendix D – Data Validation Report

Appendix E – Borehole and Test pit Logs

# 1. Introduction

## 1.1. Background

The Land Development Agency (LDA) engaged Coffey Environments Australia Pty Ltd (Coffey) to undertake a Phase 1 and Phase 2 Contamination Assessment of the land comprising Block 2, Section 28, Greenway, ACT (the site).

This assessment was completed in general accordance with Coffey's proposal dated 19 December 2014 (ref: ENAUBRAD01326AA-P01, dated 19 December 2014). LDA is the current leaseholder of the site and requires an assessment of the contamination status and preliminary geotechnical conditions of the subsurface prior to divestment.

The site is a generally vacant parcel of land approximately 44,000m<sup>2</sup> in size, and is situated adjacent Lake Tuggeranong. This report presents the result of the contamination assessment. The geotechnical component is presented in a separate report.

## 1.2. Objectives

The overall objective of the assessment is to provide an indication of the contamination status of the site to inform future re-development works and support a Development Application (where required). Environmental Protection Agency (EPA) endorsement is required to assist with meeting this objective.

The objective of the contamination assessment was to assess the likelihood for contamination to exist on the site from past or present activities and to make recommendations on the need for further investigation and/or remediation (as required).

## 1.3. Scope of works

The work carried out by Coffey to meet the above objectives included:

- Site history and desk study for assessing the likelihood of potential contamination to exist at the site (i.e. a Phase 1 assessment).
- A site walkover to visually assess potential sources of contamination, observe surrounding land uses, topography, drainage, nearby sensitive environments, and assess details of the site history and desk study to further assess potential areas of environmental concern (AECs) and contaminants of potential concern (COPCs).
- An intrusive Phase 2 assessment, involving:
  - Collection and analysis of soil samples at 15 locations across the site targeting specific AECs. Soil samples were collected from a combination of test pits, boreholes and surface samples. Selected soil samples were also collected in duplicate and screened for Volatile Organic Compounds (VOC) using a Photoionisation Detector (PID);
  - Selected samples were analysed for a suite of COPC including petroleum hydrocarbons, pesticides, asbestos and heavy metals.
- Preparation of this report summarising relevant information including, the Phase 1 desk study, results of Phase 2 intrusive assessment, presenting and interpreting analytical results and findings, comparing contaminant concentrations to applicable screening criteria, and making conclusions and recommendations with respect to the objectives outlined in Section 1.2.

## 2. Site information

### 2.1. Site identification

The site identification information is summarised in Table 1. The site locality, site layout and general surrounding land uses are shown in Figures 1 and 2. The site boundary is shown on Figure 2.

**Table 1: Summary of Site Identification Information**

Street Address	Mortimer Lewis Drive, Greenway, ACT	
Title Identifiers	Block 2, Section 28	
Area	44,645m <sup>2</sup>	
Grid Co-ordinates	35°24'38" S 149°04'19" E	
District/Division Name	Greenway	
Zoning and permitted uses (ACTMAP1 2014)	CZ6: Leisure and Accommodation	
Current Owner(s)	Land Development Agency	
Current Site Use	Vacant grassed area	
Surrounding Land Use	North	Single storey residential properties
	South	Mortimer Lewis Drive, followed by vacant grassed land
	West	Mortimer Lewis Drive, followed by vacant grassed land and Lake Tuggeranong.
	East	Drakeford Drive followed by residential properties.

### 2.2. Topography and drainage

The site gently slopes to the west toward Lake Tuggeranong. Topographical information provided in ACT Planning and Land Authority's online interactive mapping service (ACTmapi) indicating the site lies at an approximate elevation ranging between 572m to 575m Australian Height Datum (AHD). In the eastern portion of the site, there is a slight circular hillock, which is about 1m to 2m above surrounding areas.

Paved pathways are present transecting the northern portion of the site, and are, in parts, slightly raised above surrounding land.

There is a slightly sloping depression in the southern area of the site. During periods of heavy rainfall, surface runoff may flow down this depression toward Lake Tuggeranong.

### 2.3. Local geology and soils

The 1: 100, 000 Geological Map of Canberra (Abell 1992) indicates that the site is underlain by Laidlaw Volcanic formation comprising Rhydacitic ignimbrite and minor volcanoclastic argillaceous sediments.

Jenkins (2000) describes soils as part of the Williamsdale group which is characterised by undulating rises, alluvial fans, and valley flats on Silurian Volcanic of the Canberra Formation. Soils are moderately deep, moderately well drained, Yellow Chromosols on Red and Brown Kandosols on upper rises and fan elements. On lower rises and fan elements, Jenkins (2000) identifies moderately deep to very deep, poorly to imperfectly drained Sodosols.

## 2.4. Regional hydrogeology and hydrology

The 1:100,000 scale hydrogeological map *Hydrogeology of the Australian Capital Territory* (Evans 1984) indicates the site is late Silurian diastatic, rhyoclastic, ignimbrite, sandstone, limestone and ashstone. Likely yields tend to be less than 0.5l/s. Water quality is likely to be of potable quality with dissolved solids concentration of <500mg/l. This map pre-dates the creation of Lake Tuggeranong, which may have influenced local groundwater levels.

A groundwater bore search with ACT Environment Protection and Water Regulation (EPWP) indicated there are no licensed groundwater bores within a 500m radius of the site.

The nearest surface water receptor is Lake Tuggeranong, located approximately 100m to the west of the site. Based on information provided on the ACT Territory and Municipal Services (TAMS) website<sup>1</sup>, Lake Tuggeranong is an artificial lake created in 1987 to act as a settling pond to trap soil and debris from the urban environment.

Groundwater and surface water flow direction is inferred to be west towards Lake Tuggeranong which forms the western boundary of the site.

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<sup>1</sup> [http://www.tams.act.gov.au/parks-recreation/water\\_catchments/urban\\_water\\_catchments/lake\\_tuggeranong](http://www.tams.act.gov.au/parks-recreation/water_catchments/urban_water_catchments/lake_tuggeranong)

### 3. Site history review

Information on the site history was obtained from the following sources:

- Review of historic aerial photographs held by Surveying and Spatial Data, Environment and Sustainable Development Directorate (ESDD);
- Review of contaminated land records held by the Environment Protection Authority (EPA);
- Review of Office of Regulatory Services records for dangerous goods storage; and
- Review of previous site ownership from available historical title records.

#### 3.1. Historical aerial photographs

Four historical aerial photographs were received from ACT Planning and Land Authority (ACT PLA) covering a period between 1975 and 1993. Post 1993, imagery available from Google Earth was reviewed for 2002 to 2011. Table 2 below presents a summary of observations made following the historical aerial photograph review. Historical aerial photographs are presented in Appendix A.

**Table 2: Historical Aerial Photography observations**

Image Date	Observations
1975 (colour)	<p>The majority of the site is vacant and grass covered with several tracks crossing the site. Adjacent the site, it appears that earthworks is being undertaken for the future Drakeford Drive. The eastern edge of the site appears to be exposed soil and is likely to be part of these earthworks.</p> <p>There is an area of disturbed soils in the central eastern portion of the site, including a narrow strip of exposed soil (possibly a trench) running east-west into the central area of the site (this coincides with the current underpass). Several small white cylindrical objects (possibly concrete pipes) are situated adjacent the trench.</p> <p>Offsite, Lake Tuggeranong has not yet been constructed, and Tuggeranong creek is visible approximately 400m to the west of the site. Two rectangular structures (possibly treatment ponds) are visible to the immediate west of the creek, approximately 500m from the site. The remainder of surrounding land appears vacant and grassed,</p>
1984 (colour)	<p>The majority of the site appears grassed and is similar to the previous aerial photograph. The trench visible in the previous aerial photograph appears as a culvert or walkway. An irregular patch of land partially covers the walkway in the centre of the site. The existing tracks are not visible, and appear to have been replaced with more lineal pathways across the site.</p> <p>The northbound lane of Drakeford Drive is visible, and there appears to be redevelopment earthworks to the east of Drakeford Drive. The treatment ponds to the west of the site appear to be infilled. The surrounding land use appears similar to the previous aerial photograph.</p>

Image Date	Observations
1993 (colour)	<p>The walkway appears to extend westwards towards Mortimer Lewis Drive, which is visible along the western site boundary. Two areas of the site (in the north and west) appear a deeper shade of green, possibly indicating that these are areas of higher moisture than surrounding areas.</p> <p>Lake Tuggeranong is visible, and is of a similar orientation as present. The Lake footprint covers the former treatment ponds. Residential properties are visible to the east of Drakeford Drive, and earthworks activities are occurring in areas to the north of the site. The remainder of the surrounding site use appears similar to the previous aerial photograph.</p>
22/12/2002 (Google Earth Image™)	<p>The greener area in the north and west of the site appears to be of a duller shade of green and appears similar to surrounding land. The area where the current depression in the southern area of the site is distinguishable from the darker green colour in this photograph. There is a dirt track transecting the western area of the site. The remainder of the site appears similar to the previous aerial photograph.</p> <p>Additional residential development is being constructed to the north of the site, and the southbound land of Drakeford Drive is visible. The surrounding site use appears similar to the previous aerial photograph.</p>
28/8/2011 (Google Earth Image™)	<p>A circular shaped patch of disturbed soil is visible adjacent the track in the western area of the site. The remainder of the site appears similar to the previous aerial photograph. The surrounding land use appears similar to the previous aerial photograph.</p>

### 3.2. ACT Environment Protection Authority records

Coffey submitted a request to the ACT EPA on 15 January 2015 for a search of records held pertaining to the site. ACT EPA indicated:

- There is no recorded information on potential site contamination. ACT EPA noted that similar sites have in the past been associated with site contamination due to the application of chemicals to control weeds and pests, and the placement of uncontrolled fill during the establishment of open space areas.
- The EPA has not issued any environmental protection orders under section 91C (1), 91D (1) or 125 (4) of the Environment Protection Act 1997 (the ACT) over the site.

A copy of the correspondence received from ACT EPA, referenced as 97/05256 is provided as Appendix A.

### 3.3. ACT Office of Regulatory Services records

A search of the Dangerous Goods Database and Dangerous Substances Register maintained by the Office of Regulatory Services was undertaken to evaluate whether dangerous substances have been stored at the site. The findings of this search indicate that there are no records of dangerous substances being stored at this site.

A copy of the correspondence received from ORS, dated as 5 February 2015 and is presented in Appendix A.

### **3.4. Land titles and historical documents database**

A review of the ACT Office of Regulatory Services Land Titles indicated that no records (historical or otherwise) are available for Block 2, Section 28 which is not unusual for Commonwealth land. It is understood that the site is current leased by Land Development Agency.

### **3.5. Site interview information**

Due to the undeveloped nature of the site it was not possible to identify persons with knowledge of the site history, therefore no additional practical sources of anecdotal historical information were identified during the course of this assessment.

### **3.6. Summary of site history**

The following is a summary of the history of the site:

- The site has generally been vacant and grassed, and either used as rural or open space purposes since at least 1975.
- Minor earthworks occurred in the central northern area of the site during construction of the walkway between the mid 1970's to mid 1980's.
- Ground disturbances may have occurred around the boundaries of the site during construction of Drakeford Drive, Mortimer Lewis Drive and Lake Tuggeranong between the mid 1970's and late 1980's.
- While the ACT EPA does not have records of specific potentially contaminating activities on the site, they have noted that similar sites have recorded contamination due to filling activities and application of chemicals to control weeds and pests.

### **3.7. Integrity Assessment of Historical Data**

The following sources of historical data were relied upon for this assessment:

- Aerial photographs Surveying and Spatial Data, Environment and Sustainable Development Directorate (ESDD)
- Records held by Office of Regulatory Services;

The observations made during the walkover (Section 4) were generally consistent with the records provided by third parties.

Based on the information retrieved as part of this assessment, some gaps are noted in the site history information and are as follows:

- Information on the history of the site prior to the mid 1970's was not well documented. No definitive information or imagery was available regarding the status or use of the site prior to 1975. It is likely the site was cleared circa early to mid 20<sup>th</sup> century as part of the development of Canberra. It is possible that light agricultural activities were conducted on site following clearing. This data gap is not considered to be significant.

## 4. Site observations

An environmental scientist made observations of the site during a walkover on 30 January 2015. A summary of observations made during this walkover is provided below with photographs in Appendix B.

During the walkover, the following general observations were made:

- The site predominantly consisted of cleared vacant land, bounded by Drakeford Drive to the east and Mortimer Lewis Drive to the south.
- A concrete pedestrian walkway/cycleway transects the northern part of the site from Drakeford Drive to Lewis Mortimer Drive. In some areas the walkway was raised above the surrounding ground surface, indicating localised filling. There was no other evidence of fill on the site.
- A dirt track transects the eastern portion of the site from the north. Patches of exposed soil were observed in this area, and a small mound ( $<1\text{m}^3$ ) of mulch was also observed.
- Occasional pieces of litter (food packaging) were scattered around the site, typical of most urban parklands.
- The site was slightly undulating and generally sloped from east to west toward Lake Tuggeranong;
- The site was generally grassed, and sparsely vegetated with trees or shrubs. There were isolated areas of bare earth or patchy vegetation.
- Visual indications of contamination were not observed during the site walkover.

## 5. Areas of environmental concern and chemicals of potential concern

Based on site history information and observations made during the site walkover, two Areas of Environmental Concern (AECs) and associated Contaminants of Potential Concern (COPCs) were identified at the site and summarised in Table 3.

**Table 3: Summary of Potentially Contaminating Activities, Potential Areas of Environmental Concern, Likelihood of Contamination and Contaminants of Potential Concern**

AEC #	Description	Area Potentially Impacted	Likelihood of contamination*	COPCs
1	Fill of unknown origin and quality	Imported fill/reworked natural soils are likely to be situated beneath elevated sections of the walkway. Filling may have occurred across other areas of the site, adjacent the surrounding roads. Contamination associated with filling activities could potentially affect the entire site.	Low to medium	A suite of contaminants typically found in urban fill - TRH, BTEX, PAH, OCP, OPP, metals, asbestos

Table notes:

- \* It is important to note that this is not an assessment of financial risk associated with the AEC in the event contamination is detected, but a qualitative assessment of the probability of contamination being detected at the potential AEC, based on the site history study and field observations.

TRH	Total Recoverable Hydrocarbons	Metals	arsenic, cadmium, chromium, copper, lead, nickel, mercury, zinc
BTEX	Benzene, Toluene, Ethylbenzene, Xylene	OCP	Organochlorine Pesticides
PAH	Polycyclic Aromatic Hydrocarbons	OPP	Organophosphorus Pesticides
PCB	Polychlorinated Biphenyl		

Information provided by ACT EPA indicated that similar sites in the past had been associated with site contamination due to the application of chemicals to control weeds and pests. Based on the site history study and site walkover, there was no evidence of intensive farming (either grazing or crop), nor widespread vegetation clearing, since at least the mid 1970's. It is considered unlikely that widespread applications of these substances would have been applied to this site at volumes that would result in residual concentrations likely to present an unacceptable risk to receptors. Therefore, on this occasion this was not considered a significant contaminating activity.

## 6. 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 is developed (as shown in Table 4) using information obtained from site history, site observations, proposed land use and expected ground conditions. Once the contamination status is understood through the sampling and analysis process, the CSM then allows the assessor to evaluate the risk posed by the contamination to the identified receptor, and whether remediation is required to manage that risk.

### 6.1. Potential exposure pathways

The following potential exposure pathways for contaminants have been identified:

- Dermal/direct contact
- Ingestion
- Contact with or consumption of groundwater
- Inhalation via vapour intrusion
- Inhalation of airborne particles

### 6.2. Primary release mechanisms

- Leaching
- Spills

### 6.3. Potential receptors

#### 6.3.1. Onsite

In consideration of site history, site activities, evidence of potential contamination and building condition the following exposure pathways were identified for onsite receptors:

- The future land use of the site (occupants of townhouses/apartments). The final configuration of the dwellings is unknown, however it is assumed that some of the dwellings will have access to soil via a private garden. In consideration of sensitive and non-sensitive land uses for the site, the potential human receptors are:
  - Current users of the site – visitors to the parklands.
  - Future users of the site under future residential setting through various pathways (e.g. dermal contact, inhalation, ingestion, etc.).
  - Construction workers setting through various pathways (e.g. dermal contact, inhalation, ingestion, etc.).
  - Maintenance workers in sub-surface trenches via dust movement / petroleum vapours and direct contact with impacted soils. Maintenance workers may be required in any land use scenario.
- Non-human receptors would include underground services that can be adversely affected upon exposure to petroleum hydrocarbons.
- Ecological receptors:

- The area surrounding the site is urbanised with Lake Tuggeranong being a likely receptor. The vegetation observed on site was mostly native species (e.g. eucalypts), which promote and support various animal communities (e.g. feral animals, birds, possums, etc).
- Future use of groundwater extracted for domestic and recreational purposes. The site is serviced by town water thus making it less likely groundwater would be used for this purpose.

### **6.3.2. Offsite**

Potential exposure pathways for humans and the environment are associated with the transportation of potential contamination via groundwater and surface water to offsite areas. The topography suggests that groundwater is likely to flow in a westerly direction towards Lake Tuggeranong. Surface water captured onsite is also expected to discharge into Lake Tuggeranong.

Based on the data available and our initial qualitative assessment of likely contamination, the potential exposure pathways for human and environmental offsite receptors are summarised below:

- Human receptors:
  - Humans involved in recreational activities (e.g. swimming and fishing) in Lake Tuggeranong. Lake Tuggeranong is a potential receiver of groundwater and surface water (via stormwater system).
  - Use of groundwater is extracted in areas surrounding the site for domestic and recreational purposes. The site and surrounding areas are serviced by town water thus making it less likely groundwater would be used for drinking water.
- Ecological receptors:
  - Fresh water species (e.g. crayfish, worms, etc.) where sediment is present, free swimming species (e.g. fish, tadpoles, etc.), water plants and algae.

## 6.4. Conceptual Site Model

Table 4 – Conceptual Site Model

AEC #	Potential Contamination Source	COPCs	Primary Release Mechanism	Media Potentially Impacted					Exposure pathway						Potential Receptor based on proposed residential development								
				Soil	Groundwater	Surface Water	Indoor Air	Ambient Air	Dermal / Direct contact	Ingestion	Inhalation (via vapour intrusion)	Inhalation (airborne dust or particles)	Migration of surface water	Migration of groundwater	On-site					Off-site			
															Future Residents, maintenance workers & other site visitors in future buildings	Residents, maintenance workers & other site visitors in outdoor areas	Maintenance workers in subsurface trenches	Construction Workers	Ecological	Groundwater Users	Underground infrastructure	Groundwater Users	Lake Tuggeranong (ecological and recreational)
1	Fill of unknown origin and quality	TRH, BTEX, PAH, OCP, OPP, PCB, metals, asbestos	Leaching	X	X		X	X	X	X	X	X		X	P	P	P	P	P	NC	P	NC	P

NC	No complete pathway
P	Potentially complete
NA	Not applicable

## **7. Sampling, analysis and quality control plan**

### **7.1. Sampling and analysis**

To assess a site with an area of 4.4Ha with respect to contamination, the ACT EPA endorsed NSW EPA sample design guidelines (1997) recommend a minimum of 51 sampling locations (subject to results of the site history and identified areas of environmental concern). Based on the results of the Phase 1 contamination assessment which did not identify any specific contaminating activities, except for two speculative activities, a reduced number of sample locations was deemed to be sufficient to assess this site for re-zoning purposes. Fifteen sample locations were considered adequate to get an impression of the type and homogeneity of subsurface conditions and contaminant concentrations.

Sampling locations involved two surface samples (SS1 and SS2), eight test pits (TP1 to TP8), and five hand augers (BH1 to BH5). Sample locations BH2 and TP1 targeted the suspected localised fill in the vicinity of the walkway. The remainder of the sampling locations were systematically spaced around the site, ensuring that some locations (SS1, BH5 and TP4) were situated in the eastern area of the site in the vicinity of the dirt pathway.

Target depths were to the base of fill, or base of visual/olfactory evidence of contamination (if encountered).

### **7.2. Quality control plan**

A quality assurance/quality control plan was designed to achieve the predetermined data quality objectives (DQOs) and to demonstrate accuracy, precision, comparability, representativeness and completeness of the data generated and the procedures for assessing the DQOs are met. The Data Quality Indicators (DQIs) adopted to assess DQOs are outlined in the data validation report presented in Appendix D.

## 8. Assessment Criteria

The assessment criteria proposed for this project were sourced from:

- NEPC (1999) National Environment Protection (Assessment of Site Contamination) Amendment Measure (No. 1) 2013 (NEPM).
- Friebel and Nadebaum (2011) CRC Care Technical Report No. 10 – Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater.

The NEPM (2013) presents health based investigation levels for different land uses (e.g. industrial / commercial, residential, recreational, etc.) as well as ecological investigation levels.

Based on information provided by LDA, the preliminary development plan is to redevelop the site into proposed townhouses and apartments (up to three storeys) with basement parking. We have assumed that at least some of these dwellings will have access to soil (such as private gardens). It is likely a growing medium will be imported to support vegetation within landscaping areas.

The proposed development is consistent with Residential land use scenario with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), as described in NEPM Schedule B7.

The following assessment criteria will be adopted for soil assessment purposes:

- Health screening level (HSL) for hydrocarbons (TRH, BTEX and naphthalene) via vapour intrusion (Table 1A(3) of NEPM HSL B);
- Health investigation level (HIL) for remaining COPCs (Table 1A(1) of NEPM HIL A);
- Ecological investigation and screening levels based on values listed in Tables 1B(3), 1B(4), 1B(5) and 1B(6) of the NEPM. Some EILs will be determined using ASC NEPM Toolbox;
- Direct contact and Intrusive maintenance workers screening values for petroleum hydrocarbons listed in Tables B3 and B4 (CRC, 2011); and
- Management Limits for TRH fractions in soil (Table 1B(7) of the NEPM).

The basis of this selection is discussed in the following sections.

### 8.1. Health Investigation Levels (HILs)

The HILs are applicable for assessing human health risk via relevant exposure pathways. HILs were developed for a broad range of metals and organic substances. These are generic to all soil types and apply generally to a depth of 3m below the soil surface.

#### 8.1.1. Asbestos

Visual observation for the presence of asbestos in the form of bonded ACM during the investigation was undertaken. Selected soil samples were also analysed for asbestos, and a conservative approach to assess asbestos impact (i.e. comparison against a 'non-detect' trigger level) was adopted. Should the results have exceeded the detection limit, then further investigation would have been required.

## 8.2. Health Screening Levels (HSLs)

The HSLs were developed by the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) and were adopted in the amended NEPM. The principal reference for the HSL rationale is Friebel and Nadebaum (2011) as the technical information is contained within these documents. HSLs consider human health effects of petroleum hydrocarbons (from petroleum products e.g. petrol, diesel) in soil, groundwater and soil vapour media from vapour intrusion and direct contact with soil (i.e. dust inhalation, oral ingestion, dermal contact).

The derivation of the most appropriate HSL for the given land use is also dependant on source depth for vapour intrusion, sampling depth interval, soil type and several other key limitations. An eight step process is to be followed when selecting the correct HSL for a site and include:

1. Identification of key limitations to the application of health screening levels;
2. Identification of key receptors and scenarios;
3. Identification of relevant soil type;
4. Identification of impacted media and depths;
5. Identification of source concentrations to be compared with health screening levels;
6. Selecting appropriate HSL and consideration of combining vapour intrusion and direct contact exposure;
7. Applying adjustments to the HSLs based on vapour biodegradation, soil organic carbon content, air exchange rate, and soil moisture content; and
8. Adjustments for cancer risk assessment - modification of acceptable cancer risk level, assessment of cumulative cancer risk.

The selection of the HSLs is discussed in Table 5.

**Table 5: Selection Rationale for HSLs**

Step	Rationale
1  Key Limitations	<ul style="list-style-type: none"> <li><b>Contamination source:</b> Unknown – but assumed that if petroleum contamination identified will be typical fuels.</li> <li><b>Contaminant mixtures:</b> site history indicates chemicals such as pesticides could have been used at the site. If detected these will be considered.</li> <li><b>Groundwater:</b> Licensed bores are not located within 500m of the site. The area is supplied with town water and therefore unlikely groundwater would be used as a drinking water resource. Direct contact with groundwater is unlikely, as it was not encountered at investigation locations. Based on available information, the potential for petroleum hydrocarbon impacts to groundwater appear to be low.</li> <li><b>Ecological receptors:</b> Site does not form part of conservation land but complete pathways are present requiring consideration of potential impacts to plants and transitory animals. Refer to Section 8.3.</li> <li><b>Odours:</b> None identified.</li> <li><b>Soil source thickness:</b> available information suggests contaminants would reside in fill materials and upper soils which are generally less than 1m thick.</li> <li><b>Crawl spaces:</b> Unknown. Details of proposed development are not available.</li> <li><b>Basements:</b> LDA have indicated that future development may include parking basements.</li> </ul> <p>Based on the above, HSLs are considered applicable for application at the site only to petroleum hydrocarbon contaminants (if detected) and in areas where chemical mixture do not occur.</p>

Step	Rationale
2	Refer to Section 6.3.
Key Receptors and Scenarios	Potential future land use will be medium density residential development (similar to townhouses), which is consistent residential with limited access to soils.
3	The current and dominant soil profile comprises silts and clays (Refer to Section 11.1). In consideration of these site specific subsurface conditions the HSLs adopted for vapour intrusion will be based on:
Identification of Relevant Soil Type	<ul style="list-style-type: none"> <li>A depth range between 0m to &lt;1m, as contamination if present, will be released at the surface penetrating into the subsurface.</li> <li><i>Silt</i> soil type.</li> </ul>
4	Soil criteria will apply for varying depths based on the depth of the samples (or inferred shallowest depth of which the sample is meant to characterise).
Identification of Impacted Media and Depths	
5	Each sample collected from the boreholes and surface samples analysed for TRH/BTEX will be compared to the selected HSLs (refer to Section 11).
Selection of Relevant Source Concentrations	
6	<ul style="list-style-type: none"> <li><b>HSL selection:</b> Refer to Section 8.2.</li> <li><b>Combined exposure pathway assessment for vapour intrusion:</b> N/A. No benzene was reported in samples tested.</li> </ul>
Selecting Appropriate HSLs	
7	No HSL adjustments are required or can be justified based on laboratory the results. That is, volatile petroleum hydrocarbons were not reported in soil samples analysed or evidence of odours during sampling. PID readings were <8ppm.
Applying Adjustments to HSLs	
8	Adjustment to HSLs for cancer risk is not considered necessary as the nominated lifetime cancer risk is relevant to the jurisdiction and only one known or suspected carcinogen has been identified.
Adjustments for Cancer Risk Assessment	

### 8.3. Ecological Investigation Levels (EILs)/Ecological Screening Levels (ESLs)

The ESLs and EILs have been developed for assessing risk to terrestrial ecosystems and have been developed for a number of land use scenarios. They apply to the top 2m of soil, which corresponds to the root zone and habitation zone of many species.

The ESLs are associated with selected petroleum compounds and broadly apply to coarse and fine-grained soils. For this site, the dominating soil type is silt/clay (Refer to Table 5, Step 3).

The EILs are associated with selected metals and organic compounds. These EILs depend on specific soil physiochemical properties. Site specific data including clay content, pH and Cation Exchange Capacity (CEC) and Ambient Background Concentrations (ABC) were obtained to derive site specific EILs for zinc, copper, chromium and nickel. The site is located near a large urbanised area developed over 20 years ago. Therefore, obtaining representative background concentrations is difficult. For this assessment, ABCs were taken to be represented by onsite samples collected within natural soils. Concentrations of heavy metals in natural soils were compared to and confirmed to be within ranges of published background data (Ref: NSW soils for new suburbs in low traffic areas listed on page 17 (South Australian Health Commission (1995)).

Added Contaminant Limit (ACL) for lead, arsenic, DDT, naphthalene does not require soil physiochemical properties. Site specific data used to derive EILs are summarised in Table 6 and Table 7.

**Table 6: Summary of Site Specific Soil Physiochemical Properties**

Sample ID	Soil Type	CEC (cmol/kg)	pH (pH units)	Clay Content (%) <sup>*</sup>
BH02/0-0.1	Reworked clay	9.4	6	28

**Table 7: Summary of Ambient Background Concentration (ABC) of Metals (mg/kg) based on average concentration reported in samples representing natural soils**

Sample ID	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
Natural soils	3.8	< 0.4	< 5	21	15	< 0.1	< 5	24
Published background range <sup>*</sup>	5 to 11	0.25	6 to 21	6 to 32	13 to 44	0.05	5 to 50	17 to 77

<sup>\*</sup>NSW soils for new suburbs in low traffic areas listed on page 17 (South Australian Health Commission (1995))

The NEPM (1999, amended 2013) provides the following methods for calculating site specific EILs:

- EILs = Added Contaminant Limit (ACL) + Ambient Background Concentration (ABC); and
- EIL spreadsheet in the ASC NEPM Toolbox.

The ASC NEPM Toolbox<sup>2</sup> was used to determine EILs for copper, chromium (III), nickel and zinc. ACL listed in Tables 1B(4) and 1B(5) were added to the ABC to derived site specific EILs for lead, arsenic, DDT, naphthalene. Site history information indicates contamination is likely to have been present for over 2 years; therefore ACL for aged contamination is considered appropriate for the site. Table 8 summarises derived EILs.

**Table 8: Site Specific EILs (mg/kg)**

Land use Scenario	As	Cu	Cr (III)	Pb	Ni	Zn	DDT*	Naphthalene*
Urban Residential and Open public spaces	100	190	560	1,100	150	410	180	170

\* Based on aged contamination.

