ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

DESIGNINC SYDNEY PTY LTD

ON

PRELIMINARY STAGE 2 ENVIRONMENTAL SITE ASSESSMENT

FOR

PROPOSED LINDFIELD LEARNING VILLAGE DEVELOPMENT

AT

ETON ROAD, LINDFIELD

16 OCTOBER 2017 **REF: E30259KMrpt2**

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EXECUTIVE SUMMARY

DesignInc Sydney Pty Ltd commissioned EIS to undertake a Preliminary Stage 2 Environmental Site Assessment (ESA) for the proposed Lindfield Learning Village development at Eton Road, Lindfield. Two areas where external structures are proposed are located in the south of the site as shown on the attached Figure 2. These areas are proposed to include an external covered outdoor learning area (COLA) with toilet facilities located beneath, and a new external stairway. The assessment was confined to the proposed development areas.

Potential contamination sources at the site include fill material that may have been used during construction, the use of pesticides and hazardous building materials.

Soil samples for this investigation were obtained from five sampling points located within the proposed development areas. Subsurface conditions at the sampling points included fill material to depths ranging from 0.2m to 0.35m, underlain by natural silty sand and shallow sandstone bedrock, which was encountered at depths ranging from 0.5m to 1.6m. Soil samples obtained from the fill and natural soils were analysed for a combination of heavy metals, petroleum hydrocarbons, PAHs, pesticides, PCBs and asbestos.

A fibre cement fragment (FCF) containing asbestos was encountered in the fill soils sampled from one of the boreholes. The source of the FCF is not known. It may have been imported onto the site along with the fill material, or may be associated with the construction and/or demolition of site structures. EIS are of the opinion that the asbestos contamination is confined to the fill material at the site. All fill material in the proposed development area is considered to be potentially contaminated with asbestos and should be treated accordingly.

For FCF containing asbestos, the potential exposure pathway for potential human receptors is via the inhalation of airborne asbestos fibres. EIS are of the opinion that the risk posed to human receptors is low to moderate and will require remediation.

EIS consider that the site can be made suitable for the proposed development provided that the following recommendations are implemented to minimise the risks:

1. Prepare a Remediation Action Plan (RAP) to outline remedial measures for the site;

2. Prepare an Asbestos Management Plan to outline safety measures to be undertaken during the remedial works; and

3. Prepare a Validation Assessment report on completion of remediation.

In the event that unexpected conditions are encountered during development work or between sampling locations that may pose a contamination risk, all works should stop and an environmental consultant should be engaged to inspect the site and address the issue.

The conclusions and recommendations should be read in conjunction with the limitations presented in the body of the report.

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ABBREVIATIONS

Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Australian Drinking Water Guidelines	**ADWG**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Asbestos Health Screening Levels	**ASL**
Acid Sulfate Soil	**ASS**
Above-Ground Storage Tank	**AST**
Below Ground Level	**BGL**
Bureau of Meteorology	**BOM**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
Construction Management Plan	**CMP**
Contaminant(s) of Potential Concern	**CoPC**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
Detailed Site Investigation	**DSI**
Ecological Investigation Levels	**EILs**
Ecological Screening Level	**ESL**
Environmental Management Plan	**EMP**
Excavated Natural Material	**ENM**
Environmental Protection Agency	**EPA**
Environmental Site Assessment	**ESA**
Ecological Screening Level	**ESL**
Fibre Cement Fragments	**FCF**
General Approvals of Immobilisation	**GAI**
General Solid Waste	**GSW**
Health Investigation Level	**HILs**
Hardness Modified Trigger Values	**HMTV**
Health Screening Level	**HSLs**
International Organisation of Standardisation	**ISO**
Lab Control Spike	**LCS**
Light Non-Aqueous Phase Liquid	**LNAPL**
Local Government Authority	**LGA**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Organochlorine Pesticides	**OCP**
Organophosphate Pesticides	**OPP**
Polycyclic Aromatic Hydrocarbons	**PAH**
Photo-ionisation Detector	**PID**
Practical Quantitation Limit	**PQL**