## 8.4. Management Limits

The purpose of the Management Limits is to “avoid or minimise” potential effects of petroleum hydrocarbons. NEPM (1999, amended 2013) Schedule B1 provides these as an interim Tier 1 guidance to manage effects of:

- Formation of observable Light Non-Aqueous Phase Liquid (LNAPL);
- Fire and explosive hazards; and
- Effects on buried infrastructure.

The application of the management limits requires the consideration of site-specific factors such as the depth of building services and depth to groundwater, to assess the maximum depth to which the limits should apply.

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<sup>2</sup> Calculation assumed 5% total organic carbon

## 9. Fieldwork

### 9.1. Subsurface investigations

Field investigations were carried out on 3 and 4 February 2015 by a Coffey engineer.

The sampling locations were measured relative to existing features and are shown in Figure 2. Logs of boreholes are included in Appendix E. The results of soil headspace screening are also presented logs. A summary of field investigations carried out at the site is presented in Table 9.

**Table 9: Summary of field investigations**

Date of Fieldwork	Sampling Method	Sampling Equipment	Number of Locations and Location Identification	Depth of Investigation
3/2/2015	Surface sample	Samples collected by hand from ground surface – a shovel was used to loosen surrounding soils	2 locations - SS1 to SS2	0.05m
3/2/2015	Borehole	100mm hand auger	5 locations – BH1 to BH5	1.5m
4/2/2015	Test pit	Extenda-hoe backhoe	8 locations – TP1 to TP8	1.8m to 3.6m

### 9.2. Soil sampling methodology

All soil samples were collected with a new pair of nitrile gloves. Between sampling locations the hand auger was washed by brush scrubbing with a phosphate free detergent and finally rinsed with potable water.

Soil samples were generally collected at the surface, in the fill or at major changes in stratigraphy or where evidence of odours or staining was noted (if observed). Clean 250mL glass jars were filled with soil to the brim and immediately sealed with Teflon lined caps to lower the potential for loss of volatile contaminants. Samples were then labelled and placed directly into ice filled cooler boxes. Asbestos samples were sub-sampled in plastic zip-lock bags. Material samples were placed directly into a zip-lock bag.

In boreholes and surface samples, soil samples for analysis were collected in duplicate into tightly sealed plastic bags where considered appropriate. The headspace above each sample was measured using a Mini Rae 2000 PID fitted with a 10.6eV lamp and calibrated with isobutylene gas at a concentration of 100ppm. This instrument allows rapid, semi quantitative analysis of ionisable volatile organic compounds in the soil.

## 10. Data validation assessment

### 10.1. Fieldwork quality control procedures

The field quality control was generally in accordance with the DQOs and DQIs and consisted of:

- Sampling was performed by a qualified Coffey environmental professionals generally in accordance with the procedures outlined in Coffey's Standard Operating Procedures (SOPs) which are based on industry accepted protocols for environmental sampling and are consistent with Schedule B(2) of the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999, amended 2013. Sampling activities were carried out by Coffey staff who had completed Coffey's training for Coffey SOPs including supervised field training;
- Calibration of field instruments in accordance with manufacturer's instructions.
- Collection and analysis of two blind coded duplicates. Relevant laboratory results and calculated Relative Percent Differences (RPDs) are presented in Table QAQC1 in Appendix D. Duplicate results are also presented in the results Table LR1;
- Samples (as designated on the chain of custody form) were transported in ice-cooled chests to Eurofins | MGT Pty Ltd (Eurofins) for analysis. A copy of the chain of custody record is included in Appendix C.

### 10.2. Laboratory analysis and quality assurance

Laboratory analysis of the primary and duplicate samples was undertaken by Eurofins in Melbourne, which is NATA accredited for the tests performed.

Samples were selected for analysis mainly based on geological origin type of the material, results of headspace screening and visual and olfactory observations so that samples appropriately represented materials requiring characterisation.

Laboratory results are discussed in Section 11.3 and laboratory reports (NATA certified) are presented in Appendix C. Laboratory test methods and holding times applicable for the chemicals analysed are listed in laboratory reports.

### 10.3. Laboratory data validation

Coffey assessed the laboratory data against predetermined DQOs and DQIs for laboratory procedures and results. This assessment is presented in a data validation report included in Appendix D.

Coffey concluded that the analytical results are representative of the characteristics of materials sampled and suitable for the purposes of the contamination assessment.

## **11. Results**

### **11.1. Subsurface conditions**

The subsurface conditions encountered generally comprised clayey silt topsoil overlying residual clayey silt slopewash soils and/or residual clay/silty clay.

Soils overlain coarse grained, extremely weathered, low strength dacite bedrock, which was encountered in the test pits at depths ranging between 0.9m bgs (TP7) and 1.7m bgs (TP6). The test pits were extended through the dacite until practical refusal, which was between 0.9m (TP4, TP5 and TP7) and 2m (TP2) from the top of the bedrock.

Fill material (reworked medium plasticity clay) was encountered adjacent the pathway in BH2, and extended from the ground surface to 0.4m bgs.

Groundwater was not observed within the sample locations. No unusual odours or staining/discolouration were observed at sampling locations. Natural materials encountered were generally consistent with published geological information.

Further geotechnical related information on ground conditions is included in the geotechnical report.

### **11.2. Screening for volatile organic compounds**

Soil samples screened recorded negligible readings of less than 8 ppm, indicating that volatile ionisable compounds were not present. PID results were consistent with laboratory results.

### **11.3. Laboratory analytical results**

The laboratory analytical results for soil are summarised in Table LR1. Laboratory reports are included in Appendix C.

Concentrations of COPCs were less than adopted human health and ecological investigation levels. Asbestos was not detected in the samples tested.

## 12. Discussion and Conclusions

Site history information indicated that the site was generally vacant, grassed rural/open space since at least 1975. A walkway pavement was constructed in the northern portion of the site between the 1970's and 1980's, a walkway was constructed to the site, and earthworks occurred in the vicinity of the site during construction of Drakeford Drive, Mortimer Lewis Drive and Lake Tuggeranong.

Fifteen sampling locations were used to assess the one AEC identified (fill of unknown origin and quality).

Concentrations of COPCs were less than adopted human health investigation limits for urban redevelopment for the most sensitive generic land use scenario covered under ACT EPA endorsed national guidance (NEPM, 2013) (residential land use with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry)). Therefore, concentrations detected are unlikely to pose an unacceptable risk, from a contamination perspective, to future site users in a residential, commercial or industrial land use scenario.

Concentrations of contaminants of potential concern were less than adopted ecological screening/investigation levels, therefore it is considered that there is a low likelihood that contaminant concentrations would present unacceptable risk to environmental receptors.

Groundwater was not directly assessed as part of this investigation. Impact to groundwater is considered low based on the site history and reported concentrations of the contaminants of potential concern tested in soil.

Based on the information gathered for this assessment, it appears that the site is suitable for rezoning for a proposed residential landuse.

Coffey note that due to the nature of contaminated site investigation and remediation that the degree of variability in site conditions cannot be known completely and no sampling and analysis programme can eliminate all uncertainty concerning the condition of a site, including those statistically based and substantially following guidelines made or approved by the relevant regulatory authorities.

Therefore, it is recommended that an unexpected finds protocol (UFP) is prepared by an appropriately experienced consultant for implementation as part of the recommended remediation works and construction earthworks works associated with the future development of the site. The unexpected finds protocol should include procedures and protocols for managing risks should unexpected finds of contamination be identified at the Site.

The requirements of the unexpected finds protocol should consider the findings of this investigation and where possible, the findings of other works recommended above.

## 13. Limitations

The findings within this report are the result of discrete/specific sampling practices used in accordance with normal practices and standards. To the best of our knowledge they represent a reasonable interpretation of the general conditions of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

It is the nature of contaminated site investigations that the degree of variability in site conditions cannot be known completely and no sampling and analysis program can eliminate all uncertainty concerning the condition of the site. Professional judgement must be exercised in the collection and interpretation of the data.

In preparing this report, current guidelines for assessment and management of contaminated land were followed. This work has been conducted in good faith in accordance with Coffey understanding of the client's brief and general accepted practice for environmental consulting.

We draw your attention to the attached sheets titled "Important Information about your Coffey Environmental Report" and "Important Information about your Coffey Report" which should be read in conjunction with this report. These information sheets are located at the end of Section 14.

## 14. References

**ACT EPA (2009)** *Contaminated Sites Environment Protection Policy, November 2009*. Australian Capital Territory Environment Protection Authority.

**Evans, R (1984)** *Hydrogeology of Australian Capital Territory and Environs* 1:100,000 scale map. Bureau of Mineral Resources, Geology and Geophysics, Canberra.

**Friebel, E & Nadebaum, P (2011)** *Health screening levels for petroleum hydrocarbons in soil and groundwater, Part 1: Technical development document, CRC CARE Technical Report no. 10*. CRC for Contamination Assessment and Remediation of the Environment.

**Jenkins, J.R. (2000)** *Soil Landscapes of the Canberra 1:100 000 Sheet*. Department of Land and Water Conversation, Queanbeyan

**NEPC (2013)** National Environment Protection (Assessment of Site Contamination) Measure; *Schedule B(1) – Guideline on Investigation Levels for Soil and Groundwater*. National Environment Protection Council.

**NSW DEC (2006)** *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd edition)*. New South Wales Department of Environment and Conservation.

**NSW OEH (2011)** *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (2nd edition). New South Wales Office of Environment and Heritage.

**Russel, E.A. (1980)** *Geology Map of Canberra, Queanbeyan and Environs*. 1:50,000 scale map. Bureau of Mineral Resources, Geology and Geophysics, Canberra

**Standards Australia (2005)** *AS 4482.1-2005 Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile contaminants*. Standards Australia.

# Important information about your **Coffey** Environmental Report

## **Introduction**

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

## **Your report has been written for a specific purpose**

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

## **Limitations of the Report**

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept apprised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statutes and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

## **Interpretation of factual data**

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but

steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

### **Recommendations in this report**

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

### **Report for benefit of client**

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

### **Interpretation by other professionals**

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such

assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

### **Data should not be separated from the report**

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

### **Responsibility**

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

## **Tables**

**TABLE LR1:**  
**SUMMARY OF LABORATORY RESULTS FOR SOIL SAMPLES**  
**TRH, BTEX, PAH, OCP, OPP, soil properties, heavy metals, asbestos**  
**(All results in mg/kg, unless otherwise stated)**

Sample ID	THRESHOLD CONCENTRATIONS							TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	BH1	BH2	BH3	BH4	BH5	SS1	QC1	SS2	QC2
								446625	446625	446625	446625	446625	446625	446625	446625	446625	446625	446625	446625	446625	446625	446625	446625	446625
Batch								04-Feb-15	04-Feb-15	04-Feb-15	04-Feb-15	04-Feb-15	04-Feb-15	04-Feb-15	04-Feb-15	03-Feb-15	03-Feb-15	03-Feb-15	03-Feb-15	03-Feb-15	03-Feb-15	03-Feb-15	03-Feb-15	03-Feb-15
Date of Sampling								Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil / Slope	Topsoil	Reworked Fill	Topsoil	Topsoil	Topsoil	Topsoil	Duplicate of SS1	Topsoil	Duplicate of SS2
Soil Type	HIL A (Residential access to soil) <sup>1</sup>	EIL/ESL (Urban Residential / Open Public Spaces) <sup>1</sup>	HSL-A&B (Residential) <sup>1</sup> 0-<1m <sup>a</sup>	HSL-A <sup>2</sup> (Direct Contact)	Intrusive maintenance worker (Direct Contact) <sup>2</sup>	Intrusive maintenance 0-<2m <sup>b</sup>	Management Limits for TPH Fractions <sup>1</sup>	0.1-0.2	0.1-0.2	0.2-0.3	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.05		0.0-0.05	
Depth (m)																								
<b>HEAVY METALS (TOTAL)</b>																								
Arsenic	100	100	-	-	-	-	-	3	3.9	2.8	5.5	3.2	3.0	5.3	3.7	3.1	3.3	4.6	4.4	3.4	3.9	5.1	2.7	3.0
Cadmium	20	-	-	-	-	-	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	100 <sup>e</sup>	560 <sup>d</sup>	-	-	-	-	-	12	14	22	36	13	18	33	17	19	14	25	27.0	25	23	36	10	10
Copper	6,000	190	-	-	-	-	-	< 5	< 5	< 5	5.1	< 5	< 5	7	< 5	< 5	< 5	6.2	7.1	5	6	6	< 5	< 5
Lead	300	1,100	-	-	-	-	-	8	12	11	14	10	10	15	11	12	8	12	43	12	29	14	7.2	8
Mercury	40	-	-	-	-	-	-	< 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	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	400	150	-	-	-	-	-	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Zinc	7,400	410	-	-	-	-	-	11	11	8.9	7.2	12	9	8	12	10	16	18	17	14	14	15	22	20
<b>TOTAL PETROLEUM HYDROCARBONS</b>																								
F1 (C6-C10)	-	-	-	-	-	-	700	< 20	< 20	-	< 20	< 20	-	< 20	< 20	-	< 20	-	< 20	-	-	-	< 20	< 20
F1 (C6-C10 less BTEX)	-	180	40	4,400	82,000	NL	-	< 20	< 20	-	< 20	< 20	-	< 20	< 20	-	< 20	-	< 20	-	-	-	< 20	< 20
F2 (>C10-C16)	-	120	-	-	-	-	1,000	< 50	< 50	-	< 50	< 50	-	< 50	< 50	-	< 50	-	< 50	-	-	-	< 50	< 50
F2 (>C10-C16 less naphthalene)	-	-	230	3,300	62,000	NL	-	< 50	< 50	-	< 50	< 50	-	< 50	< 50	-	< 50	-	< 50	-	-	-	< 50	< 50
F3 (>C16-C34)	-	300	-	4,500	85,000	NL	3,500	< 100	< 100	-	< 100	< 100	-	< 100	< 100	-	< 100	-	< 100	-	-	-	< 100	< 100
F4 (>C34-C40)	-	2,800	-	6,300	120,000	NL	10,000	< 100	< 100	-	< 100	< 100	-	< 100	< 100	-	< 100	-	< 100	-	-	-	< 100	< 100
<b>BTEX</b>																								
Benzene	-	50	0.6	100	1,100	77	-	< 0.1	< 0.1	-	< 0.1	< 0.1	-	< 0.1	< 0.1	-	< 0.1	-	< 0.1	-	-	-	< 0.1	< 0.1
Toluene	-	85	390	14,000	120,000	NL	-	< 0.1	< 0.1	-	< 0.1	< 0.1	-	< 0.1	< 0.1	-	< 0.1	-	< 0.1	-	-	-	< 0.1	< 0.1
Ethylbenzene	-	70	NL	4,500	85,000	NL	-	< 0.1	< 0.1	-	< 0.1	< 0.1	-	< 0.1	< 0.1	-	< 0.1	-	< 0.1	-	-	-	< 0.1	< 0.1
Total Xylene	-	105	95	12,000	130,000	NL	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	-	-	< 0.3	< 0.3
<b>POLYCYCLIC AROMATIC HYDROCARBONS</b>																								
Naphthalene	-	170	4	1,400	29,000	NL	-	< 0.5	< 0.5	-	< 0.5	< 0.5	-	< 0.5	< 0.5	-	< 0.5	-	< 0.5	-	-	-	< 0.5	< 0.5
Carcinogenic PAHs (as BaP TEQ)	3	-	-	-	-	-	-	1.2	1.2	-	1.2	1.2	-	1.2	1.2	-	1.2	-	1.2	-	-	-	1.2	1.2
Benzo(a)pyrene	-	0.7	-	-	-	-	-	< 0.5	< 0.5	-	< 0.5	< 0.5	-	< 0.5	< 0.5	-	< 0.5	-	< 0.5	-	-	-	< 0.5	< 0.5
Total PAH	300	-	-	-	-	-	-	< 0.5	< 0.5	-	< 0.5	< 0.5	-	< 0.5	< 0.5	-	< 0.5	-	< 0.5	-	-	-	< 0.5	< 0.5
<b>ORGANOCHLORINE PESTICIDES</b>																								
	6 to 600	180 <sup>6</sup>	-	-	-	-	-	-	< 0.05	< 0.05	< 0.05	-	-	-	-	-	< 0.05	-	-	-	-	-	< 0.05	< 0.05
<b>ORGANOPHOSPHORUS PESTICIDES</b>																								
	270	-	-	-	-	-	-	-	< 0.2	< 0.2	< 0.2	-	-	-	-	-	< 0.2	-	-	-	-	-	< 0.2	< 0.2
<b>SOIL PROPERTIES</b>																								
% Clay <sup>7</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	-	-	-	-
Conductivity (1:5 aqueous extract at 25°C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-	-	-	-	-	-
pH (units)(1:5 soil:CaCl2 extract)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-
Total Organic Carbon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13000	-	-	-	-	-	-	-	-
Cation Exchange Capacity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.4	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21,000	-	-	-	-	-	-	-	-
Iron (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
<b>ASBESTOS</b>																								
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	ND	-	-	ND	ND	-	-	-

NOTES:  
**Bold** Concentration exceeds the Health Investigation Levels (HIL) or Health Screen Level (HSL)  
**Bold** Concentration exceeds Management Limits / EILs / ESLs  
1 Based on NEPM (1999) (amendment 2013).  
2 CRC Care Technical Report No. 10 (Soil HSLs for direct contact)  
3 CRC Care Technical Report No. 10 (Soil HSLs for Vapour Intrusion)  
a Soil HSLs for vapour intrusion (for depth range between 0m to <1m, soil type: SILT)  
b Soil HSLs for vapour intrusion (for depth range between 0m to <2m, soil type: SILT)  
c Based on Chromium 6  
d Based on Chromium 3  
e DDT  
- No result or guideline  
\* Primary samples were mislabelled and therefore could not be analysed.  
ND Not detected  
NL Not limiting  
LOR Limit of reporting

## Figures

PLOT DATE: 16/02/2015 12:10:07 PM DWG FILE: F:\ENV\PROJECTS\OTHER OFFICES\ENABRAD\ENABRAD.DWG 1326AA-R01-D01.DWG



SOURCE: UBD STREET DIRECTORY GREGORYS  
CANBERRA, ACT  
16TH EDITION, 2012, MAP: 87 & 88

Scale (metres) 1:10 000



**LEGEND**

— APPROXIMATE SITE BOUNDARY

Scale (metres) 1:2500

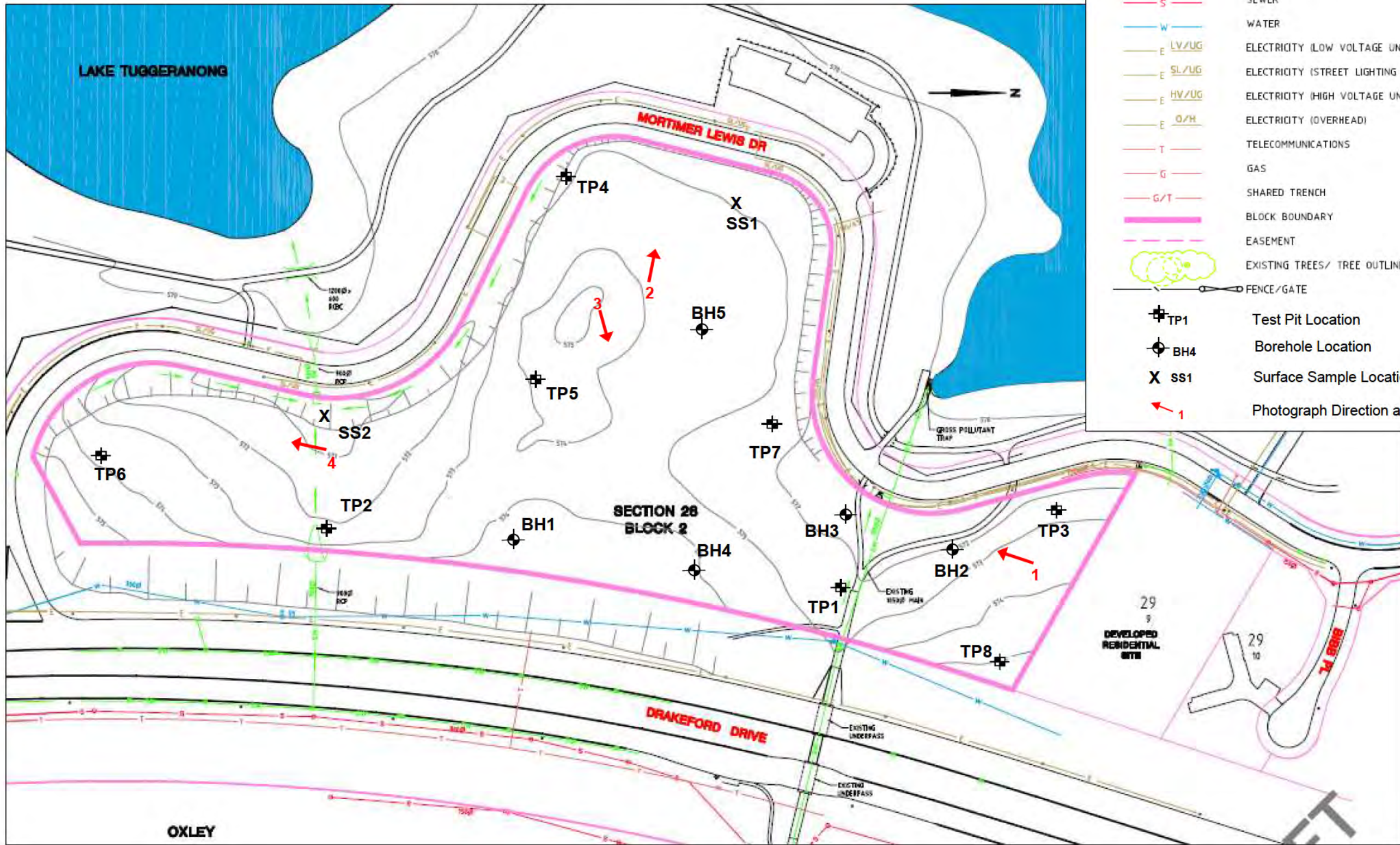
AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.2.2041  
AERIAL IMAGE ©: IMAGE @ 2014 DIGITALGLOBE

no.	description	drawn	approved	date
A	ORIGINAL ISSUE			

drawn	MV
approved	JB
date	16/02/15
scale	AS SHOWN
original size	A3



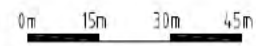
client:	LAND DEVELOPMENT AGENCY		
project:	P1 AND P2 CONTAMINATION ASSESSMENT SECTION 28, BLOCK 2, GREENWAY, ACT		
title:	SITE LOCALITY PLAN		
project no:	ENAUBRAD01326AA-R01	figure no:	FIGURE 1
rev:	A		



**LEGEND**

- EXISTING SW STORMWATER
- S SEWER
- W WATER
- LV/UG ELECTRICITY (LOW VOLTAGE UNDERGROUND)
- SL/UG ELECTRICITY (STREET LIGHTING UNDERGROUND)
- HV/UG ELECTRICITY (HIGH VOLTAGE UNDERGROUND)
- O/H ELECTRICITY (OVERHEAD)
- T TELECOMMUNICATIONS
- G GAS
- G/T SHARED TRENCH
- BLOCK BOUNDARY
- EASEMENT
- EXISTING TREES/ TREE OUTLINE
- FENCE/GATE
- TP1 Test Pit Location
- BH4 Borehole Location
- X ss1 Surface Sample Location
- 1 Photograph Direction and Number

Revision	description	drawn	approved	date
Final		█	█	17/02/15



drawn	█
approved	█
date	10/02/15
scale	1:1500 (A3 Approx)
original size	A3



client:	Land Development Agency
project:	Phase 1 and Phase 2 Contamination Assessment
title:	Site layout Plan with approximate location of samples
project no:	ENAUBRAD01326AA
figure no:	FIGURE 2

## **Appendix A - Site History Information**

62071923 - Leasing Area.



**ACT**  
Government

Justice and Community Safety

LAND TITLES  
OFFICE OF REGULATORY SERVICES  
ACT Justice and Community Safety Directorate

**COUNTER SEARCH**

Form 013 - CSF

Land Titles Act 1925

This form may be used to request searches of the land titles register. For multiple searches, please complete one form per search request.

CUSTOMER DETAILS	
Name	Contact Telephone Number
[Redacted]	

TITLE AND PARCEL IDENTIFIER				
Volume & Folio (if known)	Division	Section	Block	Unit
	Greenway	28	2	-

INSTRUMENT / DEALING NUMBER (Please provide number required)	HISTORICAL SEARCH (Please provide parcel/title details for search required)

NAME SEARCH (Please provide name required) Fee is payable for Search regardless of search result	PLAN SEARCH (provide plan number - if unknown please provide parcel details below)

SEARCH REQUEST (Please tick applicable box)	FEE	SEARCH REQUEST (Please tick applicable box)	FEE
<input type="checkbox"/> Name Search	\$26.00	<input type="checkbox"/> Sublease Plan Database Search	\$8.00
<input type="checkbox"/> Instrument / Dealing Search	\$20.00	<input type="checkbox"/> Deposited Plan Search	\$20.00
<input type="checkbox"/> Check Search	\$8.00	<input type="checkbox"/> Units Plan Search	\$20.00
<input type="checkbox"/> Crown Lease Search	\$26.00	<input type="checkbox"/> Units Plan - Common Property CT Search	\$26.00
<input type="checkbox"/> Certificate of Title (CT) Search	\$26.00	<input type="checkbox"/> Common Property CT Search	\$26.00
<input checked="" type="checkbox"/> Historical Title Search	\$26.00	<input type="checkbox"/> Community Title Scheme Search	\$20.00
<input type="checkbox"/> Sublease Plan Search	\$20.00	<input type="checkbox"/> Certified Copy POA's and Deeds	\$23 per page to a max of \$74
<input type="checkbox"/> Certified Copy (Instruments/Titles)	\$24 per page to a max of \$80		

NO RECORDS

OFFICE USE ONLY	
LTO Officer	Received by



**ACT**

Government

Environment and Planning

File Ref: 97/05256

[REDACTED]  
Coffey Environments Australia Pty Ltd  
118 Auburn Street  
Wollongong NSW 2500

**RE: CONTAMINATED LAND SEARCH**

Dear [REDACTED]

Thank you for your search form request of 15/01/2015 enquiring about:

**Block 2 Section 28 Greenway Tuggeranong**

Records held by the Environment Protection Authority (EPA) for the above block(s) indicate the following:

The block is not recorded on the EPA's contaminated sites management database or geographic information system.

The site is currently occupied by public open space adjacent to Lake Tuggeranong. Whilst there is no recorded information on potential site contamination similar sites have in the past been associated with site contamination due to the application of certain chemicals for the control of weeds and pests and the placement of uncontrolled fill during the establishment of the open space areas.

The ANZECC 1992, Guidelines for the Assessment and Management of Contaminated Sites and the ACT Contaminated Sites Environment Protection Policy, November 2009 list landfilling and pest control activities as activities associated with land contamination.

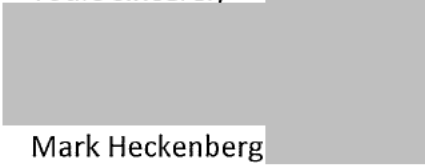
The EPA has not issued any environment protection orders under sections 91C (1), 91D (1) or 125 (4) of the *Environment Protection Act 1997* (the Act) over the sites and as a result the sites are not recorded on the Register of contaminated sites under section 21(A) of the Act.

The information detailed above only relates to records held by the EPA and may not represent the actual condition of the site.

At present EPA has no information on contamination of the above block(s) and adjacent roadways other than as detailed above. However, this does not absolutely rule out the possibility of contamination and should not be interpreted as a warranty that there is no contamination.

I appreciate that this does not absolutely rule out the existence of contamination of the soils. If you or your clients wish to be completely sure you, or they, should arrange to conduct independent tests.

Yours sincerely



Mark Heckenberg  
Project Officer  
Environment Protection and Water Regulation

15/01/2015



OFFICE OF REGULATORY SERVICES  
DEPARTMENT OF JUSTICE & COMMUNITY SAFETY

05 February 2015

Coffey Environments Australia

16 Mildura Street

FYSHWICK ACT 2609

Attention: [REDACTED]

Thank you for the application for a records search for Block 2 Section 28, Greenway ACT.

I have conducted a search of the Dangerous Goods Database and Dangerous Substances Register and hold no records for the above site.

(Please note: Under the *Dangerous Goods Act 1975* (1975 to April 2004), tanks of 50,000 litres which contained Diesel were not required to be licenced with WorkCover, only if the capacity was 50,001 litres).

If you have any questions in relation to this matter please do not hesitate in contacting me on 62076353 or email [lisa.curran@act.gov.au](mailto:lisa.curran@act.gov.au).