ABBREVIATIONS

Preliminary Site Investigation	**PSI**
Quality Assurance	**QA**
Quality Control	**QC**
Remediation Action Plan	**RAP**
Relative Percentage Difference	**RPD**
Restricted Solid Waste	**RSW**
Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
Site Audit Statement	**SAS**
Site Audit Report	**SAR**
Specific Contamination Concentration	**SCC**
Standard Penetration Test	**SPT**
Semi-Volatile Organic Compounds	**sVOC**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Standard Sampling Procedure	**SSP**
Trip Blank	**TB**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**
Trip Spike	**TS**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**
Underground Storage Tank	**UST**
Virgin Excavated Natural Material	**VENM**
Volatile Organic Compounds	**VOC**
Work Health and Safety	**WHS**

1 INTRODUCTION

DesignInc Sydney Pty Ltd ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake a Preliminary Stage 2 Environmental Site Assessment (ESA) for the proposed Lindfield Learning Village development at Eton Road, Lindfield. The site location is shown on Figure 1 and the assessment was confined to the proposed development areas as shown on Figure 2 (the site).

1.1 Proposed Development Details

EIS understand that the proposed development includes refurbishment of the existing facilities of the former UTS Lindfield campus to provide school facilities for students from kindergarten to Year 12, childcare facilities, an Intensive English Centre, Department of Education offices, a centre for education research and a conference and training centre. Demolition of the existing facilities, excavation works or significant construction works are not understood to be part of the proposed development.

Two areas understood to have new external structures proposed are located in the south of the site as shown on Figure 2. These areas are proposed to include an external covered outdoor learning area (COLA) with toilet facilities located beneath, and a new external stairway. The proposed locations of these areas are shown on Figure 2.

1.2 Aim and Objectives

The primary aims of the assessment were to:

- Assess the soil and groundwater contamination conditions in the two areas in which works are proposed that are likely to disturb soil; and
- Provide a preliminary waste classification for off-site disposal of in-situ soil in these areas.

1.3 Scope of Work

The assessment was undertaken generally in accordance with an EIS proposal (Ref: EP45647KM) of 30 August 2017 and written acceptance from the client of 31 August 2017. The scope of work included the following:

- A review of available site information, including the EIS *Preliminary Environmental Site Assessment*[2];
- Soil sampling from five sampling points and analysis of samples for contaminants of potential concern (CoPC);
- Installation of two groundwater monitoring wells;
- Interpretation of the soil analytical results against the adopted site assessment criteria (SAC);
- Assessment of data quality; and
- Preparation of this report.

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[1] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)

[2] EIS (2017) *Preliminary Environmental Site Assessment for Proposed Lindfield Learning Village Development at Eton Road, Lindfield* (Ref: E30259KMrpt dated 15 March 2017)

The report was prepared with reference to regulations and guidelines outlined in the table below. Individual guidelines are also referenced within the text of the report.

Table 1-1: Guidelines

Guidelines/Regulations/Documents
Contaminated Land Management Act (1997)[3]
State Environmental Planning Policy No.55 – Remediation of Land (1998)[4]
Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)[5]
Guidelines for Consultants Reporting on Contaminated Sites (2011)[6]
Guidelines for the NSW Site Auditor Scheme, 2nd Edition (2006)[7]
National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)[8]

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[3] NSW Government Legislation, (1997). *Contaminated Land Management Act 1997.* (referred to as CLM Act 1997)

[4] NSW Government, (1998). *State Environmental Planning Policy No. 55 – Remediation of Land.* (referred to as SEPP55)

[5] Department of Urban Affairs and Planning, and Environment Protection Authority, (1998). *Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land*. (SEPP55 Planning Guidelines)

[6] NSW Office of Environment and Heritage (OEH), (2011). *Guidelines for Consultants Reporting on Contaminated Sites.* (referred to as Reporting Guidelines 2011)

[7] NSW DEC, (2006). *Guidelines for the NSW Site Auditor Scheme, 2nd ed.* (referred to as Site Auditor Guidelines 2006)