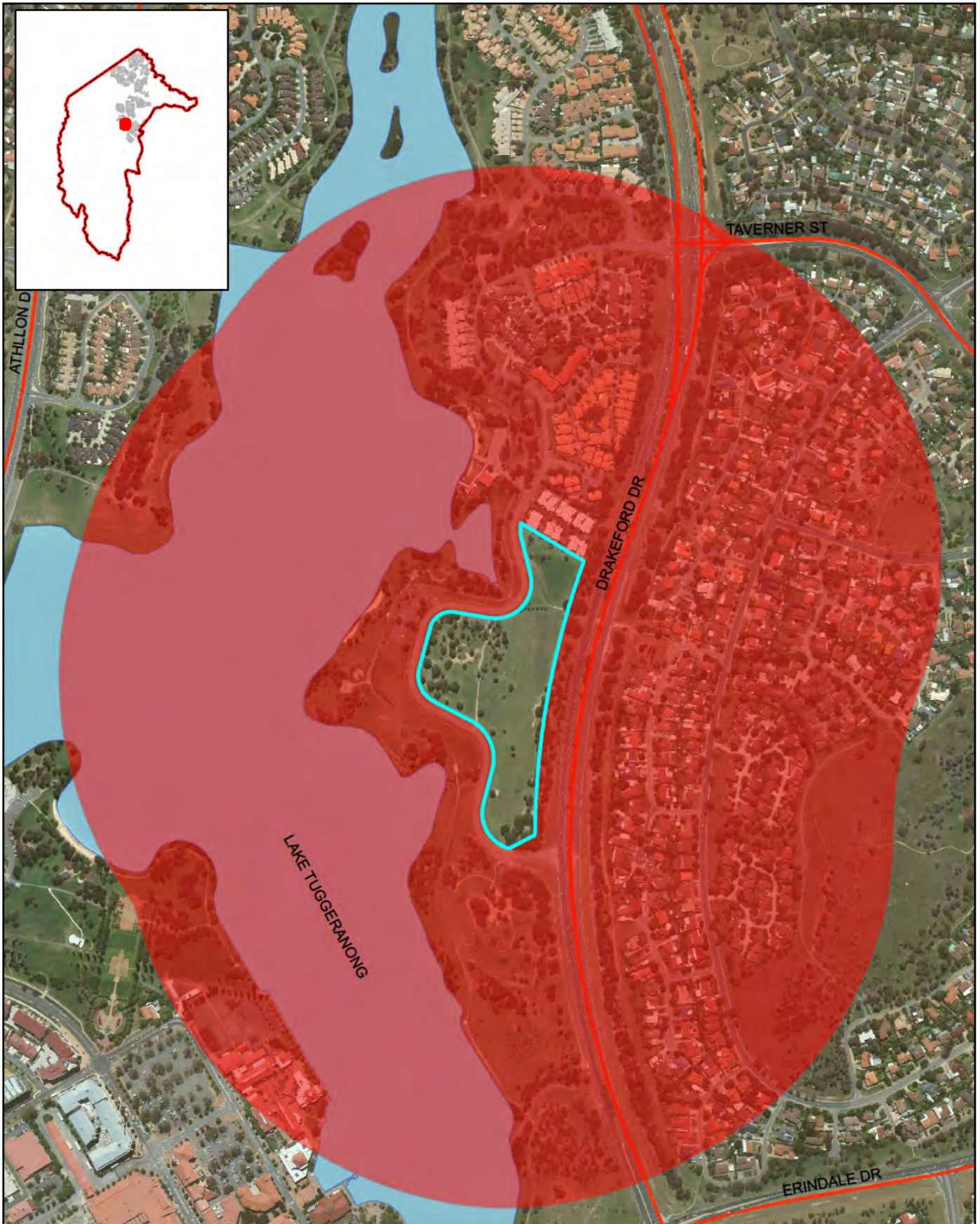
Regards



Lisa Curran  
Administration Officer  
Dangerous Substances Licencing  
WorkSafe ACT

**WORKSAFE ACT**

LVL 3 CALLAM OFFICES EASTY STREET PHILLIP ACT 2606 |  
GPO BOX 158 CANBERRA ACT 2601 |  
PHONE 6207 3000 | FAX 6205 0336 |  
WORKSAFE@ACT.GOV.AU | WORKSAFE.ACT.GOV.AU



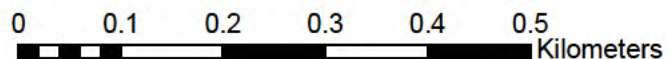
**Groundwater bore search**  
**Site: block 2, section 28 Greenway**

Date: 20 January 2015  
 Produced by: Water Regulation  
 Source: Environment and Planning Directorate (EPD)

Coordinate system: MGA Zone 55  
 Datum: GDA 1994

Contact: Contact Water Regulation via Canberra Connect (132281)

Disclaimer: EPD does not warrant that the data is free from errors.



**Legend**

- 0.5km buffer of site
- Groundwater abstraction bores
- ▲ Water table monitoring bores
- Major roads





**ACT**  
Government

Environment and Planning

Mr [REDACTED]  
Coffey Environments Australia Pty Ltd  
Email: [REDACTED]

Dear Mr Boyle

I refer to your application for a groundwater bore search. There are no privately managed groundwater abstraction bores registered under the *Water Resources Act 2007* within a 0.5km radial search area of block 2, section 28 Greenway.

Please note that this search does not include investigation and/or monitoring bores associated with possible contaminated sites in the search area. If you require more information please contact Contaminated Sites (Environment Protection Authority) on 132281.

If you have any questions please contact me on (02) 6207 5606 or email [jillian.harrap@act.gov.au](mailto:jillian.harrap@act.gov.au).

Yours sincerely

Jillian Harrap  
Environment Protection Officer  
Water Regulation  
20 January 2015

## **AERIAL PHOTOS**



1984

Site





1993

Site

## **Appendix B – Site Photographs**



Photograph 1: Looking south from the northern area of the site.



Photograph 2: Looking east towards Lewis Mortimer Drive and Lake Tuggeranong from the eastern area of the site



Photograph 3: Looking northeast towards the centre of the site from the eastern portion of the site. The dirt track is visible in the left of the photograph.



## **Appendix C – Laboratory Analytical Results**

**Coffey Environments Pty Ltd ACT**  
**16 Mildura Street**  
**Fyshwick**  
**ACT 2609**



**NATA Accredited**  
**Accreditation Number 1261**  
**Site Number 1254**

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

**Attention:** ██████████

**Report** **446625-S**  
 Project name EB1326AA  
 Received Date Feb 06, 2015

Client Sample ID			TP1_0.1-0.2	TP2_0.1-0.2	TP3_0.2-0.3	TP4_0.1-0.2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04463	M15-Fe04464	M15-Fe04465	M15-Fe04466
Date Sampled			Feb 04, 2015	Feb 04, 2015	Feb 04, 2015	Feb 04, 2015
Test/Reference	LOR	Unit				
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>						
TRH C6-C9	20	mg/kg	< 20	< 20	-	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	-	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	-	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	-	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	-	< 50
<b>BTEX</b>						
Benzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	54	87	-	73
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>						
Naphthalene <sup>N02</sup>	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	-	< 20
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	20	mg/kg	< 20	< 20	-	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	-	< 50
TRH >C10-C16 less Naphthalene (F2) <sup>N01</sup>	50	mg/kg	< 50	< 50	-	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	-	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	-	< 100
<b>Polycyclic Aromatic Hydrocarbons</b>						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6	-	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2	-	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Benzo(b&j)fluoranthene <sup>N07</sup>	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5

Client Sample ID			TP1_0.1-0.2	TP2_0.1-0.2	TP3_0.2-0.3	TP4_0.1-0.2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04463	M15-Fe04464	M15-Fe04465	M15-Fe04466
Date Sampled			Feb 04, 2015	Feb 04, 2015	Feb 04, 2015	Feb 04, 2015
Test/Reference	LOR	Unit				
<b>Polycyclic Aromatic Hydrocarbons</b>						
Fluorene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Pyrene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Total PAH	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
2-Fluorobiphenyl (surr.)	1	%	128	116	-	116
p-Terphenyl-d14 (surr.)	1	%	138	130	-	114
<b>Organochlorine Pesticides</b>						
Chlordanes - Total	0.1	mg/kg	-	< 0.1	< 0.1	< 0.1
4.4'-DDD	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
4.4'-DDE	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
4.4'-DDT	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
a-BHC	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Aldrin	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
b-BHC	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
d-BHC	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Dieldrin	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Endrin	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
g-BHC (Lindane)	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	-	< 0.05	< 0.05	< 0.05
Toxaphene	1	mg/kg	-	< 1	< 1	< 1
Dibutylchloroendate (surr.)	1	%	-	142	149	146
Tetrachloro-m-xylene (surr.)	1	%	-	139	142	146
<b>Organophosphorous Pesticides</b>						
Bolstar	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Chlorpyrifos	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Demeton-O	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Diazinon	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Dichlorvos	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Disulfoton	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Ethion	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Ethoprop	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Fenitrothion	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Fensulfothion	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Fenthion	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Merphos	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Methyl azinphos	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Methyl parathion	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Mevinphos	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Naled	0.5	mg/kg	-	< 0.5	< 0.5	< 0.5

Client Sample ID			TP1_0.1-0.2	TP2_0.1-0.2	TP3_0.2-0.3	TP4_0.1-0.2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04463	M15-Fe04464	M15-Fe04465	M15-Fe04466
Date Sampled			Feb 04, 2015	Feb 04, 2015	Feb 04, 2015	Feb 04, 2015
Test/Reference	LOR	Unit				
<b>Organophosphorous Pesticides</b>						
Phorate	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Ronnel	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Tokuthion	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Trichloronate	0.2	mg/kg	-	< 0.2	< 0.2	< 0.2
Triphenylphosphate (surr.)	1	%	-	111	111	104
<b>% Moisture</b>						
	0.1	%	5.9	14	6.0	4.7
<b>Heavy Metals</b>						
Arsenic	2	mg/kg	3.0	3.9	2.8	5.5
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	12	14	22	36
Copper	5	mg/kg	< 5	< 5	< 5	5.1
Lead	5	mg/kg	7.9	12	11	14
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	< 5	< 5	< 5	< 5
Zinc	5	mg/kg	11	11	8.9	7.2

Client Sample ID			TP5_0.1-0.2	TP6_0.1-0.2	TP7_0.1-0.2	TP8_0.1-0.2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04467	M15-Fe04468	M15-Fe04469	M15-Fe04470
Date Sampled			Feb 04, 2015	Feb 04, 2015	Feb 04, 2015	Feb 04, 2015
Test/Reference	LOR	Unit				
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>						
TRH C6-C9	20	mg/kg	< 20	-	< 20	< 20
TRH C10-C14	20	mg/kg	22	-	< 20	< 20
TRH C15-C28	50	mg/kg	53	-	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	-	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	75	-	< 50	< 50
<b>BTEX</b>						
Benzene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	-	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	-	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	53	-	79	64
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>						
Naphthalene <sup>N02</sup>	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	-	< 20	< 20
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	20	mg/kg	< 20	-	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	-	< 50	< 50
TRH >C10-C16 less Naphthalene (F2) <sup>N01</sup>	50	mg/kg	< 50	-	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	-	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	-	< 100	< 100

Client Sample ID			TP5_0.1-0.2	TP6_0.1-0.2	TP7_0.1-0.2	TP8_0.1-0.2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04467	M15-Fe04468	M15-Fe04469	M15-Fe04470
Date Sampled			Feb 04, 2015	Feb 04, 2015	Feb 04, 2015	Feb 04, 2015
Test/Reference	LOR	Unit				
<b>Polycyclic Aromatic Hydrocarbons</b>						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	-	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	-	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Benzo(b&j)fluoranthene <sup>N07</sup>	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Pyrene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Total PAH	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
2-Fluorobiphenyl (surr.)	1	%	118	-	112	121
p-Terphenyl-d14 (surr.)	1	%	121	-	118	128
<b>% Moisture</b>						
	0.1	%	5.5	4.7	5.4	5.4
<b>Heavy Metals</b>						
Arsenic	2	mg/kg	3.2	3.0	5.3	3.7
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	13	18	33	17
Copper	5	mg/kg	< 5	< 5	6.9	< 5
Lead	5	mg/kg	9.7	9.7	15	11
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	< 5	< 5	< 5	< 5
Zinc	5	mg/kg	12	9.2	8.2	12

Client Sample ID			BH1_0.1-0.2	BH2_0.0-0.1	BH3_0.0-0.1	BH4_0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04471	M15-Fe04472	M15-Fe04473	M15-Fe04474
Date Sampled			Feb 03, 2015	Feb 03, 2015	Feb 03, 2015	Feb 03, 2015
Test/Reference	LOR	Unit				
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>						
TRH C6-C9	20	mg/kg	-	< 20	-	< 20
TRH C10-C14	20	mg/kg	-	< 20	-	< 20
TRH C15-C28	50	mg/kg	-	< 50	-	< 50
TRH C29-C36	50	mg/kg	-	< 50	-	81
TRH C10-36 (Total)	50	mg/kg	-	< 50	-	81

Client Sample ID			BH1_0.1-0.2 Soil	BH2_0.0-0.1 Soil	BH3_0.0-0.1 Soil	BH4_0.0-0.1 Soil
Sample Matrix			M15-Fe04471	M15-Fe04472	M15-Fe04473	M15-Fe04474
Eurofins   mgt Sample No.			Feb 03, 2015	Feb 03, 2015	Feb 03, 2015	Feb 03, 2015
Date Sampled						
Test/Reference	LOR	Unit				
<b>BTEX</b>						
Benzene	0.1	mg/kg	-	< 0.1	-	< 0.1
Toluene	0.1	mg/kg	-	< 0.1	-	< 0.1
Ethylbenzene	0.1	mg/kg	-	< 0.1	-	< 0.1
m&p-Xylenes	0.2	mg/kg	-	< 0.2	-	< 0.2
o-Xylene	0.1	mg/kg	-	< 0.1	-	< 0.1
Xylenes - Total	0.3	mg/kg	-	< 0.3	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	-	69	-	74
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>						
Naphthalene <sup>N02</sup>	0.5	mg/kg	-	< 0.5	-	< 0.5
TRH C6-C10	20	mg/kg	-	< 20	-	< 20
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	20	mg/kg	-	< 20	-	< 20
TRH >C10-C16	50	mg/kg	-	< 50	-	< 50
TRH >C10-C16 less Naphthalene (F2) <sup>N01</sup>	50	mg/kg	-	< 50	-	< 50
TRH >C16-C34	100	mg/kg	-	< 100	-	< 100
TRH >C34-C40	100	mg/kg	-	< 100	-	< 100
<b>Polycyclic Aromatic Hydrocarbons</b>						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	-	< 0.5	-	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	-	0.6	-	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	-	1.2	-	1.2
Acenaphthene	0.5	mg/kg	-	< 0.5	-	< 0.5
Acenaphthylene	0.5	mg/kg	-	< 0.5	-	< 0.5
Anthracene	0.5	mg/kg	-	< 0.5	-	< 0.5
Benz(a)anthracene	0.5	mg/kg	-	< 0.5	-	< 0.5
Benzo(a)pyrene	0.5	mg/kg	-	< 0.5	-	< 0.5
Benzo(b&j)fluoranthene <sup>N07</sup>	0.5	mg/kg	-	< 0.5	-	< 0.5
Benzo(g,h,i)perylene	0.5	mg/kg	-	< 0.5	-	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	-	< 0.5	-	< 0.5
Chrysene	0.5	mg/kg	-	< 0.5	-	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	-	< 0.5	-	< 0.5
Fluoranthene	0.5	mg/kg	-	< 0.5	-	< 0.5
Fluorene	0.5	mg/kg	-	< 0.5	-	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	-	< 0.5	-	< 0.5
Naphthalene	0.5	mg/kg	-	< 0.5	-	< 0.5
Phenanthrene	0.5	mg/kg	-	< 0.5	-	< 0.5
Pyrene	0.5	mg/kg	-	< 0.5	-	< 0.5
Total PAH	0.5	mg/kg	-	< 0.5	-	< 0.5
2-Fluorobiphenyl (surr.)	1	%	-	133	-	110
p-Terphenyl-d14 (surr.)	1	%	-	149	-	122
<b>Organochlorine Pesticides</b>						
Chlordanes - Total	0.1	mg/kg	-	< 0.1	-	-
4.4'-DDD	0.05	mg/kg	-	< 0.05	-	-
4.4'-DDE	0.05	mg/kg	-	< 0.05	-	-
4.4'-DDT	0.05	mg/kg	-	< 0.05	-	-
a-BHC	0.05	mg/kg	-	< 0.05	-	-
Aldrin	0.05	mg/kg	-	< 0.05	-	-
b-BHC	0.05	mg/kg	-	< 0.05	-	-
d-BHC	0.05	mg/kg	-	< 0.05	-	-
Dieldrin	0.05	mg/kg	-	< 0.05	-	-
Endosulfan I	0.05	mg/kg	-	< 0.05	-	-

Client Sample ID			BH1_0.1-0.2	BH2_0.0-0.1	BH3_0.0-0.1	BH4_0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04471	M15-Fe04472	M15-Fe04473	M15-Fe04474
Date Sampled			Feb 03, 2015	Feb 03, 2015	Feb 03, 2015	Feb 03, 2015
Test/Reference	LOR	Unit				
<b>Organochlorine Pesticides</b>						
Endosulfan II	0.05	mg/kg	-	< 0.05	-	-
Endosulfan sulphate	0.05	mg/kg	-	< 0.05	-	-
Endrin	0.05	mg/kg	-	< 0.05	-	-
Endrin aldehyde	0.05	mg/kg	-	< 0.05	-	-
Endrin ketone	0.05	mg/kg	-	< 0.05	-	-
g-BHC (Lindane)	0.05	mg/kg	-	< 0.05	-	-
Heptachlor	0.05	mg/kg	-	< 0.05	-	-
Heptachlor epoxide	0.05	mg/kg	-	< 0.05	-	-
Hexachlorobenzene	0.05	mg/kg	-	< 0.05	-	-
Methoxychlor	0.05	mg/kg	-	< 0.05	-	-
Toxaphene	1	mg/kg	-	< 1	-	-
Dibutylchloroendate (surr.)	1	%	-	83	-	-
Tetrachloro-m-xylene (surr.)	1	%	-	89	-	-
<b>Organophosphorous Pesticides</b>						
Bolstar	0.2	mg/kg	-	< 0.2	-	-
Chlorpyrifos	0.2	mg/kg	-	< 0.2	-	-
Demeton-O	0.2	mg/kg	-	< 0.2	-	-
Diazinon	0.2	mg/kg	-	< 0.2	-	-
Dichlorvos	0.2	mg/kg	-	< 0.2	-	-
Disulfoton	0.2	mg/kg	-	< 0.2	-	-
Ethion	0.2	mg/kg	-	< 0.2	-	-
Ethoprop	0.2	mg/kg	-	< 0.2	-	-
Fenitrothion	0.2	mg/kg	-	< 0.2	-	-
Fensulfothion	0.2	mg/kg	-	< 0.2	-	-
Fenthion	0.2	mg/kg	-	< 0.2	-	-
Merphos	0.2	mg/kg	-	< 0.2	-	-
Methyl azinphos	0.2	mg/kg	-	< 0.2	-	-
Methyl parathion	0.2	mg/kg	-	< 0.2	-	-
Mevinphos	0.2	mg/kg	-	< 0.2	-	-
Naled	0.5	mg/kg	-	< 0.5	-	-
Phorate	0.2	mg/kg	-	< 0.2	-	-
Ronnel	0.2	mg/kg	-	< 0.2	-	-
Tokuthion	0.2	mg/kg	-	< 0.2	-	-
Trichloronate	0.2	mg/kg	-	< 0.2	-	-
Triphenylphosphate (surr.)	1	%	-	123	-	-
<b>Physical Properties</b>						
% Clay*	1	%	-	28	-	-
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	-	35	-	-
pH (units)(1:5 soil:CaCl2 extract)	0.1	pH Units	-	6.0	-	-
Total Organic Carbon	50	mg/kg	-	13000	-	-
% Moisture	0.1	%	6.2	11	13	7.5
<b>Heavy Metals</b>						
Arsenic	2	mg/kg	3.1	3.3	4.6	4.4
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	19	14	25	27
Copper	5	mg/kg	< 5	< 5	6.2	7.1
Iron	5	mg/kg	-	21000	-	-
Lead	5	mg/kg	12	8.1	12	43
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1

Client Sample ID			BH1_0.1-0.2	BH2_0.0-0.1	BH3_0.0-0.1	BH4_0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04471	M15-Fe04472	M15-Fe04473	M15-Fe04474
Date Sampled			Feb 03, 2015	Feb 03, 2015	Feb 03, 2015	Feb 03, 2015
Test/Reference	LOR	Unit				
<b>Heavy Metals</b>						
Nickel	5	mg/kg	< 5	< 5	< 5	< 5
Zinc	5	mg/kg	10	16	18	17
<b>Heavy Metals</b>						
Iron (%)	0.01	%	-	2.1	-	-
<b>Ion Exchange Properties</b>						
Cation Exchange Capacity	0.05	meq/100g	-	9.4	-	-

Client Sample ID			BH5_0.0-0.1	SS1	SS2	QC1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04475	M15-Fe04476	M15-Fe04477	M15-Fe04478
Date Sampled			Feb 03, 2015	Feb 03, 2015	Feb 03, 2015	Feb 03, 2015
Test/Reference	LOR	Unit				
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>						
TRH C6-C9	20	mg/kg	-	-	< 20	-
TRH C10-C14	20	mg/kg	-	-	< 20	-
TRH C15-C28	50	mg/kg	-	-	< 50	-
TRH C29-C36	50	mg/kg	-	-	< 50	-
TRH C10-36 (Total)	50	mg/kg	-	-	< 50	-
<b>BTEX</b>						
Benzene	0.1	mg/kg	-	-	< 0.1	-
Toluene	0.1	mg/kg	-	-	< 0.1	-
Ethylbenzene	0.1	mg/kg	-	-	< 0.1	-
m&p-Xylenes	0.2	mg/kg	-	-	< 0.2	-
o-Xylene	0.1	mg/kg	-	-	< 0.1	-
Xylenes - Total	0.3	mg/kg	-	-	< 0.3	-
4-Bromofluorobenzene (surr.)	1	%	-	-	70	-
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>						
Naphthalene <sup>N02</sup>	0.5	mg/kg	-	-	< 0.5	-
TRH C6-C10	20	mg/kg	-	-	< 20	-
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	20	mg/kg	-	-	< 20	-
TRH >C10-C16	50	mg/kg	-	-	< 50	-
TRH >C10-C16 less Naphthalene (F2) <sup>N01</sup>	50	mg/kg	-	-	< 50	-
TRH >C16-C34	100	mg/kg	-	-	< 100	-
TRH >C34-C40	100	mg/kg	-	-	< 100	-
<b>Polycyclic Aromatic Hydrocarbons</b>						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	-	-	< 0.5	-
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	-	-	0.6	-
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	-	-	1.2	-
Acenaphthene	0.5	mg/kg	-	-	< 0.5	-
Acenaphthylene	0.5	mg/kg	-	-	< 0.5	-
Anthracene	0.5	mg/kg	-	-	< 0.5	-
Benz(a)anthracene	0.5	mg/kg	-	-	< 0.5	-
Benzo(a)pyrene	0.5	mg/kg	-	-	< 0.5	-
Benzo(b&j)fluoranthene <sup>N07</sup>	0.5	mg/kg	-	-	< 0.5	-
Benzo(g,h,i)perylene	0.5	mg/kg	-	-	< 0.5	-
Benzo(k)fluoranthene	0.5	mg/kg	-	-	< 0.5	-
Chrysene	0.5	mg/kg	-	-	< 0.5	-

Client Sample ID			BH5_0.0-0.1	SS1	SS2	QC1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04475	M15-Fe04476	M15-Fe04477	M15-Fe04478
Date Sampled			Feb 03, 2015	Feb 03, 2015	Feb 03, 2015	Feb 03, 2015
Test/Reference	LOR	Unit				
<b>Polycyclic Aromatic Hydrocarbons</b>						
Dibenz(a,h)anthracene	0.5	mg/kg	-	-	< 0.5	-
Fluoranthene	0.5	mg/kg	-	-	< 0.5	-
Fluorene	0.5	mg/kg	-	-	< 0.5	-
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	-	-	< 0.5	-
Naphthalene	0.5	mg/kg	-	-	< 0.5	-
Phenanthrene	0.5	mg/kg	-	-	< 0.5	-
Pyrene	0.5	mg/kg	-	-	< 0.5	-
Total PAH	0.5	mg/kg	-	-	< 0.5	-
2-Fluorobiphenyl (surr.)	1	%	-	-	104	-
p-Terphenyl-d14 (surr.)	1	%	-	-	109	-
<b>Organochlorine Pesticides</b>						
Chlordanes - Total	0.1	mg/kg	-	-	< 0.1	-
4.4'-DDD	0.05	mg/kg	-	-	< 0.05	-
4.4'-DDE	0.05	mg/kg	-	-	< 0.05	-
4.4'-DDT	0.05	mg/kg	-	-	< 0.05	-
a-BHC	0.05	mg/kg	-	-	< 0.05	-
Aldrin	0.05	mg/kg	-	-	< 0.05	-
b-BHC	0.05	mg/kg	-	-	< 0.05	-
d-BHC	0.05	mg/kg	-	-	< 0.05	-
Dieldrin	0.05	mg/kg	-	-	< 0.05	-
Endosulfan I	0.05	mg/kg	-	-	< 0.05	-
Endosulfan II	0.05	mg/kg	-	-	< 0.05	-
Endosulfan sulphate	0.05	mg/kg	-	-	< 0.05	-
Endrin	0.05	mg/kg	-	-	< 0.05	-
Endrin aldehyde	0.05	mg/kg	-	-	< 0.05	-
Endrin ketone	0.05	mg/kg	-	-	< 0.05	-
g-BHC (Lindane)	0.05	mg/kg	-	-	< 0.05	-
Heptachlor	0.05	mg/kg	-	-	< 0.05	-
Heptachlor epoxide	0.05	mg/kg	-	-	< 0.05	-
Hexachlorobenzene	0.05	mg/kg	-	-	< 0.05	-
Methoxychlor	0.05	mg/kg	-	-	< 0.05	-
Toxaphene	1	mg/kg	-	-	< 1	-
Dibutylchloroendate (surr.)	1	%	-	-	127	-
Tetrachloro-m-xylene (surr.)	1	%	-	-	134	-
<b>Organophosphorous Pesticides</b>						
Bolstar	0.2	mg/kg	-	-	< 0.2	-
Chlorpyrifos	0.2	mg/kg	-	-	< 0.2	-
Demeton-O	0.2	mg/kg	-	-	< 0.2	-
Diazinon	0.2	mg/kg	-	-	< 0.2	-
Dichlorvos	0.2	mg/kg	-	-	< 0.2	-
Disulfoton	0.2	mg/kg	-	-	< 0.2	-
Ethion	0.2	mg/kg	-	-	< 0.2	-
Ethoprop	0.2	mg/kg	-	-	< 0.2	-
Fenitrothion	0.2	mg/kg	-	-	< 0.2	-
Fensulfothion	0.2	mg/kg	-	-	< 0.2	-
Fenthion	0.2	mg/kg	-	-	< 0.2	-
Merphos	0.2	mg/kg	-	-	< 0.2	-
Methyl azinphos	0.2	mg/kg	-	-	< 0.2	-
Methyl parathion	0.2	mg/kg	-	-	< 0.2	-

Client Sample ID			BH5_0.0-0.1	SS1	SS2	QC1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M15-Fe04475	M15-Fe04476	M15-Fe04477	M15-Fe04478
Date Sampled			Feb 03, 2015	Feb 03, 2015	Feb 03, 2015	Feb 03, 2015
Test/Reference	LOR	Unit				
<b>Organophosphorous Pesticides</b>						
Mevinphos	0.2	mg/kg	-	-	< 0.2	-
Naled	0.5	mg/kg	-	-	< 0.5	-
Phorate	0.2	mg/kg	-	-	< 0.2	-
Ronnel	0.2	mg/kg	-	-	< 0.2	-
Tokuthion	0.2	mg/kg	-	-	< 0.2	-
Trichloronate	0.2	mg/kg	-	-	< 0.2	-
Triphenylphosphate (surr.)	1	%	-	-	86	-
<b>% Moisture</b>						
	0.1	%	5.8	12	14	12
<b>Heavy Metals</b>						
Arsenic	2	mg/kg	3.4	3.9	2.7	5.1
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	25	23	10	36
Copper	5	mg/kg	5.4	5.7	< 5	6.4
Lead	5	mg/kg	12	29	7.2	14
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	< 5	< 5	< 5	< 5
Zinc	5	mg/kg	14	14	22	15

Client Sample ID			QC2
Sample Matrix			Soil
Eurofins   mgt Sample No.			M15-Fe04479
Date Sampled			Feb 03, 2015
Test/Reference	LOR	Unit	
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>			
TRH C6-C9	20	mg/kg	< 20
TRH C10-C14	20	mg/kg	< 20
TRH C15-C28	50	mg/kg	< 50
TRH C29-C36	50	mg/kg	< 50
TRH C10-36 (Total)	50	mg/kg	< 50
<b>BTEX</b>			
Benzene	0.1	mg/kg	< 0.1
Toluene	0.1	mg/kg	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2
o-Xylene	0.1	mg/kg	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3
4-Bromofluorobenzene (surr.)	1	%	79
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>			
Naphthalene <sup>N02</sup>	0.5	mg/kg	< 0.5
TRH C6-C10	20	mg/kg	< 20
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	20	mg/kg	< 20
TRH >C10-C16	50	mg/kg	< 50
TRH >C10-C16 less Naphthalene (F2) <sup>N01</sup>	50	mg/kg	< 50
TRH >C16-C34	100	mg/kg	< 100
TRH >C34-C40	100	mg/kg	< 100

Client Sample ID			QC2
Sample Matrix			Soil
Eurofins   mgt Sample No.			M15-Fe04479
Date Sampled			Feb 03, 2015
Test/Reference	LOR	Unit	
<b>Polycyclic Aromatic Hydrocarbons</b>			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b&j)fluoranthene <sup>N07</sup>	0.5	mg/kg	< 0.5
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	< 0.5
Total PAH	0.5	mg/kg	< 0.5
2-Fluorobiphenyl (surr.)	1	%	113
p-Terphenyl-d14 (surr.)	1	%	117
<b>Organochlorine Pesticides</b>			
Chlordanes - Total	0.1	mg/kg	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05
a-BHC	0.05	mg/kg	< 0.05
Aldrin	0.05	mg/kg	< 0.05
b-BHC	0.05	mg/kg	< 0.05
d-BHC	0.05	mg/kg	< 0.05
Dieldrin	0.05	mg/kg	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05
Endrin	0.05	mg/kg	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05
g-BHC (Lindane)	0.05	mg/kg	< 0.05
Heptachlor	0.05	mg/kg	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05
Toxaphene	1	mg/kg	< 1
Dibutylchloroendate (surr.)	1	%	128
Tetrachloro-m-xylene (surr.)	1	%	140