[8] National Environment Protection Council, (2013). *National Environmental Protection (Assessment of Site Contamination) Amendment Measure 1999* (as amended 2013). (referred to as NEPM 2013)

2 SITE INFORMATION

2.1 Background

2.1.1 Preliminary Environmental Site Assessment (EIS 2017)

A review of the history of the UTS Lindfield campus indicated that it was likely to have been undisturbed bushland until 1915, when it was acquired for use as an army rifle range. The rifle range appeared to have actually been located approximately 150m south-east of the current site. Development occurred on the campus from the 1960s with the construction of brick and concrete buildings and roadways within landscaped areas. The campus was used as an education facility since development occurred and served as the UTS campus for approximately 25 years until its closure at the end of 2015.

Potential contamination sources on the campus included fill material that may have been used during construction, the former rifle range, the use of pesticides and hazardous building materials. Based on a qualitative assessment of various lines of evidence, it was concluded that there was a low potential for widespread significant site contamination. If contamination is present it is likely to be located in discrete locations or hotspots.

EIS recommended an investigation of any unpaved areas where children could potentially come into regular contact with soil and that a hazardous building material assessment should be undertaken prior to any refurbishment works. EIS were of the opinion that the site can be made suitable for the proposed development provided that the recommendations were completed.

Other relevant information from the Preliminary ESA report has been summarised later in the current report.

2.2 Site Identification

Table 2-1: Site Identification

Current Site Owner:	NSW Minister for Education
Site Address:	Eton Road, Lindfield, NSW, 2070 (Listed in some sources as 100 Eton Rd, unnumbered in other sources.)
Lot & Deposited Plan:	Part of Lot 2 DP1151638
Current Land Use:	Vacant
Proposed Land Use:	Education
Local Government Authority:	Ku-ring-gai Council

Current Zoning:	Part zoned B4 Mixed Use Part zoned E3 Environmental Management Part zoned R1 General Residential
Total Area of Former UTS Campus:	Approximately 5ha
Maximum Total Area of Proposed Soil Disturbance For Development:	Approximately 500m^2
RL (AHD) (approx.):	50m – 66m
Geographical Location (decimal degrees) (approx.):	Latitude: -33.789969° Longitude: 151.160619°

2.3 Site Location, Regional Setting and Topography

The campus is located close to a predominantly residential area of Lindfield. The campus is located on the crest of a hill, which in the vicinity of the site generally slopes downwards towards the south.

2.4 Site Inspection

A walkover inspection of the proposed development areas was undertaken by EIS on 8 September 2017. The area where the COLA is proposed (see Plate 1 below) was located to the south of a 3-4 storey brick building, and was generally covered with grass, trees and other vegetation, gravel or sandstone outcrops.

Plate 1: the area in the south of the site where a Covered Outdoor Learning Area (COLA) is proposed.

The area where the new external stairway is proposed (see Plate 2 below) was located to the south-east of a 2-3 storey brick building and concrete stairway, and was generally grass-covered.

Plate 2: the area in the south-east of the site where a new external stairway is proposed.

2.5 Regional Geology

A review of the regional geological map of Sydney (1983[9]) indicated that the site is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses.

2.6 Acid Sulfate Soil Risk and Planning

The site is not located in an acid sulfate soil (ASS) risk area according to the risk maps prepared by the Department of Land and Water Conservation. However as the site is located within 500m of a Class 1-4 acid sulfate soil area in the Ku-ring-gai Local Environmental Plan 2015, it is automatically considered to be located within a Class 5 area. Works in Class 5 areas that could pose an environmental risk in terms of ASS include works which are likely to lower the water table below 1m AHD on the adjacent land Class 1-4 land. This is not considered likely for the proposed development. The nearest Class 1-4 area is located approximately 100m to the south of the site and is associated with Blue Gum Creek.

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[9] Department of Mineral Resources, (1983). *1:100,000 Geological Map of Sydney (Series 9130).*

2.7 Hydrogeology

Hydrogeological information indicated that the regional aquifer on-site and in the areas immediately surrounding the site includes porous, extensive aquifers of low to moderate productivity. The information reviewed indicated that the subsurface conditions at the site are likely to consist of residual soils overlying shallow sandstone bedrock. The potential for viable groundwater abstraction and use of groundwater under these conditions is considered to be low.

2.8 Receiving Water Bodies

The site location and regional topography indicated that excess surface water flows have the potential to enter Blue Gum Creek, located approximately 100m to the south of the site, and Sugarbag Creek, located approximately 100m east of the site. The creeks are considered to be potential receptors.

3 CONCEPTUAL SITE MODEL (CSM)

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the available site information.

3.1 Potential Contamination Sources, Areas of Environmental Concern (AEC) and Contaminants of Potential Concern (CoPC)

The potential contamination sources, AEC and CoPC are presented in the following table:

Table 3-1: Potential Contamination Sources, AEC and CoPC

Source / AEC	CoPC
Fill material - The majority of the site appears to have been built at the level of the existing landscape. It is possible that fill material may have been used in some areas. If so, the fill may have been contaminated as environmental controls were less stringent at the time the buildings were constructed.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (referred to as total recoverable hydrocarbons – TRHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos
Land behind a rifle range – Stray bullets may have landed on the site. Most of the bullets would have been stopped by the earthworks around the target. The risk of encountering spent ammunition is considered to be very low.	Lead
Use of pesticides – Pesticides may have been used beneath the buildings and/or around the site.	Heavy metals, OCPs and OPPs
Hazardous Building Material – Hazardous building materials may be present in the existing buildings on site.	Asbestos, lead and PCBs

3.2 Mechanism for Contamination, Affected Media, Receptors and Exposure Pathways

The mechanisms for contamination, affected media, receptors and exposure pathways relevant to the potential contamination sources and AEC are outlined in the following table:

Table 3-2: CSM Table

Potential mechanism for contamination	Potential mechanisms for contamination include: • Fill material – importation of impacted material, top-down impacts (e.g. leaching from surficial material), or sub-surface release (e.g. impacts from buried material); • In the vicinity of a rifle range – top-down impacts (e.g. leaching from surficial material); • Use of pesticides – top-down and spills (e.g. during normal use, application and/or improper storage); and • Hazardous building material – within current buildings.
Affected media	Soil and soil vapour have been identified as potentially affected media. The potential for groundwater impacts is considered to be relatively low. However, groundwater would need to be considered in the event significant contamination was identified in soil.
Receptor identification	Potential human receptors include site occupants, construction workers and intrusive maintenance workers. Potential ecological receptors include terrestrial organisms and plants, and freshwater ecology in Blue Gum Creek and Sugarbag Creek.
Potential Exposure pathways	Potential exposure pathways relevant to the human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, naphthalene and BTEX). The potential for exposure would typically be associated with construction and excavation works and the use of unpaved areas and basements (i.e. vapour inhalation or incidental contact with groundwater seepage). Potential exposure pathways for ecological receptors include primary contact and ingestion.
Presence of preferential pathways for contaminant movement	Existing underground services may be potential preferential pathways for contaminant migration. This could occur via groundwater or seepage if present, or via soil and vapour migration through the service trench backfill.

4 SAMPLING, ANALYSIS AND QUALITY PLAN

4.1 Data Quality Objectives (DQO)

The NEPM 2013 defines the DQO process as a seven-step iterative planning tool used to define the type, quantity and quality of data needed to inform decisions relating to the environmental condition of the site. The DQO process is detailed in the Site Auditor Guidelines 2006 and the USEPA documents Data Quality Objectives Processes for Hazardous Waste Site Investigations (2000) and Guidance on Systematic Planning Using the Data Quality Objectives Process (2006). These seven steps are applicable to this assessment as summarised in the table below:

Table 4-1: DQOs – Seven Steps

Step	Input
State the Problem	The CSM has identified AEC at the site which may pose a risk to the site receptors. An intrusive investigation is required to assess the risk and comment on the suitability of the site for the proposed development or intended land use.
Identify the Decisions/ Goal of the Study	The data collection is project specific and has been designed based on the following information: • A review of site information including site history; • AEC, CoPC, receptors, pathways and media identified in the CSM; • Development of SAC for each medium; and • The use of decision statements outlined below: 1) Did the site inspection, or does the historical information identify potential contamination sources/AEC at the site? 2) Are any results above the SAC? 3) Do potential risks associated with contamination exist, and if so, what are they? 4) Is remediation required? 5) Is the site characterisation sufficient to provide adequate confidence in the above decisions? 6) Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation? For this assessment, the individual results have been assessed as either above or below the SAC. Statistical evaluation of the dataset via calculation of mean values and/or 95% upper confidence limit (UCL) values has not been undertaken due to the spatial distribution of the data and the number of samples submitted for analysis.
Identify Information Inputs	The following information will be collected: • Soil samples based on subsurface conditions; • Groundwater samples from monitoring wells (if groundwater is encountered); • The SAC will be designed based on the criteria outlined in NEPM 2013. Other criteria will be used as required and detailed in this report;

Step	Input
	• The samples will be analysed in accordance with the analytical methods outlined in NEPM 2013; • Field screening information (i.e. PID data, presence of hydrocarbons etc.) will be taken into consideration in selecting the analytical schedule; and • Any additional information that may arise during the field work will also be used as data inputs.
Define the Study Boundary	The sampling will be confined to the proposed development areas of the site as shown in Figures 2 and 3.
Develop the analytical approach (or decision rule)	The following acceptable limits will be adopted for the data quality assessment: • The following acceptance criteria will be used to assess the RPD results: ➢ results > 10 times the practical quantitation limit (PQL), RPDs < 50% are acceptable; ➢ results between 5 and 10 times PQL, RPDs < 75% are acceptable; ➢ results < 5 times PQL, RPDs < 100% are acceptable; and ➢ An explanation is provided if RPD results are outside the acceptance criteria. • Acceptable concentrations in trip spike and trip blank samples. Non-compliance to be documented in the report; • The following acceptance criteria will be used to assess the primary laboratory QA/QC results. Non-compliance to be documented: ➢ <u>RPDs</u>: - Results that are < 5 times the PQL, any RPD is acceptable; and - Results > 5 times the PQL, RPDs between 0-50% are acceptable; ➢ <u>LCS recovery and matrix spikes</u>: - 70-130% recovery acceptable for metals and inorganics; - 60-140% recovery acceptable for organics; and - 10-140% recovery acceptable for VOCs; ➢ <u>Surrogate spike recovery</u>: - 60-140% recovery acceptable for general organics; and - 10-140% recovery acceptable for VOCs; ➢ <u>Blanks</u>: All less than PQL.
Specify the performance or acceptance criteria	NEPM 2013 defines decision errors as “incorrect decisions caused by using data which is not representative of site conditions”. This can arise from errors during sampling or analytical testing. A combination of these errors is referred to as “total study error”. The study error can be managed through the correct choice of sample design and measurement. Decision errors can be controlled through the use of hypothesis testing. The test can be used to show either that the baseline condition is false or that there is insufficient evidence to indicate that the baseline condition is false. The null hypothesis is an assumption that is assumed to be true in the absence of contrary evidence. In this case, for example, the CoPC identified in the CSM is considered to pose a risk to receptors unless proven not to. The null hypothesis has been adopted for this assessment.

Step	Input
Optimise the design for obtaining data	The most resource-effective design will be used in an optimum manner to achieve the assessment objectives.

4.2 Soil Sampling Plan and Methodology

The soil sampling plan and methodology adopted for this assessment are outlined in the table below:

Table 4-2: Soil Sampling Plan and Methodology

Aspect	Input
Sampling Density	The NSW EPA Contaminated Sites Sampling Design Guidelines (1995[10]) recommend a sampling density for an environmental assessment based on the size of the investigation area. The guideline provides a minimum number of sampling points required for the investigation on a systematic sampling pattern. The guidelines recommend sampling from a minimum of five evenly spaced sampling points for the total proposed development area of approximately 500m^2. Samples for this investigation were obtained from five sampling points as shown on the attached Figure 3. This density meets the minimum sampling density recommended by the EPA.
Sampling Plan	The sampling locations were placed on a systematic plan with a grid spacing of approximately 10m-15m between sampling locations. A systematic plan was considered suitable to address potential contaminants associated with the fill material.
Sampling Equipment	Soil samples were obtained on 8 September 2017 in accordance with the standard sampling procedure (SSP) attached in the appendices. Sampling locations were cleared for underground services by an external contractor prior to sampling as outlined in the SSP. The sample locations were drilled using a hydraulically operated drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler.
Sampling Collection and Field QA/QC	Soil samples were collected from the fill and natural profiles based on field observations. The sampling depths are shown on the logs attached in the appendices. During sampling, soil at selected depths was split into primary and duplicate samples for field QA/QC analysis.

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[10] NSW EPA, (1995), *Contaminated Sites Sampling Design Guidelines.* (referred to as EPA Sampling Design Guidelines 1995)

Aspect	Input
	Samples were placed in glass jars with plastic caps and teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags. Sampling personnel used disposable nitrile gloves during sampling activities. The samples were labelled with the job number, sampling location, sampling depth and date in accordance with the SSP.
Field PID Screening for VOCs	A photoionisation detector (PID) was used to screen the samples for the presence of VOCs. The sensitivity of the PID is dependent on the organic compound and varies for different mixtures of hydrocarbons. Some compounds give relatively high readings and some can be undetectable even though present in identical concentrations. The PID is best used semi-quantitatively to compare samples contaminated by the same hydrocarbon source. The PID is calibrated before use by measurement of an isobutylene standard gas. All the PID measurements are quoted as parts per million (ppm) isobutylene equivalents. PID screening for VOCs was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases.
Sample Preservation	Soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with the SSP. On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures.

4.3 Groundwater Sampling Plan and Methodology

The groundwater sampling plan and methodology is outlined in the table below:

Table 4-3: Groundwater Sampling Plan and Methodology

Aspect	Input
Sampling Plan	Groundwater monitoring wells were installed in two selected boreholes (BH2 and BH4), one in each of the two development locations, as shown on Figure 3. The monitoring well locations were chosen based on subsurface conditions encountered during the investigation.

Aspect	Input
Monitoring Well Installation Procedure	The monitoring well construction details are documented on the corresponding borehole logs attached in the appendices. The monitoring wells were installed to depths of approximately 1.7m (MW2) and 2.7m (MW4) below ground level. These were the depths at which the 'TC' bit refused on hard bedrock during drilling of the boreholes. Deeper core drilling was beyond the scope of this assessment. The installation depth was designed to make an assessment of shallow perched groundwater conditions if present. The wells were constructed as follows: • A 50mm diameter Class 18 PVC casing and machine slotted screen; • A 2mm sand filter pack was used around the screen section for groundwater infiltration; • A bentonite seal was used on top of the slotted section to seal the wells; and • A stand pipe (BH2) or gatic cover (BH4) was installed at the surface with a concrete plug to limit the inflow of surface water.
Groundwater Development and Sampling	The monitoring wells were dry following installation. The wells were allowed to charge for 7 days after installation. Both wells were dry when groundwater sampling was attempted on 15 September 2017.

4.4 Analytical Schedule

The analytical schedule is outlined in the following table:

Table 4-4: Analytical Schedule

CoPC	Fill Samples	Natural Soil Samples
Heavy Metals	5	5
TRH/BTEX	5	5
PAHs	5	5
OCPs/OPPs	5	0
PCBs	5	0
Asbestos	5	0

4.4.1 Laboratory Analysis

The samples were analysed by the NATA-accredited laboratory using the analytical methods detailed in Schedule B(3) of NEPM 2013. Reference should be made to the laboratory report attached in the appendices for further details.

Table 4-5: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples and field QA/QC samples including intra-laboratory duplicates, trip blanks and trip spikes	Envirolab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	#175353

5 SITE ASSESSMENT CRITERIA (SAC)

The SAC adopted for the assessment are outlined in the table below. The SAC have been derived from the NEPM 2013 and other guidelines as applicable. The guideline values for individual contaminants are presented in the attached report tables.