<b>Client Sample ID</b>			<b>QC2</b>
<b>Sample Matrix</b>			<b>Soil</b>
<b>Eurofins   mgt Sample No.</b>			<b>M15-Fe04479</b>
<b>Date Sampled</b>			<b>Feb 03, 2015</b>
Test/Reference	LOR	Unit	
<b>Organophosphorous Pesticides</b>			
Bolstar	0.2	mg/kg	< 0.2
Chlorpyrifos	0.2	mg/kg	< 0.2
Demeton-O	0.2	mg/kg	< 0.2
Diazinon	0.2	mg/kg	< 0.2
Dichlorvos	0.2	mg/kg	< 0.2
Disulfoton	0.2	mg/kg	< 0.2
Ethion	0.2	mg/kg	< 0.2
Ethoprop	0.2	mg/kg	< 0.2
Fenitrothion	0.2	mg/kg	< 0.2
Fensulfothion	0.2	mg/kg	< 0.2
Fenthion	0.2	mg/kg	< 0.2
Merphos	0.2	mg/kg	< 0.2
Methyl azinphos	0.2	mg/kg	< 0.2
Methyl parathion	0.2	mg/kg	< 0.2
Mevinphos	0.2	mg/kg	< 0.2
Naled	0.5	mg/kg	< 0.5
Phorate	0.2	mg/kg	< 0.2
Ronnel	0.2	mg/kg	< 0.2
Tokuthion	0.2	mg/kg	< 0.2
Trichloronate	0.2	mg/kg	< 0.2
Triphenylphosphate (surr.)	1	%	103
<b>% Moisture</b>			
	0.1	%	14
<b>Heavy Metals</b>			
Arsenic	2	mg/kg	3.0
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	9.5
Copper	5	mg/kg	< 5
Lead	5	mg/kg	7.6
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	< 5
Zinc	5	mg/kg	20

### Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported. A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

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

Description	Testing Site	Extracted	Holding Time
<b>Eurofins   mgt Suite 4</b>			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions - Method: TRH C6-C36 - LTM-ORG-2010	Melbourne	Feb 09, 2015	14 Day
BTEX - Method: TRH C6-C40 - LTM-ORG-2010	Melbourne	Feb 09, 2015	14 Day
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: TRH C6-C40 - LTM-ORG-2010	Melbourne	Feb 09, 2015	14 Day
Polycyclic Aromatic Hydrocarbons - Method: USEPA 8270 Polycyclic Aromatic Hydrocarbons	Melbourne	Feb 09, 2015	14 Day
<b>Eurofins   mgt Suite 14</b>			
Organochlorine Pesticides - Method: USEPA 8081 Organochlorine Pesticides	Melbourne	Feb 09, 2015	14 Day
Organophosphorous Pesticides - Method: USEPA 8270 Organophosphorus Pesticides	Melbourne	Feb 09, 2015	14 Day
<b>NEPM Screen for Soil Classification</b>			
% Clay* - Method: LTM-GEN-7040	Brisbane	Feb 10, 2015	6 Month
Conductivity (1:5 aqueous extract at 25°C) - Method: LM-LTM-INO-4010	Melbourne	Feb 09, 2015	7 Day
pH (units)(1:5 soil:CaCl2 extract)	Melbourne	Feb 09, 2015	7 Day
Total Organic Carbon - Method: APHA 5310B Total Organic Carbon	Melbourne	Feb 10, 2015	28 Day
Heavy Metals - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Feb 09, 2015	180 Day
Ion Exchange Properties	Melbourne	Feb 10, 2015	
% Moisture - Method: LTM-GEN-7080 Moisture	Melbourne	Feb 06, 2015	14 Day
Metals M8 - Method: USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury	Melbourne	Feb 09, 2015	28 Day

<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> ██████████
<b>Eurofins   mgt Client Manager:</b> ██████████		

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
Sample ID	Sample Date	Sampling Time	Matrix	LAB ID							
TP1_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04463			X		X		X
TP2_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04464			X	X	X		X
TP3_0.2-0.3	Feb 04, 2015		Soil	M15-Fe04465			X	X			X
TP4_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04466			X	X	X		X
TP5_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04467			X		X		X
TP6_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04468			X				X
TP7_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04469			X		X		X
TP8_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04470	X		X		X		X
BH1_0.1-0.2	Feb 03, 2015		Soil	M15-Fe04471	X		X				X
BH2_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04472	X		X	X	X	X	X

<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> ██████████
<b>Eurofins   mgt Client Manager:</b> ██████████		

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
BH3_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04473			X				X
BH4_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04474			X	X			X
BH5_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04475	X		X				X
SS1	Feb 03, 2015		Soil	M15-Fe04476	X		X				X
SS2	Feb 03, 2015		Soil	M15-Fe04477			X	X	X		X
QC1	Feb 03, 2015		Soil	M15-Fe04478			X				X
QC2	Feb 03, 2015		Soil	M15-Fe04479			X	X	X		X
TP1_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04480		X					
TP2_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04481		X					
TP3_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04482		X					
TP4_0.6-0.7	Feb 04, 2015		Soil	M15-Fe04483		X					

<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> ██████████
<b>Eurofins   mgt Client Manager:</b> ██████████		

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
TP5_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04484		X					
TP6_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04485		X					
TP7_0.6-0.7	Feb 04, 2015		Soil	M15-Fe04486		X					
TP8_0.8-0.9	Feb 04, 2015		Soil	M15-Fe04487		X					
BH1_0.2-0.7	Feb 03, 2015		Soil	M15-Fe04488		X					
BH2_0.1-0.4	Feb 03, 2015		Soil	M15-Fe04489		X					
BH2_0.4-0.8	Feb 03, 2015		Soil	M15-Fe04490		X					
BH3_0.1-0.6	Feb 03, 2015		Soil	M15-Fe04491		X					
BH4_0.5-0.7	Feb 03, 2015		Soil	M15-Fe04492		X					
BH5_0.1-0.4	Feb 03, 2015		Soil	M15-Fe04493		X					
BH5_0.4-0.6	Feb 03, 2015		Soil	M15-Fe04494		X					

<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> ██████████
<b>Eurofins   mgt Client Manager:</b> ██████████		

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
QAQC1	Feb 04, 2015		Soil	M15-Fe04495		X					
QAQC2	Feb 04, 2015		Soil	M15-Fe04496		X					
QAQC3	Feb 04, 2015		Soil	M15-Fe04497		X					
QAQC4	Feb 04, 2015		Soil	M15-Fe04498		X					
QAQC5	Feb 04, 2015		Soil	M15-Fe04499		X					
QAQC6	Feb 04, 2015		Soil	M15-Fe04500		X					
QAQC7	Feb 04, 2015		Soil	M15-Fe04501		X					
QAQC8	Feb 04, 2015		Soil	M15-Fe04502		X					

## Eurofins | mgt Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

### Holding Times

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

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

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

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

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

### UNITS

**mg/kg:** milligrams per Kilogram

**mg/l:** milligrams per litre

**ug/l:** micrograms per litre

**ppm:** Parts per million

**ppb:** Parts per billion

**%:** Percentage

**org/100ml:** Organisms per 100 millilitres

**NTU:** Nephelometric Turbidity Units

**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

### TERMS

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery
<b>CRM</b>	Certified Reference Material - reported as percent recovery
<b>Method Blank</b>	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>Batch Duplicate</b>	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
<b>Batch SPIKE</b>	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>ASLP</b>	Australian Standard Leaching Procedure (AS4439.3)
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - ACCEPTANCE CRITERIA

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

Results <10 times the LOR : No Limit

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

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

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

### QC DATA GENERAL COMMENTS

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

**Quality Control Results**

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Method Blank</b>							
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
<b>Method Blank</b>							
<b>BTEX</b>							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
<b>Method Blank</b>							
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH C6-C10 less BTEX (F1)	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
<b>Method Blank</b>							
<b>Polycyclic Aromatic Hydrocarbons</b>							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g,h,i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a,h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
<b>Method Blank</b>							
<b>Organochlorine Pesticides</b>							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
4,4'-DDD	mg/kg	< 0.05			0.05	Pass	
4,4'-DDE	mg/kg	< 0.05			0.05	Pass	
4,4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-BHC	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-BHC	mg/kg	< 0.05			0.05	Pass	
d-BHC	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endosulfan II	mg/kg	< 0.05			0.05	Pass	
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-BHC (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.05			0.05	Pass	
Toxaphene	mg/kg	< 1			1	Pass	
<b>Method Blank</b>							
<b>Organophosphorous Pesticides</b>							
Bolstar	mg/kg	< 0.2			0.2	Pass	
Chlorpyrifos	mg/kg	< 0.2			0.2	Pass	
Demeton-O	mg/kg	< 0.2			0.2	Pass	
Diazinon	mg/kg	< 0.2			0.2	Pass	
Dichlorvos	mg/kg	< 0.2			0.2	Pass	
Disulfoton	mg/kg	< 0.2			0.2	Pass	
Ethion	mg/kg	< 0.2			0.2	Pass	
Ethoprop	mg/kg	< 0.2			0.2	Pass	
Fenitrothion	mg/kg	< 0.2			0.2	Pass	
Fensulfothion	mg/kg	< 0.2			0.2	Pass	
Fenthion	mg/kg	< 0.2			0.2	Pass	
Merphos	mg/kg	< 0.2			0.2	Pass	
Methyl azinphos	mg/kg	< 0.2			0.2	Pass	
Methyl parathion	mg/kg	< 0.2			0.2	Pass	
Mevinphos	mg/kg	< 0.2			0.2	Pass	
Naled	mg/kg	< 0.5			0.5	Pass	
Phorate	mg/kg	< 0.2			0.2	Pass	
Ronnel	mg/kg	< 0.2			0.2	Pass	
Tokuthion	mg/kg	< 0.2			0.2	Pass	
Trichloronate	mg/kg	< 0.2			0.2	Pass	
<b>Method Blank</b>							
% Clay*	%	pass			1	N/A	
Conductivity (1:5 aqueous extract at 25°C)	uS/cm	< 10			10	Pass	
Total Organic Carbon	mg/kg	< 50			50	Pass	
<b>Method Blank</b>							
<b>Heavy Metals</b>							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Iron	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
<b>LCS - % Recovery</b>							
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>							
TRH C6-C9	%	94			70-130	Pass	
TRH C10-C14	%	128			70-130	Pass	
<b>LCS - % Recovery</b>							
<b>BTEX</b>							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzene	%	88			70-130	Pass	
Toluene	%	89			70-130	Pass	
Ethylbenzene	%	86			70-130	Pass	
m&p-Xylenes	%	85			70-130	Pass	
Xylenes - Total	%	84			70-130	Pass	
<b>LCS - % Recovery</b>							
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>							
Naphthalene	%	82			75-125	Pass	
TRH C6-C10	%	98			70-130	Pass	
TRH >C10-C16	%	124			70-130	Pass	
<b>LCS - % Recovery</b>							
<b>Polycyclic Aromatic Hydrocarbons</b>							
Acenaphthene	%	94			70-130	Pass	
Acenaphthylene	%	93			70-130	Pass	
Anthracene	%	93			70-130	Pass	
Benz(a)anthracene	%	91			70-130	Pass	
Benzo(a)pyrene	%	97			70-130	Pass	
Benzo(b&j)fluoranthene	%	85			70-130	Pass	
Benzo(g,h,i)perylene	%	92			70-130	Pass	
Benzo(k)fluoranthene	%	85			70-130	Pass	
Chrysene	%	90			70-130	Pass	
Dibenz(a,h)anthracene	%	97			70-130	Pass	
Fluoranthene	%	91			70-130	Pass	
Fluorene	%	95			70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	95			70-130	Pass	
Naphthalene	%	95			70-130	Pass	
Phenanthrene	%	94			70-130	Pass	
Pyrene	%	91			70-130	Pass	
<b>LCS - % Recovery</b>							
<b>Organochlorine Pesticides</b>							
4,4'-DDD	%	107			70-130	Pass	
4,4'-DDE	%	103			70-130	Pass	
4,4'-DDT	%	93			70-130	Pass	
a-BHC	%	112			70-130	Pass	
Aldrin	%	112			70-130	Pass	
b-BHC	%	111			70-130	Pass	
d-BHC	%	112			70-130	Pass	
Dieldrin	%	104			70-130	Pass	
Endosulfan I	%	108			70-130	Pass	
Endosulfan II	%	90			70-130	Pass	
Endosulfan sulphate	%	84			70-130	Pass	
Endrin	%	96			70-130	Pass	
Endrin aldehyde	%	96			70-130	Pass	
Endrin ketone	%	120			70-130	Pass	
g-BHC (Lindane)	%	120			70-130	Pass	
Heptachlor	%	109			70-130	Pass	
Heptachlor epoxide	%	114			70-130	Pass	
Hexachlorobenzene	%	102			70-130	Pass	
Methoxychlor	%	72			70-130	Pass	
<b>LCS - % Recovery</b>							
<b>Organophosphorous Pesticides</b>							
Diazinon	%	88			70-130	Pass	
Ethion	%	85			70-130	Pass	
Fenitrothion	%	93			70-130	Pass	

Test	Units	Result 1	Acceptance Limits	Pass Limits	Qualifying Code		
Methyl parathion	%	78	70-130	Pass			
Mevinphos	%	113	70-130	Pass			
<b>LCS - % Recovery</b>							
Total Organic Carbon	%	95	70-130	Pass			
<b>LCS - % Recovery</b>							
<b>Heavy Metals</b>							
Arsenic	%	95	80-120	Pass			
Cadmium	%	95	80-120	Pass			
Chromium	%	99	80-120	Pass			
Copper	%	100	80-120	Pass			
Lead	%	98	80-120	Pass			
Mercury	%	98	75-125	Pass			
Nickel	%	100	80-120	Pass			
Zinc	%	96	80-120	Pass			
Test	Lab Sample ID	QA Source	Units	Result 1	Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>							
<b>Heavy Metals</b>							
Arsenic	M15-Fe04371	NCP	%	90	75-125	Pass	
<b>Spike - % Recovery</b>							
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>							
TRH C6-C9	M15-Fe04464	CP	%	90	70-130	Pass	
TRH C10-C14	M15-Fe04464	CP	%	105	70-130	Pass	
<b>Spike - % Recovery</b>							
<b>BTEX</b>							
Benzene	M15-Fe04464	CP	%	80	70-130	Pass	
Toluene	M15-Fe04464	CP	%	87	70-130	Pass	
Ethylbenzene	M15-Fe04464	CP	%	88	70-130	Pass	
m&p-Xylenes	M15-Fe04464	CP	%	88	70-130	Pass	
o-Xylene	M15-Fe04464	CP	%	85	70-130	Pass	
Xylenes - Total	M15-Fe04464	CP	%	87	70-130	Pass	
<b>Spike - % Recovery</b>							
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>							
Naphthalene	M15-Fe04464	CP	%	77	70-130	Pass	
TRH C6-C10	M15-Fe04464	CP	%	96	70-130	Pass	
TRH >C10-C16	M15-Fe04464	CP	%	101	70-130	Pass	
<b>Spike - % Recovery</b>							
<b>Organochlorine Pesticides</b>							
4.4'-DDD	M15-Fe04595	NCP	%	99	70-130	Pass	
4.4'-DDE	M15-Fe04595	NCP	%	97	70-130	Pass	
4.4'-DDT	M15-Fe04595	NCP	%	76	70-130	Pass	
a-BHC	M15-Fe04595	NCP	%	108	70-130	Pass	
Aldrin	M15-Fe04595	NCP	%	107	70-130	Pass	
b-BHC	M15-Fe04595	NCP	%	104	70-130	Pass	
d-BHC	M15-Fe04595	NCP	%	112	70-130	Pass	
Dieldrin	M15-Fe04595	NCP	%	103	70-130	Pass	
Endosulfan I	M15-Fe04595	NCP	%	101	70-130	Pass	
Endosulfan II	M15-Fe04595	NCP	%	83	70-130	Pass	
Endosulfan sulphate	M15-Fe04595	NCP	%	76	70-130	Pass	
Endrin	M15-Fe04595	NCP	%	82	70-130	Pass	
Endrin aldehyde	M15-Fe04595	NCP	%	88	70-130	Pass	
Endrin ketone	M15-Fe04595	NCP	%	121	70-130	Pass	
g-BHC (Lindane)	M15-Fe04595	NCP	%	115	70-130	Pass	
Heptachlor	M15-Fe04595	NCP	%	101	70-130	Pass	
Heptachlor epoxide	M15-Fe04595	NCP	%	111	70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Hexachlorobenzene	M15-Fe04595	NCP	%	94			70-130	Pass	
Methoxychlor	M15-Fe04595	NCP	%	80			70-130	Pass	
<b>Spike - % Recovery</b>									
<b>Organophosphorous Pesticides</b>				Result 1					
Diazinon	M15-Fe04465	CP	%	128			70-130	Pass	
Ethion	M15-Fe04465	CP	%	120			70-130	Pass	
Fenitrothion	M15-Fe04465	CP	%	91			70-130	Pass	
Methyl parathion	M15-Fe04465	CP	%	79			70-130	Pass	
Mevinphos	M15-Fe04465	CP	%	99			70-130	Pass	
<b>Spike - % Recovery</b>									
<b>Heavy Metals</b>				Result 1					
Cadmium	M15-Fe04472	CP	%	83			75-125	Pass	
Chromium	M15-Fe04472	CP	%	94			75-125	Pass	
Copper	M15-Fe04472	CP	%	97			75-125	Pass	
Lead	M15-Fe04472	CP	%	84			75-125	Pass	
Mercury	M15-Fe04472	CP	%	94			70-130	Pass	
Nickel	M15-Fe04472	CP	%	86			75-125	Pass	
Zinc	M15-Fe04472	CP	%	88			75-125	Pass	
<b>Spike - % Recovery</b>									
<b>Polycyclic Aromatic Hydrocarbons</b>				Result 1					
Acenaphthene	M15-Fe04474	CP	%	104			70-130	Pass	
Acenaphthylene	M15-Fe04474	CP	%	103			70-130	Pass	
Anthracene	M15-Fe04474	CP	%	94			70-130	Pass	
Benz(a)anthracene	M15-Fe04474	CP	%	117			70-130	Pass	
Benzo(a)pyrene	M15-Fe04474	CP	%	104			70-130	Pass	
Benzo(b&j)fluoranthene	M15-Fe04474	CP	%	100			70-130	Pass	
Benzo(g,h,i)perylene	M15-Fe04474	CP	%	109			70-130	Pass	
Benzo(k)fluoranthene	M15-Fe04474	CP	%	107			70-130	Pass	
Chrysene	M15-Fe04474	CP	%	90			70-130	Pass	
Dibenz(a,h)anthracene	M15-Fe04474	CP	%	106			70-130	Pass	
Fluoranthene	M15-Fe04474	CP	%	109			70-130	Pass	
Fluorene	M15-Fe04474	CP	%	104			70-130	Pass	
Indeno(1,2,3-cd)pyrene	M15-Fe04474	CP	%	116			70-130	Pass	
Naphthalene	M15-Fe04474	CP	%	102			70-130	Pass	
Phenanthrene	M15-Fe04474	CP	%	114			70-130	Pass	
Pyrene	M15-Fe04474	CP	%	108			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>									
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>				Result 1	Result 2	RPD			
TRH C6-C9	M15-Fe04463	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	M15-Fe04463	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M15-Fe04463	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M15-Fe04463	CP	mg/kg	< 50	< 50	<1	30%	Pass	
<b>Duplicate</b>									
<b>BTEX</b>				Result 1	Result 2	RPD			
Benzene	M15-Fe04463	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M15-Fe04463	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M15-Fe04463	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M15-Fe04463	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M15-Fe04463	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M15-Fe04463	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	

Duplicate								
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>				Result 1	Result 2	RPD		
Naphthalene	M15-Fe04463	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
TRH C6-C10	M15-Fe04463	CP	mg/kg	< 20	< 20	<1	30%	Pass
TRH C6-C10 less BTEX (F1)	M15-Fe04463	CP	mg/kg	< 20	< 20	<1	30%	Pass
TRH >C10-C16	M15-Fe04463	CP	mg/kg	< 50	< 50	<1	30%	Pass
TRH >C16-C34	M15-Fe04463	CP	mg/kg	< 100	< 100	<1	30%	Pass
TRH >C34-C40	M15-Fe04463	CP	mg/kg	< 100	< 100	<1	30%	Pass
Duplicate								
<b>Organochlorine Pesticides</b>				Result 1	Result 2	RPD		
Chlordanes - Total	M15-Fe04556	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
4,4'-DDD	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
4,4'-DDE	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
4,4'-DDT	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
a-BHC	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Aldrin	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
b-BHC	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
d-BHC	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Dieldrin	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endosulfan I	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endosulfan II	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endosulfan sulphate	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endrin	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endrin aldehyde	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endrin ketone	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
g-BHC (Lindane)	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Heptachlor	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Heptachlor epoxide	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Hexachlorobenzene	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Methoxychlor	M15-Fe04556	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Toxaphene	M15-Fe04556	NCP	mg/kg	< 1	< 1	<1	30%	Pass
Duplicate								
% Moisture	M15-Fe04471	CP	%	6.2	6.8	8.0	30%	Pass
Duplicate								
<b>Heavy Metals</b>				Result 1	Result 2	RPD		
Arsenic	M15-Fe04471	CP	mg/kg	3.1	2.9	6.0	30%	Pass
Cadmium	M15-Fe04471	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass
Chromium	M15-Fe04471	CP	mg/kg	19	17	10	30%	Pass
Copper	M15-Fe04471	CP	mg/kg	< 5	< 5	<1	30%	Pass
Lead	M15-Fe04471	CP	mg/kg	12	10	15	30%	Pass
Mercury	M15-Fe04471	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Nickel	M15-Fe04471	CP	mg/kg	< 5	< 5	<1	30%	Pass
Zinc	M15-Fe04471	CP	mg/kg	10	9.4	10	30%	Pass
Duplicate								
<b>Polycyclic Aromatic Hydrocarbons</b>				Result 1	Result 2	RPD		
Acenaphthene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Acenaphthylene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Anthracene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Benz(a)anthracene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Benzo(a)pyrene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Benzo(b&j)fluoranthene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Benzo(g,h,i)perylene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Benzo(k)fluoranthene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Chrysene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Dibenz(a,h)anthracene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass

Duplicate								
<b>Polycyclic Aromatic Hydrocarbons</b>				Result 1	Result 2	RPD		
Fluoranthene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Fluorene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Indeno(1.2.3-cd)pyrene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Naphthalene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Phenanthrene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Pyrene	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Duplicate								
<b>Organophosphorous Pesticides</b>				Result 1	Result 2	RPD		
Bolstar	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Chlorpyrifos	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Demeton-O	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Diazinon	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Dichlorvos	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Disulfoton	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Ethion	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Ethoprop	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Fenitrothion	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Fensulfthion	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Fenthion	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Merphos	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Methyl azinphos	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Methyl parathion	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Mevinphos	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Naled	M15-Fe04472	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Phorate	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Ronnel	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Tokuthion	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Trichloronate	M15-Fe04472	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
% Clay*	M15-Ja15347	NCP	%	< 1	< 1	<1	30%	Pass
Conductivity (1:5 aqueous extract at 25°C)	M15-Fe04472	CP	uS/cm	35	33	4.0	30%	Pass
pH (units)(1:5 soil:CaCl2 extract)	M15-Fe04472	CP	pH Units	6.0	5.9	pass	30%	Pass
Total Organic Carbon	S15-Fe04216	NCP	mg/kg	17000	16000	5.0	30%	Pass
Duplicate								
<b>Heavy Metals</b>				Result 1	Result 2	RPD		
Arsenic	M15-Fe04472	CP	mg/kg	3.3	3.8	12	30%	Pass
Cadmium	M15-Fe04472	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass
Chromium	M15-Fe04472	CP	mg/kg	14	14	1.0	30%	Pass
Copper	M15-Fe04472	CP	mg/kg	< 5	< 5	<1	30%	Pass
Iron	M15-Fe04472	CP	mg/kg	21000	21000	1.0	30%	Pass
Lead	M15-Fe04472	CP	mg/kg	8.1	8.0	1.0	30%	Pass
Mercury	M15-Fe04472	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Nickel	M15-Fe04472	CP	mg/kg	< 5	< 5	<1	30%	Pass
Zinc	M15-Fe04472	CP	mg/kg	16	16	<1	30%	Pass
Duplicate								
<b>Heavy Metals</b>				Result 1	Result 2	RPD		
Iron (%)	M15-Fe04472	CP	%	2.1	2.1	1.0	30%	Pass
Duplicate								
<b>Ion Exchange Properties</b>				Result 1	Result 2	RPD		
Cation Exchange Capacity	S15-Fe04221	NCP	meq/100g	1.6	1.5	6.0	30%	Pass

**Comments**
**Sample Integrity**

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

**Qualifier Codes/Comments**

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

**Authorised By**


Analytical Services Manager  
 Senior Analyst-Organic (VIC)  
 Senior Analyst-Volatile (VIC)  
 Senior Analyst-Metal (VIC)  
 Senior Analyst-Inorganic (VIC)  
 Senior Analyst-Asbestos (NSW)  
 Senior Analyst-Inorganic (QLD)


**National Laboratory Manager**

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Uncertainty data is available on request

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# Certificate of Analysis



**NATA Accredited**  
**Accreditation Number 1261**  
**Site Number 18217**

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

**Coffey Environments Pty Ltd ACT**  
**16 Mildura Street**  
**Fyshwick**  
**ACT 2609**

**Attention:** [REDACTED]  
**Report** 446625-AID  
**Project Name** EB1326AA  
**Received Date** Feb 06, 2015  
**Date Reported** Feb 12, 2015

## Methodology:

**Asbestos ID** Conducted in accordance with the Australian Standard AS 4964 – 2004: Method for the Qualitative Identification of Asbestos in Bulk Samples and in-house Method LTM-ASB-8020 by polarised light microscopy (PLM) and dispersion staining (DS) techniques. Bulk samples include building materials, soils and ores.

**Subsampling Soil Samples** The whole sample submitted is first dried and then sieved through a 10mm sieve followed by a 2mm sieve. All fibrous matter viz greater than 10mm, greater than 2mm as well as the material passing through the 2mm sieve are retained and analysed for the presence of asbestos. If the sub 2mm fraction is greater than approximately 30 to 60g then a sub-sampling routine based on ISO 3082:2009(E) Iron ores - Sampling and Sample preparation procedures is employed. Depending on the nature and size of the soil sample, the sub-2 mm residue material may need to be sub-sampled for trace analysis in accordance with AS 4964-2004.

**Bonded asbestos-containing material (ACM)** The material is first examined and any fibres isolated and where required interfering organic fibres or matter may be removed by treating the sample for several hours at a temperature not exceeding  $400 \pm 30^{\circ}\text{C}$ . The resultant material is then ground and examined in accordance with AS 4964-2004.

**Limit of Reporting** The nominal detection limit of the AS4964 method is around 0.01%. The examination of large sample sizes (at least 500 ml is recommended) may improve the likelihood of identifying asbestos material in the greater than 2 mm fraction. The NEPM screening level of 0.001% w/w asbestos in soil for FA and AF (i.e. non-bonded/friable asbestos) only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. NOTE: NATA News, September 2011 – page 34, states, "Weighing of fibres is problematic and can lead to loss of fibres and potential exposure for laboratory analysts. To request laboratories to report information which is outside the scope of AS 4964-2004 and the scope of their accreditation is misleading and is most unwise" therefore such values reported are outside the scope of Eurofins | mgt NATA accreditation as designated by an asterisk.

**Project Name** EB1326AA  
**Project ID**  
**Date Sampled** Feb 03, 2015 to Feb 04, 2015  
**Report** 446625-AID

Client Sample ID	Eurofins   mgt Sample No.	Date Sampled	Sample Description	Result
TP8_0.1-0.2	15-Fe04470	Feb 04, 2015	Approximate Sample 116g Sample consisted of: Brown fine-grained soil and rocks	No asbestos detected. Organic fibre detected. No respirable fibres detected.
BH1_0.1-0.2	15-Fe04471	Feb 03, 2015	Approximate Sample 74g Sample consisted of: Brown fine-grained soil and rocks	No asbestos detected. Organic fibre detected. No respirable fibres detected.
BH2_0.0-0.1	15-Fe04472	Feb 03, 2015	Approximate Sample 75g Sample consisted of: Brown fine-grained soil and rocks	No asbestos detected. Organic fibre detected. No respirable fibres detected.
BH5_0.0-0.1	15-Fe04475	Feb 03, 2015	Approximate Sample 80g Sample consisted of: Brown fine-grained soil and rocks	No asbestos detected. Organic fibre detected. No respirable fibres detected.
SS1	15-Fe04476	Feb 03, 2015	Approximate Sample 59g Sample consisted of: Brown fine-grained soil and rocks	No asbestos detected. Organic fibre detected. No respirable fibres detected.

### Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported. A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

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

Description	Testing Site	Extracted	Holding Time
Asbestos – LTM-ASB-8020	Sydney	Feb 10, 2015	Indefinite

<b>Company Name:</b> Coffey Environments Pty Ltd ACT	<b>Order No.:</b>	<b>Received:</b> Feb 6, 2015 11:34 AM
<b>Address:</b> 16 Mildura Street Fyshwick ACT 2609	<b>Report #:</b> 446625	<b>Due:</b> Feb 13, 2015
	<b>Phone:</b> +61 2 6260 7288	<b>Priority:</b> 5 Day
<b>Project Name:</b> EB1326AA	<b>Fax:</b> +61 2 6260 7211	<b>Contact Name:</b> [REDACTED]

**Eurofins | mgt Client Manager:** [REDACTED]

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
Sample ID	Sample Date	Sampling Time	Matrix	LAB ID							
TP1_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04463			X	X			X
TP2_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04464			X	X	X		X
TP3_0.2-0.3	Feb 04, 2015		Soil	M15-Fe04465			X	X			X
TP4_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04466			X	X	X		X
TP5_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04467			X		X		X
TP6_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04468			X				X
TP7_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04469			X		X		X
TP8_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04470	X		X		X		X
BH1_0.1-0.2	Feb 03, 2015		Soil	M15-Fe04471	X		X				X
BH2_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04472	X		X	X	X	X	X

<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> <span style="background-color: #cccccc; display: inline-block; width: 100px; height: 1em;"></span>
Eurofins   mgt Client Manager: <span style="background-color: #cccccc; display: inline-block; width: 100px; height: 1em;"></span>		

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
BH3_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04473			X				X
BH4_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04474			X	X			X
BH5_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04475	X		X				X
SS1	Feb 03, 2015		Soil	M15-Fe04476	X		X				X
SS2	Feb 03, 2015		Soil	M15-Fe04477			X	X	X		X
QC1	Feb 03, 2015		Soil	M15-Fe04478			X				X
QC2	Feb 03, 2015		Soil	M15-Fe04479			X	X	X		X
TP1_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04480		X					
TP2_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04481		X					
TP3_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04482		X					
TP4_0.6-0.7	Feb 04, 2015		Soil	M15-Fe04483		X					

**Company Name:** Coffey Environments Pty Ltd ACT  
**Address:** 16 Mildura Street  
 Fyshwick  
 ACT 2609  
  
**Project Name:** EB1326AA

**Order No.:**  
**Report #:** 446625  
**Phone:** +61 2 6260 7288  
**Fax:** +61 2 6260 7211

**Received:** Feb 6, 2015 11:34 AM  
**Due:** Feb 13, 2015  
**Priority:** 5 Day  
**Contact Name:**

Eurofins | mgt Client Manager:

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
TP5_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04484		X					
TP6_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04485		X					
TP7_0.6-0.7	Feb 04, 2015		Soil	M15-Fe04486		X					
TP8_0.8-0.9	Feb 04, 2015		Soil	M15-Fe04487		X					
BH1_0.2-0.7	Feb 03, 2015		Soil	M15-Fe04488		X					
BH2_0.1-0.4	Feb 03, 2015		Soil	M15-Fe04489		X					
BH2_0.4-0.8	Feb 03, 2015		Soil	M15-Fe04490		X					
BH3_0.1-0.6	Feb 03, 2015		Soil	M15-Fe04491		X					
BH4_0.5-0.7	Feb 03, 2015		Soil	M15-Fe04492		X					
BH5_0.1-0.4	Feb 03, 2015		Soil	M15-Fe04493		X					
BH5_0.4-0.6	Feb 03, 2015		Soil	M15-Fe04494		X					

<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> <span style="background-color: #cccccc; display: inline-block; width: 100px; height: 1em;"></span>
<b>Eurofins   mgt Client Manager:</b> <span style="background-color: #cccccc; display: inline-block; width: 100px; height: 1em;"></span>		

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
QAQC1	Feb 04, 2015		Soil	M15-Fe04495		X					
QAQC2	Feb 04, 2015		Soil	M15-Fe04496		X					
QAQC3	Feb 04, 2015		Soil	M15-Fe04497		X					
QAQC4	Feb 04, 2015		Soil	M15-Fe04498		X					
QAQC5	Feb 04, 2015		Soil	M15-Fe04499		X					
QAQC6	Feb 04, 2015		Soil	M15-Fe04500		X					
QAQC7	Feb 04, 2015		Soil	M15-Fe04501		X					
QAQC8	Feb 04, 2015		Soil	M15-Fe04502		X					

## Eurofins | mgt Internal Quality Control Review and Glossary

### General

1. QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Samples were analysed on an 'as received' basis.
4. This report replaces any interim results previously issued.

### Holding Times

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

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

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

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

### UNITS

% w/w: weight for weight basis	grams per kilogram
Filter loading:	fibres/100 graticule areas
Reported Concentration:	fibres/mL
Flowrate:	L/min

### TERMS

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>COC</b>	Chain of custody
<b>SRA</b>	Sample Receipt Advice
<b>ISO</b>	International Standards Organisation
<b>AS</b>	Australian Standards
<b>WA DOH</b>	Western Australia Department of Health
<b>NOHSC</b>	National Occupational Health and Safety Commission
<b>ACM</b>	Bonded asbestos-containing material means any material containing more than 1% asbestos and comprises asbestos-containing-material which is in sound condition, although possibly broken or fragmented, and where the asbestos is bound in a matrix such as cement or resin. Common examples of ACM include but are not limited to: pipe and boiler insulation, sprayed-on fireproofing, troweled-on acoustical plaster, floor tile and mastic, floor linoleum, transite shingles, roofing materials, wall and ceiling plaster, ceiling tiles, and gasket materials. This term is restricted to material that cannot pass a 7 mm x 7 mm sieve. This sieve size is selected because it approximates the thickness of common asbestos cement sheeting and for fragments to be smaller than this would imply a high degree of damage and hence potential for fibre release.
<b>FA</b>	FA comprises friable asbestos material and includes severely weathered cement sheet, insulation products and woven asbestos material. This type of friable asbestos is defined here as asbestos material that is in a degraded condition such that it can be broken or crumbled by hand pressure. This material is typically unbonded or was previously bonded and is now significantly degraded (crumbling).
<b>PACM</b>	Presumed Asbestos-Containing Material means thermal system insulation and surfacing material found in buildings, vessels, and vessel sections constructed no later than 1980 that are assumed to contain greater than one percent asbestos but have not been sampled or analyzed to verify or negate the presence of asbestos.
<b>AF</b>	Asbestos fines (AF) are defined as free fibres, or fibre bundles, smaller than 7mm. It is the free fibres which present the greatest risk to human health, although very small fibres (< 5 microns in length) are not considered to be such a risk. AF also includes small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve. (Note that for bonded ACM fragments to pass through a 7 mm x 7 mm sieve implies a substantial degree of damage which increases the potential for fibre release.)
<b>AC</b>	Asbestos cement means a mixture of cement and asbestos fibres (typically 90:10 ratios).

**Comments**

**Sample Integrity**

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

**Qualifier Codes/Comments**

Code	Description
N/A	Not applicable

**Authorised by:**



Senior Analyst-Asbestos (NSW)

**National Laboratory Manager**

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

Uncertainty data is available on request

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<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> <span style="background-color: #cccccc; display: inline-block; width: 100px; height: 1em;"></span>
--	--	--

**Eurofins | mgt Client Manager:**

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
Sample ID	Sample Date	Sampling Time	Matrix	LAB ID							
TP1_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04463			X		X		X
TP2_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04464			X	X	X		X
TP3_0.2-0.3	Feb 04, 2015		Soil	M15-Fe04465			X	X			X
TP4_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04466			X	X	X		X
TP5_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04467			X		X		X
TP6_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04468			X				X
TP7_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04469			X		X		X
TP8_0.1-0.2	Feb 04, 2015		Soil	M15-Fe04470	X		X		X		X
BH1_0.1-0.2	Feb 03, 2015		Soil	M15-Fe04471	X		X				X
BH2_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04472	X		X	X	X	X	X

<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> <span style="background-color: #cccccc; display: inline-block; width: 100px; height: 1em;"></span>
<b>Eurofins   mgt Client Manager:</b> <span style="background-color: #cccccc; display: inline-block; width: 150px; height: 1em;"></span>		

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
BH3_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04473			X				X
BH4_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04474			X	X			X
BH5_0.0-0.1	Feb 03, 2015		Soil	M15-Fe04475	X		X				X
SS1	Feb 03, 2015		Soil	M15-Fe04476	X		X				X
SS2	Feb 03, 2015		Soil	M15-Fe04477			X	X	X		X
QC1	Feb 03, 2015		Soil	M15-Fe04478			X				X
QC2	Feb 03, 2015		Soil	M15-Fe04479			X	X	X		X
TP1_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04480		X					
TP2_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04481		X					
TP3_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04482		X					
TP4_0.6-0.7	Feb 04, 2015		Soil	M15-Fe04483		X					

<b>Company Name:</b> Coffey Environments Pty Ltd ACT	<b>Order No.:</b>	<b>Received:</b> Feb 6, 2015 11:34 AM
<b>Address:</b> 16 Mildura Street Fyshwick ACT 2609	<b>Report #:</b> 446625	<b>Due:</b> Feb 13, 2015
<b>Project Name:</b> EB1326AA	<b>Phone:</b> +61 2 6260 7288	<b>Priority:</b> 5 Day
	<b>Fax:</b> +61 2 6260 7211	<b>Contact Name:</b> [REDACTED]

**Eurofins | mgt Client Manager:** [REDACTED]

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>									X		
<b>External Laboratory</b>											
TP5_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04484		X					
TP6_0.7-0.8	Feb 04, 2015		Soil	M15-Fe04485		X					
TP7_0.6-0.7	Feb 04, 2015		Soil	M15-Fe04486		X					
TP8_0.8-0.9	Feb 04, 2015		Soil	M15-Fe04487		X					
BH1_0.2-0.7	Feb 03, 2015		Soil	M15-Fe04488		X					
BH2_0.1-0.4	Feb 03, 2015		Soil	M15-Fe04489		X					
BH2_0.4-0.8	Feb 03, 2015		Soil	M15-Fe04490		X					
BH3_0.1-0.6	Feb 03, 2015		Soil	M15-Fe04491		X					
BH4_0.5-0.7	Feb 03, 2015		Soil	M15-Fe04492		X					
BH5_0.1-0.4	Feb 03, 2015		Soil	M15-Fe04493		X					
BH5_0.4-0.6	Feb 03, 2015		Soil	M15-Fe04494		X					

<b>Company Name:</b> Coffey Environments Pty Ltd ACT <b>Address:</b> 16 Mildura Street Fyshwick ACT 2609  <b>Project Name:</b> EB1326AA	<b>Order No.:</b> <b>Report #:</b> 446625 <b>Phone:</b> +61 2 6260 7288 <b>Fax:</b> +61 2 6260 7211	<b>Received:</b> Feb 6, 2015 11:34 AM <b>Due:</b> Feb 13, 2015 <b>Priority:</b> 5 Day <b>Contact Name:</b> <span style="background-color: #cccccc; display: inline-block; width: 100px; height: 1em;"></span>
<b>Eurofins   mgt Client Manager:</b> <span style="background-color: #cccccc; display: inline-block; width: 100px; height: 1em;"></span>		

Sample Detail					Asbestos Absence / Presence	HOLD	Metals M8	Eurofins   mgt Suite 14	Eurofins   mgt Suite 4	NEPM Screen for Soil Classification	Moisture Set
<b>Laboratory where analysis is conducted</b>											
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>						X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>					X						
<b>Brisbane Laboratory - NATA Site # 20794</b>										X	
<b>External Laboratory</b>											
QAQC1	Feb 04, 2015		Soil	M15-Fe04495		X					
QAQC2	Feb 04, 2015		Soil	M15-Fe04496		X					
QAQC3	Feb 04, 2015		Soil	M15-Fe04497		X					
QAQC4	Feb 04, 2015		Soil	M15-Fe04498		X					
QAQC5	Feb 04, 2015		Soil	M15-Fe04499		X					
QAQC6	Feb 04, 2015		Soil	M15-Fe04500		X					
QAQC7	Feb 04, 2015		Soil	M15-Fe04501		X					
QAQC8	Feb 04, 2015		Soil	M15-Fe04502		X					

## Sample Receipt Advice

Company name: **Coffey Environments Pty Ltd ACT**

Contact name: [REDACTED]  
Project name: EB1326AA  
COC number: Not provided  
Turn around time: 5 Day  
Date/Time received: Feb 6, 2015 11:34 AM  
Eurofins | mgt reference: **446625**

### Sample information

- A detailed list of analytes logged into our LIMS, is included in the attached summary table.
  - Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 6.9 degrees Celsius.
  - All samples have been received as described on the above COC.
  - COC has been completed correctly.
  - Attempt to chill was evident.
  - Appropriately preserved sample containers have been used.
  - All samples were received in good condition.
  - Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
  - Appropriate sample containers have been used.
  - Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

### Contact notes

If you have any questions with respect to these samples please contact:

[REDACTED]

Results will be delivered electronically via e.mail to [REDACTED]



Chain of Custody

No: 07819

Laboratory Quotation / Order No:

Job No: EB1326AM Sheet 1 of 3

Dispatch to: (Address & Phone No.) MGT MEDICINE CANTON	Sampled by: [Redacted]	Consigning Officer: [Redacted]
Attention: [Redacted]	Project Manager: (report results to) [Redacted]	Date Dispatched: 5/2/15
		Courier Service: [Redacted]
		Consignment Note No: [Redacted]

Relinquished by: [Redacted]	Date: 5/2/15	Time: 14-15	Received by: [Redacted]	Date: 6/2	Time: 11.34am
			EF/mgt		

Comments	Sample Matrix	Container Type and Preservative	Sample No.	Date Sampled	Analyses Required										Sample Condition on Receipt	
					PAHs	TPHs	MAHs = BTEX	Metals:	B4	M8	Asb ID.	B14				
	S	1 JAL, 1 BAG, 1	TP1 0.1-0.2	4/2/15						/	/					
			TP1 0.7-0.8							/	/					
			TP2 0.1-0.2							/	/					
			TP2 0.7-0.8							/	/					
			TP3 0.2-0.3							/	/					
			TP3 0.7-0.8							/	/					
			TP4 0.1-0.2							/	/					
			TP4 0.6-0.7							/	/					
			TP5 0.2-0.2							/	/					
			TP5 0.7-0.8							/	/					
			TP6 0.1-0.2							/	/					
			TP6 0.7-0.8							/	/					
			TP7 0.1-0.2							/	/					
			TP7 0.6-0.7							/	/					
			TP8 0.1-0.2							/	/					
			TP8 0.8-0.9	4/2/15						/	/					

Special Laboratory Instructions: *Analyses to request to be emailed separately*

Detection Limits: \_\_\_\_\_ Turnaround Required: \_\_\_\_\_

JOB NUMBER MUST BE REFERENCED ON ALL SUBSEQUENT PAGES

Copies: WHITE: Sign on release. YELLOW: If dispatched to interstate Lab. Lab to sign on receipt and fax back to Coffey. BLUE: To be returned with results.

446625





Chain of Custody

Laboratory Quotation / Order No:

No: 07821  
Job No: FB1326m Sheet 3 of 3

Dispatch to: (Address & Phone No.) <u>MGT</u> <u>CHILLER</u>	Sampled by: [Redacted]	Consigning Officer: [Redacted]
Attention: [Redacted]	Project Manager (report results to) [Redacted]	Date Dispatched: <u>5/2/15</u>
		Courier Service: <u>FULPRIM</u>
		Consignment Note No:

Relinquished by: [Redacted]	Date: <u>5/2/15</u>	Time: <u>14:20</u>	Received by: [Redacted]	Date: <u>6/2</u>	Time: <u>11.30 am</u>
			<u>EF/mgt</u>		

Comments	Sample Matrix	Container Type and Preservative	Sample No.	Date Sampled	Analyses Required				Sample Condition on Receipt
					PAHs	TPHs	MAHs = BTEX	Metals	
	<u>S</u>	<u>EA 1 JAL, 10F</u>	<u>QAQC1</u>	<u>4/2/15</u>					
	↓	↓	<u>QAQC2</u>	↓					
			<u>QAQC3</u>						
			<u>QAQC4</u>						
			<u>QAQC5</u>						
			<u>QAQC6</u>						
			<u>QAQC7</u>						
			<u>QAQC8</u>						

Special Laboratory Instructions:

Detection Limits: \_\_\_\_\_ Turnaround Required: \_\_\_\_\_

JOB NUMBER MUST BE REFERENCED ON ALL SUBSEQUENT PAGES

Copies: WHITE: Sign on release. YELLOW: If dispatched to interstate Lab, Lab to sign on receipt and fax back to Coffey. BLUE: To be returned with results.

446625

## EnviroSampleVIC

---

**From:** [REDACTED]  
**Sent:** Friday, 6 February 2015 11:34 AM  
**To:** EnviroSampleVIC  
**Subject:** RE: EB1326AA  
**Attachments:** ENAUBRAD01326AA - completed COC.pdf

Hi

Please see attached completed CoC

Kind Regards

[REDACTED]  
Senior Environmental Scientist

118 Auburn Street  
Wollongong, NSW 2500, Australia

t: + [REDACTED] (direct)

t: +61 2 4201 1400 (office)

m: + [REDACTED]



---

**From:** EnviroSampleVIC [<mailto:EnviroSampleVic@eurofins.com.au>]  
**Sent:** Friday, 6 February 2015 9:33 AM  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** EB1326AA

Hi [REDACTED]

Please advise analysis asap.

Thanks

[REDACTED]

Enquiries VIC

**Eurofins | mgt**  
2-5 Kingston Town Close  
OAKLEIGH VIC 3166  
AUSTRALIA  
Fax : +61385645090

## **Appendix D – Data Validation Report**

# QA/QC DATA VALIDATION REPORT

Job No: ENAUBRAD01326AA

Batches:

Eurofins MGT: 446625



## I. SAMPLE HANDLING

1. Were the sample **holding times\*** met?
2. Were the samples in **proper custody** between the field and reaching the laboratory?
3. Were the samples **properly and adequately preserved**?  
*This includes keeping the samples chilled, where applicable.*
4. Were the samples received by the laboratory in good condition?

Yes	No (Comment below)
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

\* Refer to laboratory reports for specific holding times.

### COMMENTS:

- Sample temperature upon receipt was 6.9°C. This recorded temperature is marginally above the maximum recommended temperature of 6°C. It is considered unlikely that data is affected through potential loss of volatiles at these elevated sample temperatures because:
  - Samples are considered representative of the material and laboratory results generally reflect field observations; and
  - Samples stored in ice chests/fridge following collection. Therefore the opportunity for degradation of contaminants of potential concern (COPCs) within the sample is considered low.

Sample Handling was:

Satisfactory

Unsatisfactory

Partially Satisfactory

# QA/QC DATA VALIDATION REPORT

Job No: ENAUBRAD01326AA

Batches:

Eurofins MGT: 446625



## II PRECISION/ACCURACY ASSESSMENT

1. Was a NATA registered laboratory used?
2. Did the laboratory perform the requested tests?
3. Were the laboratory methods adopted NATA endorsed?\*
4. Were the appropriate test procedures followed?
5. Were the reporting limits satisfactory?
6. Was the NATA Seal on the reports?
7. Were the reports signed by an authorised person?

\* The test methods adopted are listed in relevant laboratory reports.

Yes	No (Comment below)
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

### COMMENTS:

Precision/Accuracy of the Laboratory Report	<input checked="" type="checkbox"/> Satisfactory	<input type="checkbox"/> Unsatisfactory
	<input type="checkbox"/> Partially Satisfactory	

# QA/QC DATA VALIDATION REPORT

Job No: ENAUBRAD01326AA

Batches:

Eurofins MGT: 446625



## III. FIELD QA/QC

1. Number of Primary Samples Analysed:

Analyte	No of samples analysed (percentage – must be more than 10%):	
	Primary	Duplicates
Heavy Metals	15	2 (13%)
TRH / BTEX / PAH	8	1 (12%)
OCP / OPP	5	1 (20%)
Asbestos	5	N/A
Soil Properties (including pH, EC, Ion exchange properties)	1	N/A

2. Number of Days of Sampling: 3 days (soil)

3. Number and Type of QA/QC Samples Collected:

	SOIL	WATER
Field Duplicates (at least 1 in 10 samples)	2 intra-laboratory duplicate	N/A
Trip Spikes	0	N/A
Trip Blanks (at least 1/day or sampling event)	0	N/A
Wash Blanks / Equipment Rinsate (at least 1/day/matrix/equipment)	0	N/A
Other (Field Blanks, etc.)	0	N/A

## 4. FIELD DUPLICATES

A. Were an Adequate Number of field duplicates analysed for each chemical (min. 10%)?

B. Were RPDs within Control Limits?

a. Organics

b. Metals/Inorganics

Yes	No (Comment below)
<input checked="" type="checkbox"/> See note	<input type="checkbox"/>
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

\* - Result < 10 times LOR then No Limit

- Result > 10 times LOR then control limit of 30%

### COMMENTS:

- Results of quality control soil samples are presented in Table QAQC1.

# QA/QC DATA VALIDATION REPORT

Job No: ENAUBRAD01326AA

Batches:

Eurofins MGT: 446625



## 5. TRIP BLANKS

- A. Were an adequate number of trip blanks collected?
- B. Were the trip blanks free of contaminants?  
(If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.)

Yes	No (Comment below)
<input type="checkbox"/>	<input checked="" type="checkbox"/>
NA	NA

## 6. TRIP SPIKES

- A. Were an adequate number of trip spikes collected?
- B. Were the spike recoveries within control limits (60% to 110%)?

Yes	No (Comment below)
<input type="checkbox"/>	<input checked="" type="checkbox"/>
NA	NA

## 7. WASH BLANKS

- A. Were an adequate number of Wash Blanks collected?
- B. Were the Wash Blanks free of contaminants?  
(If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.)

Yes	No (Comment below)
<input type="checkbox"/>	<input checked="" type="checkbox"/>
NA	NA

### COMMENTS:

- Surface samples were collected directly by hand (with nitrile glove). Samples from test pits were collected from soils in the centre of the excavator bucket. Therefore a wash blank was not considered necessary for these samples. A wash blank was not collected from the hand auger. This is not considered to impact the results of the assessment as the hand auger was decontaminated in between sample locations in accordance with Coffey SOPs and industry accepted practice, and contaminants of potential concern were less than adopted investigation levels. Therefore cross contamination is unlikely to have occurred.
- A trip spike and blank was not transported with the samples. This is not considered significant as evidence of volatile hydrocarbons were not observed during fieldwork, and concentrations of COPCs were less than adopted guideline levels.

Field QA/QC was:	<input checked="" type="checkbox"/> Satisfactory	<input type="checkbox"/> Unsatisfactory
	<input type="checkbox"/> Partially Satisfactory	

# QA/QC DATA VALIDATION REPORT

Job No: ENAUBRAD01326AA

Batches:

Eurofins MGT: 446625



## IV LABORATORY INTERNAL QUALITY CONTROL PROCEDURES

### 1. Type of QA/QC Samples

	TRH	BTEX	PAH	OCP/OPP	Metals
Laboratory Blanks/Reagent Blanks (at least 1 per batch)	✓	✓	✓	✓	✓
Laboratory Duplicates (at least 1 per batch or 1 per 10 samples whichever is the smaller)	✓	✓	✓	✓	✓
Matrix Spikes/Matrix Spike Duplicates (1 for each soil type)	✓	✓	✓	✓	✓
Laboratory Control Spike	✓	✓	✓	✓	✓
Surrogate (where appropriate)*	NA	1	2	2/1	NA

\*Number of surrogate spikes carried out on each sample

2. Were the laboratory blanks/reagent blanks free of contamination?
3. Were the spike recoveries within laboratory control limits?#
  - a. Organics
  - b. Metals/Inorganic
4. Were the RPDs of the laboratory duplicates within control limits?#
5. Were the surrogate recoveries within control limits?

Yes	No (Comment below)
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

#### Eurofins Laboratory control limits:

- \* - General: MS & LCS (70 to 130%) & surrogates (50 to 150%)
- Phenols: MS & LCS (30 to 130%) & surrogates (20 to 130%)
- # - Result < 10 times LOR then No Limit
- Result between 10 and 20 times LOR then control limit of 0 to 50%
- Result > 20 times LOR then control limit of 0 to 30%

#### COMMENTS:

5. The laboratory internal QA/QC was:	<input checked="" type="checkbox"/> Satisfactory	<input type="checkbox"/> Unsatisfactory
	<input type="checkbox"/> Partially Satisfactory	

# QA/QC DATA VALIDATION REPORT

Job No: ENAUBRAD01326AA

Batches:

Eurofins MGT: 446625



## V. DATA USABILITY

- |   |                                     |
|---|-------------------------------------|
| 1. Data Directly Usable   | <input checked="" type="checkbox"/> |
| 2. Data Usable with the following corrections/modifications (see comment below) | <input type="checkbox"/>            |
| 3. Data Not Usable.   | <input type="checkbox"/>            |

### **COMMENTS:**

QA/QC Report Prepared by

QA/QC Report Reviewed by:

  
(Reviewer)

Table QAQC1: Relative Percentage Difference for Soil Samples

Batch		446625			446625		
		Primary Sample Conc. (mg/kg)	Intra-laboratory duplicate Sample Conc. (mg/Kg)	RPD (%)	Primary Sample Conc. (mg/kg)	Inter-laboratory duplicate Sample Conc. (mg/Kg)	RPD (%)
Sample No.	Laboratory Reporting Limits (mg/kg)	SS1	QC1		SS2	QC2	
Depth (m)	Eurofins	1.3	1.3		1.30	1.30	
<b>HEAVY METALS</b>							
Arsenic	2	3.9	5.1	27	2.7	3.0	11
Cadmium	0.4	< 0.4	< 0.4	ND	< 0.4	< 0.4	ND
Chromium	5	23	36	44	10	9.5	5
Copper	5	5.7	6.4	12	< 5	< 5	ND
Lead	5	29	14	70	7.2	7.6	5
Mercury	0.1	< 0.1	< 0.1	ND	< 0.1	< 0.1	ND
Nickel	5	< 5	< 5	ND	< 5	< 5	ND
Zinc	5	14	15	7	22	20	10
<b>TOTAL RECOVERABLE HYDROCARBONS</b>							
F1 (C6-C10)	20	< 20	< 20	ND	< 20	< 20	ND
F1 (C6-C10 less BTEX)	20	< 20	< 20	ND	< 20	< 20	ND
F2 (>C10-C16)	50	< 50	< 50	ND	< 50	< 50	ND
F2 (>C10-C16 less naphthalene)	50	< 50	< 50	ND	< 50	< 50	ND
F3 (>C16-C34)	100	< 100	< 100	ND	< 100	< 100	ND
F4 (>C34-C40)	100	< 100	< 100	ND	< 100	< 100	ND
<b>BTEX</b>							
Benzene	0.1	< 0.1	< 0.1	ND	< 0.1	< 0.1	ND
Toluene	0.1	< 0.1	< 0.1	ND	< 0.1	< 0.1	ND
Ethylbenzene	0.1	< 0.1	< 0.1	ND	< 0.1	< 0.1	ND
Total Xylene	0.3	< 0.3	< 0.3	ND	< 0.3	< 0.3	ND
<b>POLYCYCLIC AROMATIC HYDROCARBONS</b>							
Naphthalene	0.5	< 0.5	< 0.5	ND	< 0.5	< 0.5	ND
Carcenogenic PAHs (as BaP TEQ)	0.5	0.6	0.6	0	0.6	0.6	0
Benzo(a)pyrene	0.5	< 0.5	< 0.5	ND	< 0.5	< 0.5	ND
Total PAH	0.5	< 0.5	< 0.5	ND	< 0.5	< 0.5	NC
<b>ORGANOCHLORINE PESTICIDES</b>							
	various	< LOR	< LOR	ND	< LOR	< LOR	ND
<b>ORGANOPHOSPHORUS PESTICIDES</b>							
	various	< LOR	< LOR	ND	< LOR	< LOR	ND

Notes:

**Bold**

RPD exceeds control limit of 30% for soil if:

- Result < 10 times LOR then No Limit
- Result > 10 times LOR then control limit of 30%

RPD Relative Percentage Difference

NA Not Applicable

ND Not Detected

NC Contaminant is not detected in primary sample but is detected in duplicate sample, or vice versa

LOR Limit of Reporting

- No result or guideline

## **Appendix E – Borehole and Test pit Logs**

# Soil Description Explanation Sheet (1 of 2)

## DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

## CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

## PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 µm to 2.36 mm
	medium	200 µm to 600 µm
	fine	75 µm to 200 µm

## MOISTURE CONDITION

**Dry** Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

**Moist** Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

**Wet** As for moist but with free water forming on hands when handled.

## CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH $S_u$ (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	-	Crumbles or powders when scraped by thumbnail.

## DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

## MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

## SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous layers of lenticular shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

## GEOLOGICAL ORIGIN

### WEATHERED IN PLACE SOILS

Extremely weathered material Structure and fabric of parent rock visible.

Residual soil Structure and fabric of parent rock not visible.

### TRANSPORTED SOILS

Aeolian soil Deposited by wind.

Alluvial soil Deposited by streams and rivers.

Colluvial soil Deposited on slopes (transported downslope by gravity).

Fill Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.

Lacustrine soil Deposited by lakes.

Marine soil Deposited in ocean basins, bays, beaches and estuaries.

# Soil Description Explanation Sheet (2 of 2)

## SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60 mm and basing fractions on estimated mass)				USC	PRIMARY NAME	
COARSE GRAINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	GRAVELS More than half of coarse fraction is larger than 2.0 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	GRAVEL	
			Predominantly one size or a range of sizes with more intermediate sizes missing.	GP	GRAVEL	
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	GM	SILTY GRAVEL	
			Plastic fines (for identification procedures see CL below)	GC	CLAYEY GRAVEL	
	SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes missing	SW	SAND	
			Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	SAND	
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).	SM	SILTY SAND	
			Plastic fines (for identification procedures see CL below).	SC	CLAYEY SAND	
	FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm  (A 0.075 mm particle is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.				
		SILTS & CLAYS Liquid limit less than 50	DRY STRENGTH	DILATANCY	TOUGHNESS	
None to Low			Quick to slow	None	ML	SILT
Medium to High			None	Medium	CL	CLAY
SILTS & CLAYS Liquid limit greater than 50		Low to medium	Slow to very slow	Low	OL	ORGANIC SILT
		High	None	High	MH	SILT
		Medium to High	None	Low to medium	CH	CLAY
HIGHLY ORGANIC SOILS		Readily identified by colour, odour, spongy feel and frequently by fibrous texture.			Pt	PEAT

• Low plasticity – Liquid Limit  $W_L$  less than 35%. • Modium plasticity –  $W_L$  between 35% and 50%.

### COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM	TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.		SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.		TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.		TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.		INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

## Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.

**DEFINITIONS:** Rock substance, defect and mass are defined as follows:

**Rock Substance** In engineering terms rock substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic.

**Defect** Discontinuity or break in the continuity of a substance or substances.

**Mass** Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

### SUBSTANCE DESCRIPTIVE TERMS:

**ROCK NAME** Simple rock names are used rather than precise geological classification.

**PARTICLE SIZE** Grain size terms for sandstone are:  
**Coarse grained** Mainly 0.6mm to 2mm  
**Medium grained** Mainly 0.2mm to 0.6mm  
**Fine grained** Mainly 0.06mm (just visible) to 0.2mm

**FABRIC** Terms for layering of penetrative fabric (eg. bedding, cleavage etc. ) are:

**Massive** No layering or penetrative fabric.

**Indistinct** Layering or fabric just visible. Little effect on properties.

**Distinct** Layering or fabric is easily visible. Rock breaks more easily parallel to layering of fabric.

### ROCK SUBSTANCE STRENGTH TERMS

Term	Abbreviation	Point Load Index, I <sub>s50</sub> (MPa)	Field Guide
Very Low	VL	Less than 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30mm thick can be broken by finger pressure.

Low	L	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
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Medium	M	0.3 to 1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
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High	H	1 to 3	A piece of core 150mm long by 50mm can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
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Very High	VH	3 to 10	Hand specimen breaks after more than one blow of a pick; rock rings under hammer.
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Extremely High	EH	More than 10	Specimen requires many blows with geological pick to break; rock rings under hammer.
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### CLASSIFICATION OF WEATHERING PRODUCTS

Term	Abbreviation	Definition
Residual Soil	RS	Soil derived from the weathering of rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely Weathered Material	XW	Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded in water. Original rock fabric still visible.
Highly Weathered Rock	HW	Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by leaching or may be decreased due to the deposition of minerals in pores.
Moderately Weathered Rock	MW	The whole of the rock substance is discoloured, usually by iron staining or bleaching, to the extent that the colour of the fresh rock is no longer recognisable.
Slightly Weathered Rock	SW	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance (usually by limonite) has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Fresh Rock	FR	Rock substance unaffected by weathering.

#### Notes on Weathering:

- AS1726 suggests the term "Distinctly Weathered" (DW) to cover the range of substance weathering conditions between XW and SW. For projects where it is not practical to delineate between HW and MW or it is judged that there is no advantage in making such a distinction. DW may be used with the definition given in AS1726.
- Where physical and chemical changes were caused by hot gasses and liquids associated with igneous rocks, the term "altered" may be substituted for "weathering" to give the abbreviations XA, HA, MA, SA and DA.

#### Notes on Rock Substance Strength:

- In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may break readily parallel to the planar anisotropy.
- The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms.
- The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index (I<sub>s50</sub>). The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.

# Rock Description Explanation Sheet (2 of 2)

COMMON DEFECTS IN ROCK MASSES		Diagram	Map Symbol	Graphic Log (Note 1)	DEFECT SHAPE	TERMS
Term	Definition					
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub parallel to layering (eg bedding) or a planar anisotropy in the rock substance (eg, cleavage). May be open or closed.				Planar	The defect does not vary in orientation
					Curved	The defect has a gradual change in orientation
					Undulating	The defect has a wavy surface
Joint	A surface or crack across which the rock has little or no tensile strength, but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.				Stepped	The defect has one or more well defined steps
					Irregular	The defect has many sharp changes of orientation
					<b>Note:</b> The assessment of defect shape is partly influenced by the scale of the observation.	
Sheared Zone (Note 3)	Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.				<b>ROUGHNESS TERMS</b>	
					Slickensided	Grooved or striated surface, usually polished
					Polished	Shiny smooth surface
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.				Smooth	Smooth to touch. Few or no surface irregularities
					Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
					Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.
Crushed Seam (Note 3)	Seam with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties.				<b>COATING TERMS</b>	
					Clean	No visible coating
					Stained	No visible coating but surfaces are discoloured
Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface.				Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
					Coating	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein.
					<b>BLOCK SHAPE TERMS</b>	
Extremely Weathered Seam	Seam of soil substance, often with gradational boundaries. Formad by weathering of the rock substance in place.				Blocky	Approximately equidimensional
					Tabular	Thickness much less than length or width
					Columnar	Height much greater than cross section

**Notes on Defects:**

1. Usually borehole logs show the true dip of defects and face sketches and sections the apparent dip.
2. Partings and joints are not usually shown on the graphic log unless considered significant.
3. Sheared zones, sheared surfaces and crushed seams are faults in geological terms.

# Engineering Log - Hand Auger

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Borehole ID. **BH01**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date started: **03 Feb 2015**

date completed: **03 Feb 2015**

checked by: **SE**

checked by: **JB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°  
 drill model: Hand Auger hole diameter: 100 mm

drilling information				material substance			
method & support	penetration	samples & field tests	depth (m)	graphic log	classification symbol	material description	structure and additional observations
						SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	
						moisture condition	consistency / relative density
						hand penetrometer (kPa)	
HA	1	E	0.0 - 0.5			TOPSOIL: Sandy SILT: low liquid limit, brown, fine to coarse grained sand, with some roots.	TOPSOIL PID: 1.6 ppm
		E	0.5 - 0.7		Cl	CLAY: medium plasticity, orange-brown, with some fine to medium grained sand.	RESIDUAL SOIL PID: 1.3 ppm
			0.7 - 0.7			Hand Auger BH01 terminated at 0.7 m Target depth	

<b>method</b> AD auger drilling* AS auger screwing* HA hand auger W washbore HA hand auger	<b>support</b> M mud N nil C casing <b>penetration</b>  <b>water</b> 	<b>samples &amp; field tests</b> B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear, peak/remoulded (kPa) R refusal HB hammer bouncing	<b>classification symbol &amp; soil description</b> based on Unified Classification System <b>moisture</b> D dry M moist W wet Wp plastic limit Wl liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSst very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Hand Auger

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Borehole ID. **BH02**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date started: **03 Feb 2015**

date completed: **03 Feb 2015**

checked by: **SE**

checked by: **JB**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°  
 drill model: Hand Auger hole diameter: 100 mm

drilling information				material substance			
method & support	penetration	samples & field tests	depth (m)	graphic log	classification symbol	material description	structure and additional observations
HA N	1 2 3	E E E	0.5		CI	FILL: CLAY: medium plasticity, brown-dark brown, with some silt and fine roots, trace sand.	FILL
						FILL: CLAY: medium plasticity, brown/red-brown, with some silt and fine to coarse grained sand.	FILL (RE-WORKED NATURAL)
						CLAY: medium plasticity, brown/orange-brown mottled white, with some fine to medium grained sand.	RESIDUAL SOIL
Hand Auger BH02 terminated at 0.8 m Target depth							

<b>method</b> AD auger drilling* AS auger screwing* HA hand auger W washbore HA hand auger	<b>support</b> M mud N nil C casing <b>penetration</b>  <b>water</b> 	<b>samples &amp; field tests</b> B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear, peak/remoulded (kPa) R refusal HB hammer bouncing	<b>classification symbol &amp; soil description</b> based on Unified Classification System <b>moisture</b> D dry M moist W wet Wp plastic limit Wl liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Hand Auger

Borehole ID. **BH03**  
 sheet: 1 of 1  
 project no. **ENAUBRAD01326AA**  
 date started: **03 Feb 2015**  
 date completed: **03 Feb 2015**  
 checked by: **JB**

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°  
 drill model: Hand Auger hole diameter: 100 mm

drilling information				material substance			
method & support	penetration	samples & field tests	depth (m)	graphic log	classification symbol	material description	structure and additional observations
HA	1 2 3	E	0.5		CI	<p><b>TOPSOIL: Sandy SILT:</b> low liquid limit, brown, fine grained sand, with some fine roots.</p> <p><b>Silty CLAY:</b> medium plasticity, pale grey/grey-brown, with trace fine grained sand.</p>	<p>TOPSOIL PID: 5.9 ppm</p> <p>SLOPEWASH PID: 8 ppm</p>
			1.0			Hand Auger BH03 terminated at 0.7 m Target depth	
			1.5				

<b>method</b> AD auger drilling* AS auger screwing* HA hand auger W washbore HA hand auger	<b>support</b> M mud N nil C casing <b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear, peak/remoulded (kPa) R refusal HB hammer bouncing	<b>classification symbol &amp; soil description</b> based on Unified Classification System <b>moisture</b> D dry M moist W wet Wp plastic limit Wl liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Hand Auger

Borehole ID. **BH04**  
 sheet: 1 of 1  
 project no. **ENAUBRAD01326AA**  
 date started: **03 Feb 2015**  
 date completed: **03 Feb 2015**  
 checked by: **JB**

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°  
 drill model: Hand Auger hole diameter: 100 mm

drilling information				material substance			
method & support	penetration	samples & field tests	depth (m)	graphic log	classification symbol	material description	structure and additional observations
HA	1 2 3	E	0.5			<b>TOPSOIL: Sandy SILT:</b> low liquid limit, brown, fine grained sand, with some fine roots.  <b>CLAY:</b> medium plasticity, orange-brown, with trace fine to medium grained sand. 0.2 m: sand grading to fine to medium grained, roots absent	<b>TOPSOIL</b> PID: 5 ppm  <b>RESIDUAL SOIL</b>  PID: 2.8 ppm
			1.0			Hand Auger BH04 terminated at 0.8 m Target depth	

<b>method</b> AD auger drilling* AS auger screwing* HA hand auger W washbore HA hand auger	<b>support</b> M mud N nil C casing  <b>penetration</b>  <b>water</b> 	<b>samples &amp; field tests</b> B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear, peak/remoulded (kPa) R refusal HB hammer bouncing	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet Wp plastic limit Wl liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Hand Auger

Borehole ID. **BH05**  
 sheet: 1 of 1  
 project no. **ENAUBRAD01326AA**  
 date started: **03 Feb 2015**  
 date completed: **03 Feb 2015**  
 checked by: **JB**

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

position: Not Specified surface elevation: Not Specified angle from horizontal: 90°  
 drill model: Hand Auger hole diameter: 100 mm

drilling information				material substance						
method & support	penetration	samples & field tests	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
HA N	1 2 3	E	0.5		CI	TOPSOIL: Clayey SILT: low liquid limit, brown, with some fine to medium grained sand.	D			TOPSOIL PID: 6 ppm
						Silty CLAY: medium plasticity, orange-brown, with trace fine grained sand.	-Wp	St - VS		RESIDUAL SOIL PID: 4.1 ppm
						CLAY: medium plasticity, orange-brown, with trace fine to medium grained sand.	<Wp	H		PID: 0.9 ppm
Hand Auger BH05 terminated at 0.7 m Target depth										

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<b>method</b> AD auger drilling* AS auger screwing* HA hand auger W washbore HA hand auger	<b>support</b> M mud N nil C casing <b>penetration</b>  no resistance ranging to refusal <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear, peak/remoulded (kPa) R refusal HB hammer bouncing	<b>classification symbol &amp; soil description</b> based on Unified Classification System <b>moisture</b> D dry M moist W wet Wp plastic limit Wl liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VS stiff very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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\* bit shown by suffix  
 e.g. AD/T  
 B blank bit  
 T TC bit  
 V V bit

# Engineering Log - Excavation

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID. **TP01**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

assessment: **DB**

checked by: **JB**

position: Not Specified      surface elevation: Not Specified      pit orientation:  
 equipment type: JCB-3XC Track      excavation method: E      excavation dimensions: 1.8 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N									<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine grained sub-angular gravel and fine rootlets.	D			<b>TOPSOIL</b>
						0.5		MH	<b>Clayey SILT:</b> low liquid limit, pale grey mottled pale brown, trace fine to medium grained sub-angular gravel and fine rootlets.	<Wp	H - Fb		<b>SLOPEWASH</b>
						1.0							
						1.5							
						2.0			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale brown, extremely weathered, very low to low strength.				<b>BEDROCK</b>
						2.5							
						3.0							
						3.5							
Test pit TP01 terminated at 3.6 m Target depth on very slow progress													

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<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Excavation

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID. **TP02**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

assessment: **DB**

checked by: **JB**

position: Not Specified      surface elevation: Not Specified      pit orientation:  
 equipment type: JCB-3XC Track      excavation method: E      excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N		1 2 3							<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine grained sub-angular gravel, trace fine rootlets.	M			<b>TOPSOIL</b>
				E		0.5		CH	<b>Silty CLAY:</b> medium to high plasticity, pale grey mottled orange-brown, trace fine rootlets.	=Wp	St		<b>RESIDUAL SOIL</b>
				E									
				E		1.0							
						1.5			<b>DACITE:</b> coarse grained, pale brown-pale grey, extremely weathered, very low to low strength.				<b>BEDROCK</b>
				E		2.0							
						2.5							
						3.0							
						3.5			Test pit TP02 terminated at 3.2 m Target depth at or near bucket refusal				

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<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Excavation

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID. **TP03**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

assessment: **DB**

checked by: **JB**

position: Not Specified      surface elevation: Not Specified      pit orientation:  
 equipment type: JCB-3XC Track      excavation method: E      excavation dimensions: 1.8 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N		1				0.0			<b>TOPSOIL: Sandy SILT:</b> low liquid limit, dark brown, fine to medium grained sand, trace fine to medium grained sub-angular gravel and fine rootlets.	D		100	<b>TOPSOIL</b>
		2				0.2							
		3				0.4							
						0.5		CL	<b>Silty CLAY:</b> low to medium plasticity, red-brown mottled pale brown, trace fine grained rootlets.	<Wp	H		<b>RESIDUAL SOIL</b>
						1.0							
						1.5			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale brown, extremely weathered, low strength.				<b>BEDROCK</b>
						2.0							
						2.3			Test pit TP03 terminated at 2.3 m Target depth bucket refusal				
						2.5							
						3.0							
						3.5							

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<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Excavation

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID. **TP04**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

assessment: **DB**

checked by: **JB**

position: Not Specified      surface elevation: Not Specified      pit orientation:  
 equipment type: JCB-3XC Track      excavation method: E      excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N		1		E		0.0			<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine grained sub-angular gravel and fine rootlets.	D			<b>TOPSOIL</b>
		2		D		0.5		CL	<b>Silty CLAY:</b> low plasticity, red-brown mottled pale-brown and yellow-brown, trace fine rootlets.	<Wp	H		<b>RESIDUAL SOIL</b>
		3		E		1.0		CH	<b>Silty CLAY:</b> high plasticity, brown.				D: 0.8m-1.0m
				B + D		1.5			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale brown, extremely weathered, low strength.				<b>BEDROCK</b>
						2.0							
						2.3			Test pit TP04 terminated at 2.3 m Target depth at or near bucket refusal				
						2.5							
						3.0							
						3.5							

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<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b> no resistance ranging to refusal <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Excavation

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID. **TP05**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

assessment: **DB**

checked by: **JB**

position: Not Specified      surface elevation: Not Specified      pit orientation:  
 equipment type: JCB-3XC Track      excavation method: E      excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N									<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine sub-angular gravel and fine roots.	D			<b>TOPSOIL</b>
						0.5		MH	<b>Clayey SILT:</b> low liquid limit, pale grey mottled pale brown, trace medium to coarse grained sand and fine rootlets.	<Wp	H		<b>SLOPEWASH</b>
						1.0		CH	<b>Silty CLAY:</b> high plasticity, red-brown.				<b>RESIDUAL SOIL</b>
						1.5			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale brown, extremely weathered, low strength.				<b>BEDROCK</b>
						2.0							
						2.5			Test pit TP05 terminated at 2.3 m Target depth at or near bucket refusal				
						3.0							
						3.5							

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<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Excavation

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID. **TP06**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

assessment: **DB**

checked by: **JB**

position: Not Specified      surface elevation: Not Specified      pit orientation:  
 equipment type: JCB-3XC Track      excavation method: E      excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N		1		E		0.0		ML	<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown/dark brown, fine to medium grained sand, trace fine to medium sub-angular gravel and fine roots.	M	H	100	<b>TOPSOIL</b>
X		2		D		0.2		ML	<b>Clayey SILT:</b> low liquid limit, pale brown mottled pale grey, trace fine roots.	<Wp	H	200	<b>SLOPEWASH</b>
BH		3		B		0.4		ML				300	
B				E		0.6		ML				400	
R				D		0.8		CH	<b>Silty CLAY:</b> high plasticity, pale brown.				<b>RESIDUAL SOIL</b>
E						1.0		CH					
						1.2		CH					
						1.4		CH					
						1.6		CH					
						1.8		CH					
						2.0		CH					
						2.2		CH					
						2.4		CH					
						2.6		CH					
						2.8		CH					
						3.0		CH					
						3.1		CH					
						3.2		CH					
						3.3		CH					
						3.4		CH					
						3.5		CH					
						3.6		CH					
						3.7		CH					
						3.8		CH					
						3.9		CH					
						4.0		CH					
						4.1		CH					
						4.2		CH					
						4.3		CH					
						4.4		CH					
						4.5		CH					
						4.6		CH					
						4.7		CH					
						4.8		CH					
						4.9		CH					
						5.0		CH					
						5.1		CH					
						5.2		CH					
						5.3		CH					
						5.4		CH					
						5.5		CH					
						5.6		CH					
						5.7		CH					
						5.8		CH					
						5.9		CH					
						6.0		CH					
						6.1		CH					
						6.2		CH					
						6.3		CH					
						6.4		CH					
						6.5		CH					
						6.6		CH					
						6.7		CH					
						6.8		CH					
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						7.1		CH					
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						9.9		CH					
						10.0		CH					
						10.1		CH					
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						14.0		CH					
						14.1		CH					
						14.2		CH					
						14.3		CH					
						14.4		CH					
						14.5		CH					
						14.6		CH					
						14.7		CH					
						14.8		CH					
						14.9		CH					
						15.0		CH					

# Engineering Log - Excavation

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID. **TP07**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

assessment: **DB**

checked by: **JB**

position: Not Specified      surface elevation: Not Specified      pit orientation:  
 equipment type: JCB-3XC Track      excavation method: E      excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N		1		E		0.0			<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine rootlets.	D		100	<b>TOPSOIL</b>
		2		D		0.5		CL	<b>Silty Sandy CLAY:</b> low plasticity, red-brown, fine grained sand, trace fine rootlets.	<Wp	H	200	<b>RESIDUAL SOIL</b>
		3		E		1.0			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale-brown, extremely weathered, low strength.			300	<b>BEDROCK</b>
						1.5						400	
						2.0			Test pit TP07 terminated at 1.8 m Target depth at or near bucket refusal				
						2.5							
						3.0							
						3.5							

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<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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# Engineering Log - Excavation

client: **Land Development Agency**

principal: -

project: **P1 +P2 Contamination Assessment and Preliminary Geotechnical Assessment**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID. **TP08**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

assessment: **DB**

checked by: **JB**

position: Not Specified      surface elevation: Not Specified      pit orientation:  
 equipment type: JCB-3XC Track      excavation method: E      excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
		1 2 3							SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components			100 200 300 400	
N									<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine grained sub-angular gravel and rootlets.	D			<b>TOPSOIL/SLOPEWASH</b>
						0.5		CL	<b>Silty CLAY:</b> low to medium plasticity, red-brown mottled pale brown, trace fine rootlets.	<Wp	H		<b>RESIDUAL SOIL</b>
			Not Observed			1.0							
						1.5			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale-brown, extremely wethered, low strength.				<b>BEDROCK</b>
						2.0							
						2.5			Test pit TP08 terminated at 2.4 m Target depth at very slow progress				
						3.0							
						3.5							

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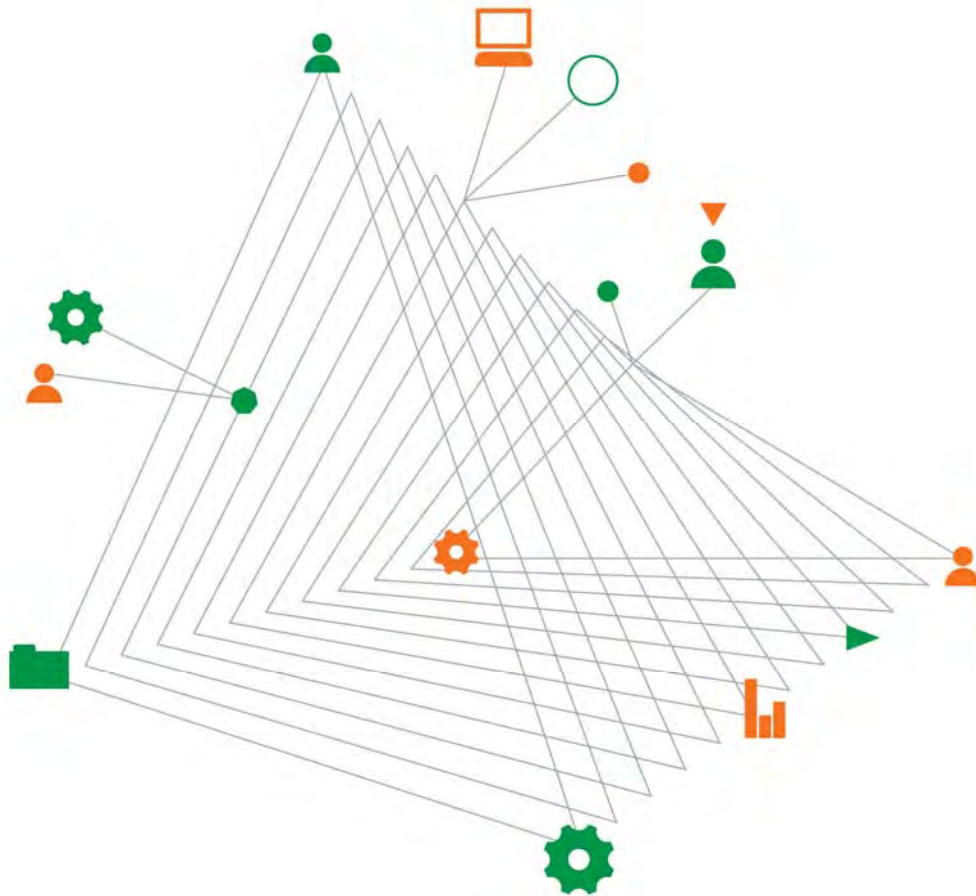
<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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**Land Development Agency**

**Block 2 Section 28 Greenway, ACT**

Preliminary Geotechnical Investigation

20 February 2015



Experience  
comes to life  
when it is  
powered by  
expertise

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## Block 2 Section 28 Greenway, ACT

Prepared for  
Land Development Agency  
Level 7 TransACT House,  
470 Northbourne Avenue,  
Dickson ACT 2602

Prepared by  
Coffey Geotechnics Pty Ltd  
16 Mildura Street  
Fyshwick ACT 2609 Australia  
t: +61 2 6260 7288 f: +61 2 6260 7211  
ABN: 93 056 929 483

20 February 2015

### Document authorisation

Our ref: ENAUBRAD01326AA-R02

For and on behalf of Coffey



Canberra Manager

### Quality information

#### Revision history

Revision	Description	Date	Author	Reviewer	Signatory
00	Final	13/02/2015			

#### Distribution

Report Status	No. of copies	Format	Distributed to	Date
Final	1	PDF	Graeme Walker - LDA	20/02/2015

## **Executive Summary**

Land Development Agency (LDA) is the current leaseholder of Block 2, Section 28, Greenway, ACT. We understand that the site is currently assigned a Land Use Zone CZ6 - 'Leisure and Accommodation' under the Territory Plan and that the LDA intends to re-zone the site as RZ4 - allowing construction of townhouses and apartments up to three storeys with basement parking.

Coffey was commissioned by LDA to undertake a Phase 1 and 2 contamination assessment, and a preliminary geotechnical investigation to support divestment and / or future redevelopment of the site.

For specific detail on encountered subsurface conditions, reference should be made to the attached Engineering Borehole Logs included in the attached report. In summary the results of our investigation identified the following geological units within the investigation area; **Unit 1** - Topsoil, **Unit 2** - Slopewash soils, **Unit 3** - Residual soils and **Unit 4** - Dacite bedrock.

### **Trafficability**

Exposed subgrades are expected to behave poorly if exposed to heavy construction traffic, particularly when wet. Where heavy plant such as piling rigs, or mobile cranes are to traffic the site, specific analysis of working platform requirements may be required to assess working platform thickness.

### **Excavatability**

Excavation contractors should be provided with the Engineering Borehole Logs and required to make their own assessment of the suitability and productivity of particular excavation plant.

Based on two levels of basement, excavation of up to 6 m will penetrate through the Unit 1 Topsoil, Unit 2 Slope wash soils, Unit 3 Residual Soils and into Unit 4 Bedrock. The Unit 1 / Unit 2 / Unit 3 soils and some of the weathered upper Unit 4 bedrock should be able to be excavated or ripped using conventional earthmoving plant, such as large excavators with rock teeth or a bulldozer fitted with a ripper.

Where excavation extends into Unit 4 bedrock, high powered plant fitted with rippers will likely be required and the 'wear and tear' on machinery will be higher.

### **Material Reuse**

Old topsoil or highly silty soils are not suitable for re-use as Engineered Fill. We recommended these materials be stripped and stockpile for future use in landscaping activities or disposed of offsite if not required.

From a geotechnical viewpoint, with the exception of the above, all remaining site soils and weathered bedrock should generally be suitable for use as Engineered Fill, provided unsuitable materials such as organics, waste or oversized particles are removed. The project geotechnical consultant should verify the suitability of excavated material for re-use as Engineered Fill during construction.

### **Foundations**

Bulk excavation for a two storey basement is expected to expose a subgrade comprising variably weathered dacite bedrock. Depending upon final column loads; building foundations may comprise of pad or strip footings, founded at bulk excavation level in Unit 4 bedrock. However, where higher loads are proposed or where the retention system is to be formed as part of the permanent structure, perimeter building loads may be carried on suitably designed perimeter piles that are part of the basement retaining wall.

If basements are not excavated then footings may be founded in the Unit 2 and Unit 3 materials.

Preliminary foundation parameters are presented within the attached report.

### **Groundwater**

Groundwater was not observed at any of the test pit locations within the depth of investigation (3.6 m); it is therefore expected that shallow excavations above this depth would likely be above standing groundwater levels. However, groundwater levels are expected to fluctuate in response to localised rainfall and seasonal variations.

Some groundwater seepage may occur along the soil/rock interface and through any joints and defects that are present in the bedrock, particularly after periods of heavy rainfall. During construction, it should be practical to control such seepage by conventional sump pumping methods.

Further site assessment would be required to assess the presence of groundwater below the depth of the current investigation where two basement levels are proposed. Such further assessment could include the drilling of cored boreholes and installation of groundwater standpipe(s) to facilitate groundwater monitoring (if present).

### **Future Works**

The information contained within this report is considered preliminary and it is advised that prior to future development of the site, a comprehensive investigation is undertaken to further assess the subsurface conditions and confirm or otherwise our preliminary findings based on the limited number of test pits completed to date.

We recommend such further investigations include provision for diamond coring to prove the depth and nature of the bedrock to inform excavation contractors and facilitate potentially more economical foundation design. Installation of a piezometer at the site may be useful to better understand groundwater conditions and the potential for seasonal variation following periods of heavy rainfall.

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## **Tables**

Table 1 - Preliminary Geotechnical Model

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## **Appendices**

Appendix A - Engineering Test Pit Logs and Explanation Sheets

Appendix B - Laboratory Test Certificates

# 1. Introduction

This report presents the results of a preliminary geotechnical investigation carried out by Coffey Geotechnics Pty Ltd (Coffey) for the proposed divestment / redevelopment of Block 2 Section 28, Greenway ACT.

The investigation was commissioned by the Land Development Agency (LDA) and undertaken in general accordance with our proposal, reference ENAUBRAD01326AA-P01, dated 19 December 2014.

The purpose of this investigation was to provide preliminary geotechnical comment on subsurface conditions at the site to aid early investment and/or construction planning for redevelopment. Specific details of the proposed redevelopment were not known to Coffey at the time of writing this report. However, through early discussion with the LDA, we understand that developments may comprise of multistorey buildings with up to 2 levels or basement parking.

Coffey were also engaged to complete Phase 1 and Phase 2 Contamination Assessments for the site concurrently with the preliminary geotechnical investigation, the results of which are reported separately (ref: ENAUBRAD01326AA-R01, dated 18 February 2015).

## 2. Method of investigation

### 2.1. Fieldwork

Fieldwork for the preliminary geotechnical investigation was carried out on 4 February 2015 and comprised the excavation of eight test pits (TP01 to TP08) using a JCB-3XC Backhoe equipped with a 400 mm bucket with rock teeth. Figure 1 shows the approximate test pit locations within the site.

All test pits were advanced to refusal within weathered bedrock, encountered at depths of between 1.8 m and 3.6 m below existing ground surface levels.

On completion of excavation, following photography, all test pits were backfilled with the excavated spoil and tamped at the surface using the backhoe bucket. The surface of each reinstated test pit was left slightly proud to allow for some future settlement to occur.

Test pitting was observed by a Coffey Engineering Geologist who directed sampling and testing, recorded test results and logged the materials encountered. The Engineering Logs for each of the excavations are presented in Appendix A, together with Coffey soil and rock explanation sheets which describe the terms and symbols used in their preparation.

Figure 1 shows the approximate borehole locations. Reduced Levels were inferred from a client supplied survey drawing and are shown on the Engineering Borehole Logs presented in Appendix A.

### 2.2. Laboratory testing

The following geotechnical soil testing was carried out at our NATA registered laboratory on selected samples recovered during the investigation:

- Four Soaked (4 days) California Bearing Ration (CBR) tests;
- Five Atterberg Limit (Inc Linear Shrinkage) tests; and
- One Shrink Swell ( $I_{ss}$  %) test.

The laboratory test results are summarised below, test certificates are presented in Appendix B.

### 3. Results of investigation

#### 3.1. Site description

Figure 1 shows the site footprint. The irregular shaped site covers an area of approximately 44,000m<sup>2</sup>, on the eastern bank of Lake Tuggeranong. The site is currently undeveloped and comprises mainly grassland with some sparse tree cover. The site is bound to the east by Drakeford Drive, to the north by existing development(s) and the south and west by North Lewis Drive.

We understand that the site is currently assigned a Land Use Zone CZ6 - 'Leisure and Accommodation' under the Territory Plan and that the LDA intends to re-zone the site as RZ4 - allowing construction of townhouses and apartments up to three storeys with basement parking.

#### 3.2. Subsurface conditions

The Canberra 1:50,000 Geological Series Sheet indicates the site locality is underlain by rhyodacite bedrock of the Late Silurian Laidlaw Volcanics Suite. Based on our experience in the area, slope wash soils are expected to occur at the site resulting from the weathering and subsequent transportation / deposition of sediments from topographic high points such as that to the east of the site. Residual soils may be present as a result of weathering of the underlying bedrock.

For specific detail on encountered subsurface conditions reference should be made to the attached Engineering Logs (refer Appendix A).

Subsurface conditions across the site were consistent with the published geological information referred to above, generally comprising a variable thickness of topsoil overlying slopewash and / or residual soil with weathered dacite bedrock at a relatively shallow depth.

Based on information obtained from TP01 to TP08, Table 1 has been prepared for the site, summarising the ground conditions encountered at the test pit locations and presenting our inferred geotechnical model comprising four main units.

Table 1 - Preliminary Geotechnical Model

Unit	Material	Description	Depth to Top of Unit (m) <sup>3</sup>	Range of Unit Thickness (m) <sup>3</sup>
1	Topsoil	Sandy Silt, fine to medium sand, trace of fine grained sub-angular gravel and fine rootlets.	0.0	0.15 - 0.40
2	Slope wash	Clayey Silt, trace fine to medium grained sub-angular gravels and fine rootlets.	0.15 - 0.20 <sup>*1</sup>	0.70 - 1.60
3	Residual Soil	Silty Clay, generally medium to high plasticity, typically stiff and hard consistency.	0.20 - 1.10 <sup>*2</sup>	0.50 - 1.10
4	Bedrock	Dacite: Extremely and Highly weathered, very low and low strength.	0.90 - 1.80	To limit of investigation

Notes:

1. Encountered only within TP01, TP05 and TP06.
2. Not observed within TP01.
3. The depths and layer thicknesses provided in Table 1 above are based on the subsurface conditions at the borehole locations only and may not be representative of ground conditions in all areas of the site.

Groundwater was not observed during excavation at any of the test pit locations. Higher soil moisture content was noted within TP02, where the moisture content was observed to be at or near the plastic limit of the residual clay resulting in a slightly lower pocket penetrometer reading.

### 3.3. Laboratory test results

Laboratory test reports are presented in Appendix B and are summarised below.

Table 2 - Summary of Modified Compaction and CBR

Sample ID	Modified Maximum Dry Density (t/m <sup>3</sup> )	Modified Optimum Moisture Content (%)	CBR (%)
TP01 0.3 - 0.7 m	2.00	9	15
TP03 0.3 - 0.6 m	1.65	20.5	2.5
TP04 0.8 - 1.3m	1.70	21.5	3.5
TP05 0.2 - 0.9 m	1.90	11.5	5.0

Table 3 - Summary of Atterberg Limit and Shrink Swell

Sample ID	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	I <sub>ss</sub> Value (%)
TP01 0.3 - 0.7 m	26	17	9	4	-
TP03 0.3 - 0.6 m	71	28	43	19	-
TP04 0.8 - 1.3m	81	23	58	19.5	-
TP05 0.2 - 0.9 m	29	20	9	6	-
TP06 1.1 - 1.3 m	58	21	37	16.5	-
TP02 0.4 - 0.65 m	-	-	-	-	2.5

## 4. Discussion and recommendations

### 4.1. Excavation conditions

Based on the assumption that redevelopment of the site may involve two levels of basement car parking, we expect excavations may extend up to 6 m below existing surface levels.

Such an excavation will penetrate through the Unit 1 Topsoil, Unit 2 Slope wash soils, Unit 3 Residual Soils and into Unit 4 Bedrock. The Unit 1 / Unit 2 / Unit 3 soils and some of the weathered upper Unit 4 bedrock should be able to be excavated or ripped using conventional earthmoving plant, such as large excavators with rock teeth or a bulldozer fitted with a ripper.

Where excavation extends into Unit 4 bedrock, high powered plant fitted with rippers will likely be required and the 'wear and tear' on machinery will be higher.

Excavation contractors should be provided with the Engineering Borehole Logs and be required to make their own assessment on the suitability and productivity of particular excavation plant.

## 4.2. Groundwater

Groundwater was not observed at any of the test pit locations within the depth of investigation (3.6 m); it is therefore expected that shallow excavations above this depth would likely be above standing groundwater levels. However, groundwater levels are expected to fluctuate in response to localised rainfall and seasonal variations.

Some groundwater seepage may occur along the soil/rock interface and through any joints and defects that are present in the bedrock, particularly after periods of heavy rainfall. During construction, it should be practical to control such seepage by conventional sump pumping methods.

Further site assessment would be required to assess the presence of groundwater below the depth of the current investigation where two basement levels are proposed. Such further assessment could include the drilling of cored boreholes and installation of groundwater standpipe(s) to facilitate groundwater monitoring (if present).

## 4.3. Unsupported excavations

Unsupported excavations in soil and weathered bedrock may be practicable where there is sufficient space to allow for the creation of batter slopes and/or benching and where sensitive structures are not located within a distance from the crest equal to the depth of excavation.

For preliminary assessments, the batter slopes in Table 4 can be assumed for unsupported excavations.

Table 4 - Recommended Unsupported Batter Slopes

Unit	Temporary Batters	Permanent Batters
Unit 1 - Topsoil	1.5H:1V	2H:1V
Unit 2 - Slope Wash		
Unit 3 - Residual Soil		
Unit 4 - Weathered Bedrock	1H:1V	2H:1V

If there is insufficient room to form the above recommended batters, excavation extends below standing groundwater level or excavations form part of the permanent structure, then a retention system will be required.

## 4.4. Excavation support and retention design

Retaining wall systems that could be considered include:

- Soldier pile walls with infill panels (usually shotcrete, timber planks or precast concrete panels)
- Contiguous or semi contiguous piles.

If the above wall types are used to support the excavations, we recommend all piles be uniformly socketed into competent Unit 4 bedrock (expected at depth) to provide uniformity of founding conditions and additional toe stability to the wall. These types of wall could also be included as the permanent support systems.

For two basement levels, cantilevered walls are not generally feasible. Lateral stability could be provided by anchors installed progressively as the excavation proceeds. Anchors may need to be installed beneath adjacent properties and would need the permission of adjacent property owners and authorities. Alternatively, top down construction or internal bracing could be adopted.

It is recommended that detailed analysis be undertaken to develop a cost-effective retention system. As a guide, Table 5 below presents typical design parameters that can be adopted for the preliminary design of retaining walls.

Table 5 - Design Parameters for Preliminary Retaining Wall Design

Material	Bulk density, $\gamma_b$ (kN/m <sup>3</sup> ) *	c' (kPa)	$\phi'$ (degrees)	Elastic Modulus (MPa)
Unit 2 - Slope Wash	20	0	27	25
Unit 3 - Residual Soil	20	5	27	40
Unit 4 - Weathered Bedrock	23	50	30	150

Within the retained soil profile, the magnitude of adjacent ground movements will depend on the ground conditions, design lateral pressure, shoring system adopted, construction sequence and workmanship. Documented data has shown that for well-designed and constructed shoring, vertical and lateral movements may be in the order of 0.1% to 0.3% of the retained thickness of stiff clay and medium dense sand soils. If this aspect is critical, further appraisal by Coffey (possibly including numerical analysis) should be carried out to assess likely ground movements when designing the shoring system.

Where it is important to limit adjacent ground movements due to the presence of nearby sensitive structures or services, the use of relatively stiff shoring with bracing and/or tie-back anchors designed to resist pressures higher than active earth pressures may be required. We suggest that such cases be specifically addressed by Coffey during detailed design when details of adjacent footings and loadings are known.

A permanent groundwater table is unlikely to be encountered for single level basements; however, seepage from the soil and rock profile is likely to occur. Further groundwater assessment will be required where two or more basement levels are proposed. Furthermore, the potential for ground saturation due to leaking or broken services should be considered. Retaining walls should be designed for applicable surcharge loads and should be designed to resist hydrostatic pressures unless permanent drainage is provided.

Retaining wall analyses will need to consider surcharges, footing loads from adjacent structures, and hydrostatic pressure. If drained walls are to be used then adequate drainage will need to be provided behind the walls, and a permanent water collection system will be required together with flushing points for drainage system periodic maintenance. Nevertheless an allowance of potential water pressure build-up equivalent to one-third the wall height is considered to be prudent with such drainage measures installed.

## 4.5. Anchors

Anchor designs should be based on allowing an effective anchorage to be developed by locating the bond length behind an 'active zone', determined by drawing a line at 45° from the base of the wall to intersect the ground surface behind the excavated face. A working bond stress of 75 kPa can be

adopted for anchors to assist preliminary design with the provision that bond lengths are between 3 m to 7 m and anchors are to be proof loaded to at least 1.4 times their working design load.

## **4.6. Potential effect on adjacent structures**

The location, footing type, layout and founding depth for adjacent structures or services should be determined before excavation commences. Where adjacent structures are located within the zone of influence of the excavation (nominally a line extending at a slope of 1H:1V up from the base of the proposed excavation), the foundation stratum may experience horizontal and vertical movements from excavation induced ground movements due to retention deformation and this should be adequately assessed as part of excavation retention design.

Additionally the potential effects of noise and vibration on adjacent structures or services resulting from excavation equipment and methods, particularly if hard rock excavation is required, will need to be carefully considered by the contractor as part of the construction management plan.

We recommend that prior to the commencement of the bulk excavation works, dilapidation surveys of the adjacent structures are carried out as a baseline for excavation monitoring and management works.

## **4.7. Earthworks**

### **4.7.1. Fill**

The investigation did not indicate the presence of fill at the test locations. However, should fill be observed in other areas of the site with no records confirming that the fill has been compacted in accordance with an engineering specification, such material should be classified as uncontrolled and should not be used as a foundation for structures or pavements due to the potential for differential settlement.

Where existing fill is to be stripped prior to placement of Engineered Fill (if present), the exposed natural soils should be subject to a proof-roll with an appropriate roller, any excessively soft or wet zones should be treated as advised by the project geotechnical consultant.

Where fill is to support building loads or pavements it should be compacted to a minimum of 98% Standard Density at moisture content within 2% of Standard Optimum Moisture Content. Fill should be compacted in layer thicknesses appropriate to the type of compaction plant, but not exceeding 250mm compacted layer thickness.

### **4.7.2. Re-use of site won materials**

Old topsoil or highly silty soils are not suitable for re-use as Engineered Fill. We recommended these materials be stripped and stockpile for future use in landscaping activities or disposed of offsite if not required.

From a geotechnical viewpoint, with the exception of the above, all remaining site soils and weathered bedrock should generally be suitable for use as Engineered Fill, provided unsuitable materials such as organics, waste or oversized particles are removed.

The project geotechnical consultant should verify the suitability of excavated material for re-use as Engineered Fill during construction.

### 4.7.3. Trafficability of soils

Exposed soil subgrades are expected to behave poorly if exposed to heavy construction traffic, particularly when wet. A platform of granular material such as road base or crushed concrete may be needed to support construction plant. Where heavy plant such as piling rigs, or mobile cranes are to traffic the site, specific analysis of working platform requirements may be required to assess working platform thickness.

To help reduce, but not eliminate, trafficability issues associated with wet weather, exposed subgrades should be graded such that they promote surface drainage and prevent ponding.

## 4.8. Building and retaining wall foundations

Bulk excavation for a two storey basement is expected to expose a subgrade comprising variably weathered dacite bedrock. Depending upon final column loads; building foundations may comprise of pad or strip footings, founded at bulk excavation level in Unit 4 bedrock. However, where higher loads are proposed or where the retention system is to be formed as part of the permanent structure, perimeter building loads may be carried on suitably designed perimeter piles that are part of the basement retaining wall.

If basements are not excavated then footings may be founded in the Unit 2 and Unit 3 materials.

To reduce the potential for differential settlement between building footings, we recommend that all footings be founded within the same geotechnical unit.

For strip and pad footings the parameters in Table 5 may be adopted if allowable bearing pressures are preferred.

Table 6 - Preliminary Allowable Bearing Pressures for Strip and Pad Footings

Unit	Material/Origin	Allowable Bearing Pressure (kPa)	Young Modulus (MPa)
2 and 3	Slope Wash and Residual Soils	125	20
4	Weathered Dacite Bedrock	600	40

Settlements of strip and pad footings designed using the allowable values in Table 6 are anticipated to be less than 1% of the footing dimension.

For the design of piled footings to comply with AS2159-2009 a limit state design method should be adopted. Recommended preliminary design parameters for piles are presented below for Unit 4 weathered dacite bedrock:

- Ultimate End Bearing                      2,500 kPa
- Ultimate Shaft Adhesion                    80 kPa
- Young's Modulus                              60 MPa

The above end bearing values for pad / strip and or piled foundations assume a minimum embedment of at least 0.5m into the relevant bearing stratum and the shaft adhesion value assumes a minimum embedment of at least 2 pile diameters into the relevant bearing stratum.

For uplift loads the shaft adhesion value presented above should be multiplied by a factor of 0.7, in addition to the geotechnical strength reduction factor.

For limit state design a geotechnical reduction factor ( $\phi_g$ ) is to be applied to the ultimate geotechnical pile capacity assessed using the ultimate shaft resistance and end bearing values shown above to derive the design ultimate geotechnical pile capacity.

In accordance with AS2159-2009,  $\phi_g$  is dependent on assignment of an Average Risk Rating (ARR) which takes into account various geotechnical uncertainties, redundancy of the foundation system, construction supervision, and the quantity and type of pile testing. The assessment of  $\phi_g$  therefore depends on the structural design of the foundation system as well as the design and construction method, and testing (if any) to be employed by the designer and piling contractor.

For preliminary design, and in the absence of details of the proposed pile design and verification, we recommend that a  $\phi_g$  value of 0.4 be adopted. However, with an appropriate assessment of a risk rating, design based on good geotechnical data and with allowance for verification during construction it should be possible to adopt a higher  $\phi_g$  value that leads to a more economical design. The final selection of  $\phi_g$  should be reviewed by Coffey at the detailed design stage.

The use of limit state design also requires that serviceability performance of the foundation system be assessed, including pile group interaction effects. Such assessment should be carried out by an experienced geotechnical professional using well-established and soundly based methods. The modulus values given above may be adopted for such assessment, but it should be recognised that the accuracy of settlement prediction is a function of construction methodology as well as the assessed values of material stiffness, both of which can involve considerable uncertainty. Therefore, the accuracy of settlement predictions may be no better than  $\pm 50\%$ . Where foundation settlement is critical to the performance of the structure, serviceability pile load testing should be carried out to confirm the design assumptions and/or assess prediction accuracy.

The recommended design parameters assume that the bearing surfaces are clean and free from spoil and other soft and loose material and free of water at the time of placement of concrete. On excavation, should the ground conditions differ from those outlined above then further advice should be sought from Coffey. The above values for shaft adhesion assume that the walls of the shaft are suitably roughened and cleaned of smear.

It is expected that lesser weathered bedrock with a higher bearing capacity will be available at depth. Where loads are in excess of the values presented or where a higher bearing capacity will enable more cost effective design of foundations, we recommend a subsequent stage of investigation to include cored boreholes which extend to a depth at least 3m below bulk excavation level (or deeper depending on bedrock quality) to allow provision of such advice.

## 4.9. Pavement design CBR

The laboratory testing indicated a CBR value of 5 to 15 for Unit 2 Slope wash soils and 2.5 to 3.5 for Unit 3 Residual Soils when compacted to 95% Maximum Dry Density (MDD).

Given that only two out of the eight test pits encountered Unit 2 slope wash soils at the site and the variability in the results observed, we recommend that an initial value of 2.5% be used for pavement design. This value corresponds to Unit 3 Residual soils which are expected to occur over the majority of the site footprint. Once the proposed subgrade levels and development details have been resolved, further advice should be sought.

## 4.10. Site classification to AS2870-2011

It is expected that the main developments will be founded at bulk excavation level, and as such this site classification will not be relevant, however for structures similar in scale and loading to residential structures footing systems may be designed in accordance with AS2870-2011 "Residential Slabs and Footing". In accordance with the brief Coffey has carried out an assessment of the site classification in accordance with AS2870.

With reference to the Shrink Swell Index ( $I_{ss}$ ) test results for the Unit 3 Residual Soil, a value of 2.5% was reported. Based on this result and other factors considered, the residual clay could experience characteristic surface movements of up to 40 mm. Therefore, footings for structures at current ground level can be designed for Class M reactive soils in accordance with AS2870-2011.

## 4.11. Seismic design parameters

Based on AS1170.4-2007 the following parameters should be adopted for seismic design:

- Seismic Hazard Factor (Z)      0.08
- Sub-Soil Class                       $B_e$

## 5. Further geotechnical investigations

As there are no specific details of the redevelopment of the site are available at the time of writing, this report and recommendations provided are general in nature to facilitate progression of the project design and assessment.

The information contained within this report is considered preliminary and it is advised that prior to future development of the site, a comprehensive investigation is undertaken to further assess the subsurface conditions and confirm or otherwise our preliminary findings based on the limited number of boreholes completed to date.

We recommend such further investigations include provision for diamond coring to prove the depth and nature of the bedrock to inform excavation contractors and facilitate potentially more economical foundation design. Installation of a piezometer at the site should be considered to assess groundwater conditions and the potential for seasonal variation following periods of heavy rainfall.

## 6. Limitations

Subsurface conditions can be complex, vary over relatively short distances and over time. The inferred geotechnical model and recommendations in this report are preliminary in nature and based on limited subsurface investigations at two discrete locations. The engineering logs describe subsurface conditions only at the investigation locations.

Additional investigations will be required to confirm consistency or otherwise of subsurface conditions and support detailed design. A geotechnical engineer should be engaged to assist with detailed design and/or to review designs. During construction a geotechnical engineer should verify that conditions exposed are consistent with design assumptions.

The attached document entitled "Important Information about Your Coffey Report" forms an integral part of this report and presents additional information about the uses and limitations of the report.



## Important information about your **Coffey Report**

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

### **Your report is based on project specific criteria**

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Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

### **Subsurface conditions can change**

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Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

### **Interpretation of factual data**

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Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify

variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

### **Your report will only give preliminary recommendations**

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Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

### **Your report is prepared for specific purposes and persons**

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To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.



## Important information about your **Coffey Report**

### **Interpretation by other design professionals**

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Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

### **Data should not be separated from the report\***

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The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

### **Geoenvironmental concerns are not at issue**

---

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

### **Responsibility**

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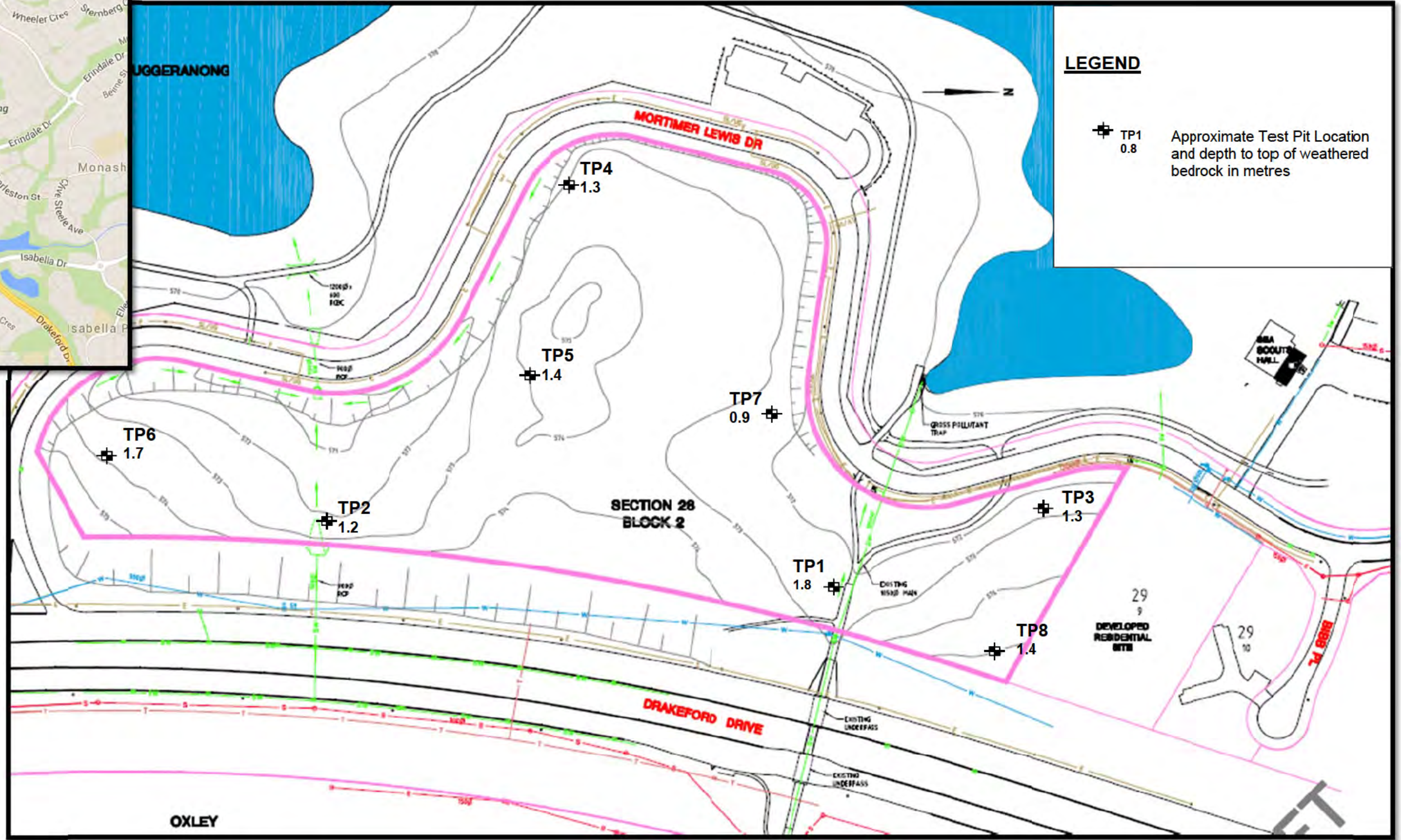
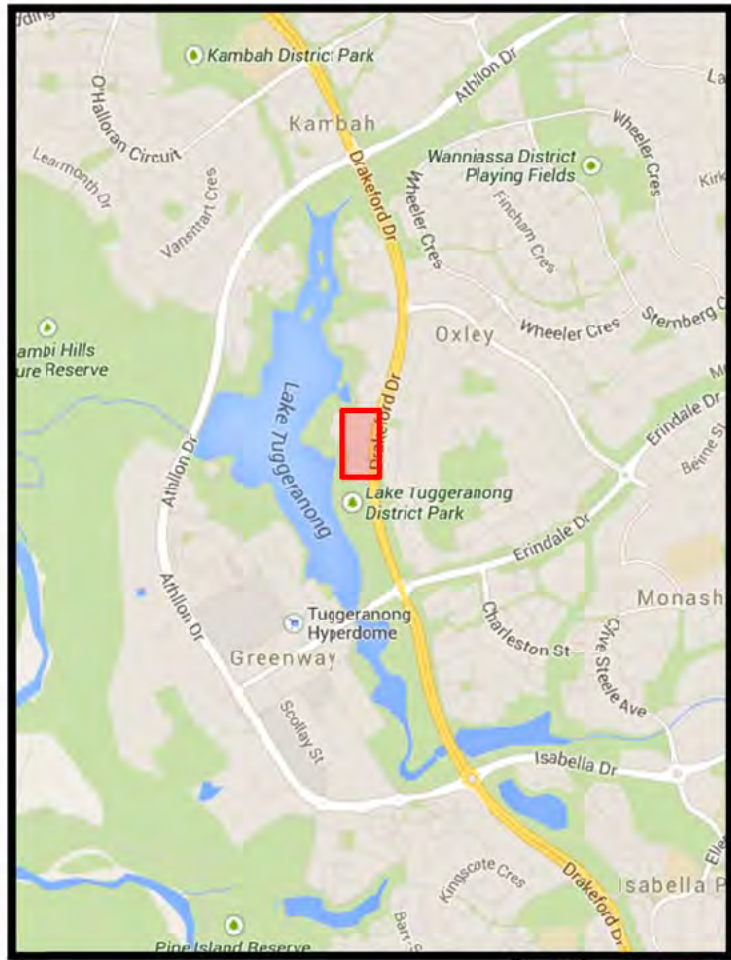
Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

\* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

### **Rely on Coffey for additional assistance**

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## Figures



**LEGEND**

TP1 0.8  
 Approximate Test Pit Location and depth to top of weathered bedrock in metres

revision	description	drawn	approved	date



drawn	
approved	
date	13/02/15
scale	1:1500 (A3 Approx)
original size	A3



client:	Land Development Agency
project:	Preliminary Geotechnical Investigation
title:	Investigation Location Plan
project no:	ENAUBRAD01326AA
figure no:	FIGURE 1

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**Appendix A - Engineering Test Pit Logs and  
Explanation Sheets**

## Soil Description Explanation Sheet (1 of 2)

### DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

### CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

### PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 $\mu$ m to 2.36 mm
	medium	200 $\mu$ m to 600 $\mu$ m
	fine	75 $\mu$ m to 200 $\mu$ m

### MOISTURE CONDITION

**Dry** Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

**Moist** Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

**Wet** As for moist but with free water forming on hands when handled.

### CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH $S_u$ (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	-	Crumbles or powders when scraped by thumbnail.

### DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

### MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

### SOIL STRUCTURE

ZONING	CEMENTING
Layers Continuous across exposure or sample.	Weakly cemented Easily broken up by hand in air or water.
Lenses Discontinuous layers of lenticular shape.	Moderately cemented Effort is required to break up the soil by hand in air or water.
Pockets Irregular inclusions of different material.	

### GEOLOGICAL ORIGIN

#### WEATHERED IN PLACE SOILS

Extremely weathered material Structure and fabric of parent rock visible.

Residual soil Structure and fabric of parent rock not visible.

#### TRANSPORTED SOILS

Aeolian soil Deposited by wind.

Alluvial soil Deposited by streams and rivers.

Colluvial soil Deposited on slopes (transported downslope by gravity).

Fill Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.

Lacustrine soil Deposited by lakes.

Marine soil Deposited in ocean basins, bays, beaches and estuaries.

## Soil Description Explanation Sheet (2 of 2)

### SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60 mm and basing fractions on estimated mass)				USC	PRIMARY NAME		
COARSE GRAINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	More than half of coarse fraction is larger than 2.36 mm (A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	GRAVEL	
			GRAVELS WITH FINES (Appreciable amount of fines)	Predominantly one size or a range of sizes with more intermediate sizes missing.	GP	GRAVEL	
		SANDS	More than half of coarse fraction is smaller than 2.36 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes	SW	SAND
				SANDS WITH FINES (Appreciable amount of fines)	Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	SAND
		SANDS WITH FINES (Appreciable amount of fines)	More than half of coarse fraction is smaller than 2.36 mm	Non-plastic fines (for identification procedures see ML below)	GM	SILTY GRAVEL	
				Plastic fines (for identification procedures see CL below)	GC	CLAYEY GRAVEL	
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm (A 0.075 mm particle is about the smallest particle visible to the naked eye)	SILTS & CLAYS Liquid limit less than 50	IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.					
		DRY STRENGTH	DILATANCY	TOUGHNESS			
		None to Low	Quick to slow	None	ML	SILT	
		Medium to High	None	Medium	CL	CLAY	
		Low to medium	Slow to very slow	Low	OL	ORGANIC SILT	
		Low to medium	Slow to very slow	Low to medium	MH	SILT	
		High	None	High	CH	CLAY	
		Medium to High	None	Low to medium	OH	ORGANIC CLAY	
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture.			Pt	PEAT		

• Low plasticity – Liquid Limit  $w_L$  less than 35%. • Medium plasticity –  $w_L$  between 35% and 50%. • High plasticity –  $w_L$  greater than 50%.

### COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM	TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.		SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.		TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.		TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.		INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

## Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.

**DEFINITIONS:** Rock substance, defect and mass are defined as follows:

**Rock Substance** In engineering terms rock substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic.

**Defect** Discontinuity or break in the continuity of a substance or substances.

**Mass** Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

### SUBSTANCE DESCRIPTIVE TERMS:

**ROCK NAME** Simple rock names are used rather than precise geological classification.

**PARTICLE SIZE** Grain size terms for sandstone are:  
 Coarse grained Mainly 0.6mm to 2mm  
 Medium grained Mainly 0.2mm to 0.6mm  
 Fine grained Mainly 0.06mm (just visible) to 0.2mm

**FABRIC** Terms for layering of penetrative fabric (eg. bedding, cleavage etc. ) are:

Massive No layering or penetrative fabric.

Indistinct Layering or fabric just visible. Little effect on properties.

Distinct Layering or fabric is easily visible. Rock breaks more easily parallel to layering of fabric.

### ROCK SUBSTANCE STRENGTH TERMS

Term	Abbreviation	Point Load Index, $I_s(50)$ (MPa)	Field Guide
Very Low	VL	Less than 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30mm thick can be broken by finger pressure.
Low	L	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	0.3 to 1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	H	1 to 3	A piece of core 150mm long by 50mm can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	VH	3 to 10	Hand specimen breaks after more than one blow of a pick; rock rings under hammer.
Extremely High	EH	More than 10	Specimen requires many blows with geological pick to break; rock rings under hammer.

### CLASSIFICATION OF WEATHERING PRODUCTS

Term	Abbreviation	Definition
Residual Soil	RS	Soil derived from the weathering of rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely Weathered Material	XW	Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded in water. Original rock fabric still visible.
Highly Weathered Rock	HW	Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by leaching or may be decreased due to the deposition of minerals in pores.
Moderately Weathered Rock	MW	The whole of the rock substance is discoloured, usually by iron staining or bleaching, to the extent that the colour of the fresh rock is no longer recognisable.
Slightly Weathered Rock	SW	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance (usually by limonite) has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Fresh Rock	FR	Rock substance unaffected by weathering.

#### Notes on Weathering:

- AS1726 suggests the term "Distinctly Weathered" (DW) to cover the range of substance weathering conditions between XW and SW. For projects where it is not practical to delineate between HW and MW or it is judged that there is no advantage in making such a distinction, DW may be used with the definition given in AS1726.
- Where physical and chemical changes were caused by hot gasses and liquids associated with igneous rocks, the term "altered" may be substituted for "weathering" to give the abbreviations XA, HA, MA, SA and DA.

#### Notes on Rock Substance Strength:

- In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may break readily parallel to the planar anisotropy.
- The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms.
- The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index  $I_s(50)$ . The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.

## Rock Description Explanation Sheet (2 of 2)

COMMON DEFECTS IN ROCK MASSES		Diagram	Map Symbol	Graphic Log (Note 1)	DEFECT SHAPE	TERMS
Term	Definition					
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub parallel to layering (eg bedding) or a planar anisotropy in the rock substance (eg, cleavage). May be open or closed.		20 Bedding 20 Cleavage		Planar	The defect does not vary in orientation
					Curved	The defect has a gradual change in orientation
					Undulating	The defect has a wavy surface
Joint	A surface or crack across which the rock has little or no tensile strength, but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.		60		Stepped	The defect has one or more well defined steps
					Irregular	The defect has many sharp changes of orientation
<b>Note:</b> The assessment of defect shape is partly influenced by the scale of the observation.						
<b>ROUGHNESS TERMS</b>						
Sheared Zone (Note 3)	Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.		35		Slickensided	Grooved or striated surface, usually polished
					Polished	Shiny smooth surface
					Smooth	Smooth to touch. Few or no surface irregularities
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.		40		Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
					Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.
<b>COATING TERMS</b>						
Crushed Seam (Note 3)	Seam with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties.		50		Clean	No visible coating
					Stained	No visible coating but surfaces are discoloured
					Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface.		65		Coating	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein.
Extremely Weathered Seam	Seam of soil substance, often with gradational boundaries. Formad by weathering of the rock substance in place.		32		Blocky	Approximately equidimensional
					Tabular	Thickness much less than length or width
					Columnar	Height much greater than cross section
<b>Notes on Defects:</b>						
1. Usually borehole logs show the true dip of defects and face sketches and sections the apparent dip.						
2. Partings and joints are not usually shown on the graphic log unless considered significant.						
3. Sheared zones, sheared surfaces and crushed seams are faults in geological terms.						

# Engineering Log - Excavation

client: **Land Development Agency**

principal:

project: **Geotechnical and Environmental Investigation**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID: **TP01**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

logged by:

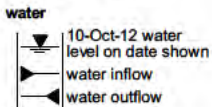
checked by:

position: E: 688211; N: 6079770 (WGS84 Zone 55) surface elevation: Not Specified pit orientation:  
 equipment type: JCB-3XC Backhoe excavation method: Backhoe Bucket excavation dimensions: 1.8 m long 0.4 m wide


excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
		1 2 3							SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components			100 200 300 400	
N									<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine grained sub-angular gravel and fine rootlets.	D			<b>TOPSOIL</b>
				E				MH	<b>Clayey SILT:</b> low liquid limit, pale grey, mottled pale brown, trace fine to medium grained sub-angular gravel and fine rootlets.	<Wp	H - Fb		<b>SLOPEWASH</b>
				B		0.5							
				E		1.0							
						1.5							
						2.0			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale brown, extremely weathered, very low to low strength.				<b>BEDROCK</b>
						2.5							
						3.0							
						3.5							
									Test pit TP01 terminated at 3.6 m Bucket Refusal				

CDF\_0.9\_046B.GLB Log\_COF EXCAVATION EB01326AA DATABASE.GPJ <<DrawingFile>> 13/02/2015 12:00

<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  no resistance ranging to refusal	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane sheareak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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drawn	<input type="checkbox"/>		client:	<b>Land Development Agency</b>		
approved	<input type="checkbox"/>		principal:			
date	13/02/2015		project:	<b>Block 2 Section 28, Greenway ACT</b>		
scale	-		title:	TP01 - Photograph		
original size	A4		project no:	<b>ENAUBRAD01326AA-AC</b>	figure no:	<b>Photo 1</b>

# Engineering Log - Excavation

client: **Land Development Agency**  
 principal:  
 project: **Geotechnical and Environmental Investigation**  
 location: **Block 2 Section 28, Greenway, ACT**

Excavation ID: **TP02**  
 sheet: 1 of 1  
 project no: **ENAUBRAD01326AA**  
 date excavated: **04 Feb 2015**  
 date completed: **04 Feb 2015**  
 logged by:  
 checked by:


position: E: 688171; N: 6079574 (WGS84 Zone 55) surface elevation: Not Specified pit orientation:  
 equipment type: JCB-3XC Backhoe excavation method: Backhoe Bucket excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance							
method support	penetration	water	samples & field tests	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N			E	0.0 - 0.5			<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine grained sub-angular gravel, trace fine rootlets.	M			<b>TOPSOIL</b>
			E	0.5 - 1.0		CH	<b>Silty CLAY:</b> medium to high plasticity, pale grey, mottled orange-brown, trace fine rootlets.	=Wp	St		<b>RESIDUAL SOIL</b>
			E	1.0 - 1.5			<b>DACITE:</b> coarse grained, pale brown-pale grey, extremely weathered, very low to low strength.				<b>BEDROCK</b>
			E	1.5 - 3.2							
				3.2 - 3.5			Test pit TP02 terminated at 3.2 m Bucket Refusal				

CDF: 0.9\_04BB.GLB Log\_COF EXCAVATION\_EB01326AA\_DATABASE.GPJ <<DrawingFile>> 13/02/2015 12:01

<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator  <b>support</b> N none S shoring	<b>penetration</b>  no resistance ranging to refusal  <b>water</b>  10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane sheapeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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drawn	■		client:	<b>Land Development Agency</b>		
approved	■		principal:			
date	13/02/2015		project:	<b>Block 2 Section 28, Greenway ACT</b>		
scale	-		title:	TP02 - Photograph		
original size	A4		project no:	<b>ENAUBRAD01326AA-AC</b>	figure no:	<b>Photo 1</b>

# Engineering Log - Excavation

client: **Land Development Agency**

principal:

project: **Geotechnical and Environmental Investigation**

location: **Block 2 Section 28, Greenway, ACT**

Excavation ID: **TP03**

sheet: 1 of 1

project no. **ENAUBRAD01326AA**

date excavated: **04 Feb 2015**

date completed: **04 Feb 2015**

logged by:


checked by:

position: E: 688189; N: 6079860 (WGS84 Zone 55) surface elevation: Not Specified pit orientation:  
 equipment type: JCB-3XC Backhoe excavation method: Backhoe Bucket excavation dimensions: 1.8 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N									<b>TOPSOIL: Sandy SILT:</b> low liquid limit, dark brown, fine to medium grained sand, trace fine to medium grained sub-angular gravel and fine rootlets.	D			<b>TOPSOIL</b>
						0.5		CL	<b>Silty CLAY:</b> low to medium plasticity, red-brown mottled pale brown, trace fine grained rootlets.	<Wp	H		<b>RESIDUAL SOIL</b>
						1.0							
						1.5			<b>DACITE:</b> coarse grained, pale grey/ orange-white/pale brown, extremely weathered, low strength.				<b>BEDROCK</b>
						2.0							
						2.5			Test pit TP03 terminated at 2.3 m Bucket Refusal				
						3.0							
						3.5							

<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane sheapeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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drawn	■		client:	<b>Land Development Agency</b>	
approved	■		principal:		
date	13/02/2015		project:	<b>Block 2 Section 28, Greenway ACT</b>	
scale	-		title:	TP03 - Photograph	
original size	A4		project no:	<b>ENAUBRAD01326AA-AC</b>	figure no:

# Engineering Log - Excavation

client: **Land Development Agency**  
 principal:  
 project: **Geotechnical and Environmental Investigation**  
 location: **Block 2 Section 28, Greenway, ACT**

Excavation ID: **TP04**  
 sheet: 1 of 1  
 project no: **ENAUBRAD01326AA**  
 date excavated: **04 Feb 2015**  
 date completed: **04 Feb 2015**  
 logged by:  
 checked by:


position: E: 688067; N: 6079680 (WGS84 Zone 55) surface elevation: Not Specified pit orientation:  
 equipment type: JCB-3XC Backhoe excavation method: Backhoe Bucket excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
		1 2 3							SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components			100 200 300 400	
N				E		0.0			<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine grained sub-angular gravel and fine rootlets.	D			<b>TOPSOIL</b>
				D		0.2		CL	<b>Silty CLAY:</b> low plasticity, red-brown mottled pale-brown and yellow-brown, trace fine rootlets.	<Wp	H		<b>RESIDUAL SOIL</b>
				E		0.4							
				B + D		0.8		CH	<b>Silty CLAY:</b> high plasticity, brown.				
						1.0							
						1.5			<b>DACITE:</b> coarse grained, pale grey/ orange-white/pale brown, extremely weathered, low strength.				<b>BEDROCK</b>
						2.0							
						2.3			Test pit TP04 terminated at 2.3 m Bucket Refusal				
						2.5							
						3.0							
						3.5							

CDF\_0\_9\_04BB.GLB Log\_COF EXCAVATION EB01326AA\_DATABASE.GPJ <<DrawingFile>> 13/02/2015 12:01

<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample #mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane sheapeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
---	--	---	--	--



drawn	<input type="checkbox"/>		client:	<b>Land Development Agency</b>		
approved	<input type="checkbox"/>		principal:			
date	13/02/2015		project:	<b>Block 2 Section 28, Greenway ACT</b>		
scale	-		title:	TP04 - Photograph		
original size	A4		project no:	<b>ENAUBRAD01326AA-AC</b>	figure no:	<b>Photo 1</b>

# Engineering Log - Excavation

client: **Land Development Agency**  
 principal:  
 project: **Geotechnical and Environmental Investigation**  
 location: **Block 2 Section 28, Greenway, ACT**

Excavation ID: **TP05**  
 sheet: 1 of 1  
 project no: **ENAUBRAD01326AA**  
 date excavated: **04 Feb 2015**  
 date completed: **04 Feb 2015**  
 logged by:  
 checked by:


position: E: 688126; N: 6079640 (WGS84 Zone 55) surface elevation: Not Specified pit orientation:  
 equipment type: JCB-3XC Backhoe excavation method: Backhoe Bucket excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N				E		0.0			<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine sub-angular gravel and fine roots.	D			<b>TOPSOIL</b>
				D		0.2		MH	<b>Clayey SILT:</b> low liquid limit, pale grey, mottled pale brown, trace medium to coarse grained sand and fine rootlets.	<Wp	H		<b>SLOPEWASH</b>
				E		0.4							
				D		0.6							
				E		0.8							
				D		1.0		CH	<b>Silty CLAY:</b> high plasticity, red-brown.				<b>RESIDUAL SOIL</b>
						1.2							
						1.4			<b>DACITE:</b> coarse grained, pale grey/ orange-white/pale brown, extremely weathered, low strength.				<b>BEDROCK</b>
						1.6							
						1.8							
						2.0							
						2.2							
						2.3			Test pit TP05 terminated at 2.3 m Bucket Refusal				
						2.5							
						3.0							
						3.5							

CDF: 0.9\_04BB.GLB Log\_COF EXCAVATION\_EB01326AA\_DATABASE.GPJ <<DrawingFile>> 13/02/2015 12:01

<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown 	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane sheapeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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drawn	■		client:	<b>Land Development Agency</b>		
approved	■		principal:			
date	13/02/2015		project:	<b>Block 2 Section 28, Greenway ACT</b>		
scale	-		title:	TP05 - Photograph		
original size	A4		project no:	<b>ENAUBRAD01326AA-AC</b>	figure no:	<b>Photo 1</b>

# Engineering Log - Excavation

client: **Land Development Agency**  
 principal:  
 project: **Geotechnical and Environmental Investigation**  
 location: **Block 2 Section 28, Greenway, ACT**

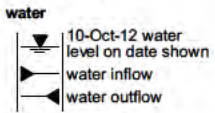
Excavation ID: **TP06**  
 sheet: 1 of 1  
 project no: **ENAUBRAD01326AA**  
 date excavated: **04 Feb 2015**  
 date completed: **04 Feb 2015**  
 logged by:  
 checked by:

position: E: 688141; N: 6079496 (WGS84 Zone 55) surface elevation: Not Specified pit orientation:  
 equipment type: JCB-3XC Backhoe excavation method: Backhoe Bucket excavation dimensions: 2.0 m long 0.4 m wide


excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
N		1		E		0.0			<b>TOPSOIL:</b> Sandy SILT: low liquid limit, pale brown/dark brown, fine to medium grained sand, trace fine to medium sub-angular gravel and fine roots.	M			<b>TOPSOIL</b>
		2		D		0.1		ML	<b>Clayey SILT:</b> low liquid limit, pale brown, mottled pale grey, trace fine roots.	<Wp	H		<b>SLOPEWASH</b>
		3		B		0.2							
				E		0.5							
						1.0							
				D		1.5		CH	<b>Silty CLAY:</b> high plasticity, pale brown.				<b>RESIDUAL SOIL</b>
						2.0			<b>DACITE:</b> coarse grained, pale brown/pale grey, extremely weathered, very low to low strength.				<b>BEDROCK</b>
						2.5							
						3.0							
						3.1			Test pit TP06 terminated at 3.1 m Bucket Refusal				
						3.5							

CDF: 0.9\_046B.GLB Log\_COF EXCAVATION EB01326AA DATABASE.GPJ <<DrawingFile>> 13/02/2015 12:01

<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  no resistance ranging to refusal	<b>samples &amp; field tests</b> U## undisturbed sample #mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane sheapeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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drawn	■		client:	<b>Land Development Agency</b>		
approved	■		principal:			
date	13/02/2015		project:	<b>Block 2 Section 28, Greenway ACT</b>		
scale	-		title:	TP06 - Photograph		
original size	A4		project no:	<b>ENAUBRAD01326AA-AC</b>	figure no:	<b>Photo 1</b>

# Engineering Log - Excavation

client: **Land Development Agency**  
 principal:  
 project: **Geotechnical and Environmental Investigation**  
 location: **Block 2 Section 28, Greenway, ACT**

Excavation ID: **TP07**  
 sheet: 1 of 1  
 project no: **ENAUBRAD01326AA**  
 date excavated: **04 Feb 2015**  
 date completed: **04 Feb 2015**  
 logged by:  
 checked by:


position: E: 688113; N: 6079761 (WGS84 Zone 55) surface elevation: Not Specified pit orientation:  
 equipment type: JCB-3XC Backhoe excavation method: Backhoe Bucket excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
		1 2 3							<b>SOIL TYPE:</b> plasticity or particle characteristic, colour, secondary and minor components			100 200 300 400	
				E					<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine rootlets.	D			<b>TOPSOIL</b>
				D		0.5		CL	<b>Silty Sandy CLAY:</b> low plasticity, red-brown, fine grained sand, trace fine rootlets.	<Wp	H		<b>RESIDUAL SOIL</b>
				E		1.0			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale-brown, extremely weathered, low strength.				<b>BEDROCK</b>
						1.5							
						2.0			Test pit TP07 terminated at 1.8 m Bucket Refusal				
						2.5							
						3.0							
						3.5							

CDF\_0\_9\_048B.GLB Log COF EXCAVATION EB01326AA DATABASE.GPJ <<DrawingFile>> 13/02/2015 12:01

<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  <b>water</b> 10-Oct-12 water level on date shown 	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane sheapeak/remounded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System  <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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drawn	■		client:	<b>Land Development Agency</b>		
approved	■		principal:			
date	13/02/2015		project:	<b>Block 2 Section 28, Greenway ACT</b>		
scale	-		title:	TP07 - Photograph		
original size	A4		project no:	<b>ENAUBRAD01326AA-AC</b>	figure no:	<b>Photo 1</b>

# Engineering Log - Excavation

client: **Land Development Agency**  
 principal:  
 project: **Geotechnical and Environmental Investigation**  
 location: **Block 2 Section 28, Greenway, ACT**

Excavation ID: **TP08**  
 sheet: 1 of 1  
 project no. **ENAUBRAD01326AA**  
 date excavated: **04 Feb 2015**  
 date completed: **04 Feb 2015**  
 logged by:  
 checked by:


position: E: 688236; N: 6079831 (WGS84 Zone 55) surface elevation: Not Specified pit orientation:  
 equipment type: JCB-3XC Backhoe excavation method: Backhoe Bucket excavation dimensions: 2.0 m long 0.4 m wide

excavation information				material substance									
method	support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
		1 2 3							<b>SOIL TYPE:</b> plasticity or particle characteristic, colour, secondary and minor components			100 200 300 400	
N				E					<b>TOPSOIL: Sandy SILT:</b> low liquid limit, pale brown, fine to medium grained sand, trace fine grained sub-angular gravel and rootlets.	D			<b>TOPSOIL/SLOPEWASH</b>
			Not Observed	E		0.5		CL	<b>Silty CLAY:</b> low to medium plasticity, red-brown, mottled pale brown, trace fine rootlets.	<Wp	H		<b>RESIDUAL SOIL</b>
				E		1.0							
						1.5			<b>DACITE:</b> coarse grained, pale grey/orange-white/pale-brown, extremely weathered, low strength.				<b>BEDROCK</b>
						2.0							
						2.5			Test pit TP08 terminated at 2.4 m Bucket Refusal				
						3.0							
						3.5							

CDF: 0.9\_04BB.GLB Log\_COF EXCAVATION\_EB01326AA\_DATABASE.GPJ <<DrawingFile>> 13/02/2015 12:01

<b>method</b> N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator	<b>penetration</b>  no resistance ranging to refusal <b>water</b> 10-Oct-12 water level on date shown water inflow water outflow	<b>samples &amp; field tests</b> U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane sheapeak/remoulded (uncorrected kPa) R refusal	<b>classification symbol &amp; soil description</b> based on Unified Classification System <b>moisture</b> D dry M moist W wet W <sub>p</sub> plastic limit W <sub>L</sub> liquid limit	<b>consistency / relative density</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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drawn	■		client:	<b>Land Development Agency</b>		
approved	■		principal:			
date	13/02/2015		project:	<b>Block 2 Section 28, Greenway ACT</b>		
scale	-		title:	TP08 - Photograph		
original size	A4		project no:	<b>ENAUBRAD01326AA-AC</b>	figure no:	<b>Photo 1</b>

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## **Appendix B - Laboratory Test Certificates**

# Material Test Report

Client:	Coffey Environments Pty Ltd 16 Mildura Street Fishwick ACT 2609
Principal:	Land Development Agency
Project No.:	INFOFYSH00632AA
Project Name:	ENAUBRAD01326AA - LDA Sec 28 Block 2 Greenway
Lot No.:	TRN:

Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.



Approved Signatory: Rod Wilkins  
 (Senior Geotechnician)  
 NATA Accredited Laboratory Number: 431  
 Date of Issue: 19/02/2015

## Material Details

Source	Test Pit	Sampled From	
Description	Investigation	Location	Greenway, ACT
Specification	No Specification	Sampling Method	Sampled by Coffey Geotechnics

## Sample Details

Sample ID	FYSH15S-00162	FYSH15S-00163	FYSH15S-00164	FYSH15S-00165	FYSH15S-00166
Field Sample ID	00001	00002	00003	00004	00005
Date Sampled	4/02/2015	4/02/2015	4/02/2015	4/02/2015	4/02/2015
Date Submitted:	11/02/2015	11/02/2015	11/02/2015	11/02/2015	11/02/2015
Sample Location:	TP1	TP3	TP4	TP5	TP6
	0.3 - 0.7m	0.3 - 0.6m	0.8 - 1.3m	0.2 - 0.9m	1.1 - 1.3m

## Other Test Results

Description	Method	Results					Limits
Sample History	AS 1289.1.1	Oven-dried	Oven-dried	Oven-dried	Oven-dried	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	4.0	19.0	19.5	6.0	16.5	
Mould Length (mm)		254	254	254	254	254	
Crumbling		No	No	No	No	No	
Curling		No	Yes	Yes	No	Yes	
Cracking		No	No	No	No	No	
Liquid Limit (%)	AS 1289.3.1.1	26	71	81	29	58	
Method		Four Point	Four Point	Four Point	Four Point	Four Point	
Plastic Limit (%)	AS 1289.3.2.1	17	28	23	20	21	
Plasticity Index (%)	AS 1289.3.3.1	9	43	58	9	37	
Modified Maximum Dry Density (t/m <sup>3</sup> )	AS 1289.5.2.1	2.00	1.65	1.69	1.90		
Modified Optimum Moisture Content (%)		9.0	20.5	21.5	11.5		
Oversize Sieve (mm)		19.0	19.0	19.0	19.0		
Oversize Material (%)		0	0	0	0		

## Comments


N/A

# Material Test Report

Client:	Coffey Environments Pty Ltd 16 Mildura Street Fyshwick ACT 2609
Principal:	Land Development Agency
Project No.:	INFOFYSH00632AA
Project Name:	ENAUBRAD01326AA - LDA Sec 28 Block 2 Greenway
Lot No.:	TRN:

Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.



Approved Signatory: Rod Wilkins  
 (Senior Geotechnician)  
 NATA Accredited Laboratory Number: 431  
 Date of Issue: 19/02/2015

## Material Details

Source	Test Pit	Sampled From	
Description	Investigation	Location	Greenway, ACT
Specification	No Specification	Sampling Method	Sampled by Coffey Geotechnics

## Sample Details

Sample ID	FYSH15S-00162	FYSH15S-00163	FYSH15S-00164	FYSH15S-00165	FYSH15S-00166
Field Sample ID	00001	00002	00003	00004	00005
Date Sampled	4/02/2015	4/02/2015	4/02/2015	4/02/2015	4/02/2015
Date Submitted:	11/02/2015	11/02/2015	11/02/2015	11/02/2015	11/02/2015
Sample Location:	TP1	TP3	TP4	TP5	TP6
	0.3 - 0.7m	0.3 - 0.6m	0.8 - 1.3m	0.2 - 0.9m	1.1 - 1.3m

## Other Test Results

Description	Method	Results				Limits
CBR At 2.5mm (%)	AS 1289.6.1.1	15	2.5	3.5		
CBR At 5.0mm (%)					5.0	
Maximum Dry Density (t/m <sup>3</sup> )		2.00	1.65	1.69	1.90	
Optimum Moisture Content (%)		9.0	20.6	21.5	11.7	
Dry Density before Soaking (t/m <sup>3</sup> )		1.91	1.58	1.61	1.81	
Density Ratio before Soaking (%)		95.5	95.5	95.5	95.0	
Moisture Content before Soaking (%)		8.9	20.2	22.1	11.3	
Moisture Ratio before Soaking (%)		99.5	98.0	103.0	96.5	
Dry Density after Soaking (t/m <sup>3</sup> )		1.89	1.48	1.56	1.76	
Density Ratio after Soaking (%)		95	89	92	93	
Swell (%)		1.0	6.5	3.5	2.5	
Moisture Content of Top 30mm (%)		13.3	34.0	29.8	18.6	
Moisture Content of Remaining Depth (%)		13.0	28.0	25.1	16.2	
Compactive Effort		Modified	Modified	Modified	Modified	
Surcharge Mass (kg)		4.50	4.50	4.50	4.50	
Period of Soaking (Days)		4	4	4	4	
Oversize Material (%)		0.0	0.0	0.0	0.0	

## Comments

N/A

# Shrink Swell Index Report

Client:	Coffey Testing Pty Ltd (Fyshwick) 16 Mildura Street Fyshwick ACT 2609
Principal:	LANDDEVELOPMENT AGENCY
Project No.:	INFOARTA01316AA
Project Name:	INTERLAB - ENAUBRAD01326AA - GEO-ENVIRONMENTAL INVESTIGATION
Lot No.:	TRN:

Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.



WORLD RECOGNISED ACCREDITATION

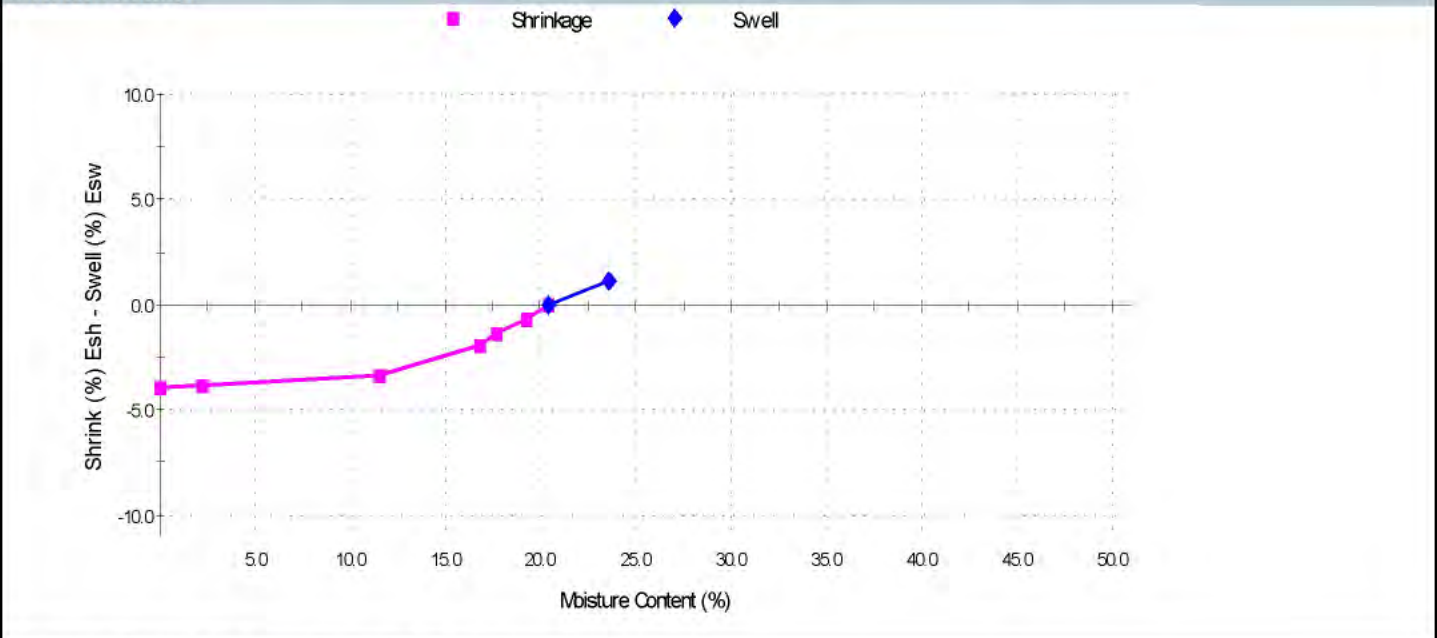
Approved Signatory: Garry Collins  
 (Specialised Testing Manager)  
 NATA Accredited Laboratory Number: 431  
 Date of Issue: 18/02/2015

## Sample Details

Sample ID:	ARTA15S-00094	Sampling Method:	Submitted by client
Date Sampled:	4/02/2015	Material:	Subgrade
Date Submitted:	16/02/2015	Source:	Ex Job Site
Date Tested:	18/02/2015		
Project Location:	Block 2, Section 28, Greenway ACT		
Sample Location:	TP2 (0.40 to 0.65 m)		
Borehole Number:	TP2		
Borehole Depth (m):	0.40 to 0.65		

Swell Test AS 1289.7.1.1		Shrink Test AS 1289.7.1.1	
Swell on Saturation (%):	1.1	Shrink on drying (%):	3.9
Moisture Content before (%):	20.4	Shrinkage Moisture Content (%):	20.4
Moisture Content after (%):	23.6	Est. inert material (%):	<5
Est. Unc. Comp. Strength before (kPa):	>500	Crumbling during shrinkage:	Very Slight
Est. Unc. Comp. Strength after (kPa):	300	Cracking during shrinkage:	Very Slight

## Shrink Swell



Shrink Swell Index - Iss (%): 2.5

Comments

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