Table 5-1: SAC Adopted for this Investigation

Guideline	Applicability
Health Investigation Levels (HILs) (NEPM 2013)	The HIL-A criteria for 'residential with accessible soil' have been adopted for this assessment. The HIL-A criteria also apply to children's day care centres, preschools and primary schools, which are considered to be the most sensitive potential use for the proposed development areas.
Health Screening Levels (HSLs) (NEPM 2013)	The HSL-A criteria for 'residential with accessible soil' have been adopted for this assessment. The HSL-A criteria also apply to any sensitive potential land uses, as described above for the HILs.
Ecological Assessment Criteria (NEPM 2013)	A preliminary screening of ecological risk has been undertaken based on the limited information available at this stage. The ecological criteria for 'urban residential and public open space (URPOS)' exposure setting have been adopted. Soil parameters: pH; cation exchange capacity (CEC); and clay content have not been analysed for the assessment. On this basis, the EIL and ESL calculations have taken the 'worst case' scenario in order to generate the ecological criteria. The EILs for selected metals have been derived using the ambient background concentration (ABC) values for low traffic (25th percentiles) areas for old suburbs of NSW published in Olszowy et. al. (1995[11]).
Direct Contact Limits for TRH (NEPM 2013)	These guidelines will be used after considering the relevant HSLs and ESLs for adverse effects of TRH contamination if necessary.
Asbestos in Soil	The 'presence/absence' of asbestos in soil has been adopted as the assessment criterion as a conservative measure.
Waste Classification (WC) Criteria	The criteria outlined in the NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014[12]) has been adopted to classify the material for off-site disposal.

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[11] Olszowy, H., Torr, P., and Imray, P., (1995), *Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4*. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission.

[12] NSW EPA, (2014), *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2014)

6 INVESTIGATION RESULTS

6.1 Subsurface Conditions

A summary of the subsurface conditions encountered during the investigation is presented in the table below. Reference should be made to the borehole logs attached in the appendices for further details.

Table 6-1: Summary of Subsurface Conditions

Profile	Description (m in bgl)
Fill	Fill material was encountered at the surface in all boreholes and extended to depths of approximately 0.2m to 0.35m. The fill typically comprised fine to medium-grained silty sand with gravel.
Natural Soil	Natural silty sand was encountered beneath the fill material in all boreholes.
Bedrock	Sandstone bedrock was encountered at depths ranging from approximately 0.5m to 1.6m.
Groundwater	Groundwater seepage was not encountered in the boreholes during drilling. All boreholes remained dry on completion of drilling and a short time after. The monitoring wells remained dry 7 days after installation.

6.2 Field Screening

A summary of the field screening results is presented in the table below.

Table 6-2: Summary of Field Screening

Aspect	Details (m in bgl)
PID Screening of Soil Samples for VOCs	PID soil sample headspace readings are presented in the attached report tables and the COC documents attached in the appendices. All results were 0ppm equivalent isobutylene which indicates a lack of PID detectable VOCs.

6.3 Soil Laboratory Results

The soil laboratory results are compared to the relevant SAC in the attached report tables. A summary of the results assessed against the SAC is presented below.

Table 6-3: Summary of Soil Laboratory Results

Analyte	Results Compared to SAC
Heavy Metals	**HILs:** All heavy metal results were below the HIL-A criteria.

Analyte	Results Compared to SAC
	EILs: All heavy metal results were below the EIL-URPOS criteria. **Waste Classification:** All heavy metal results were less than the CT1 and SCC1 criteria.
TRH	**HSLs:** All TRH results were below the HSL-A criteria. **ESLs:** All TRH results were below the ESL-URPOS criteria. **Waste Classification:** All TRH results were less than the relevant CT1 and SCC1 criteria.
BTEX	**HSLs:** All BTEX results were below the HSL-A criteria. **ESLs:** All BTEX results were below the ESL-URPOS criteria. **Waste Classification:** All BTEX results were less than the relevant CT1 and SCC1 criteria.
PAHs	**HILs:** All PAH results were below the HIL-A criteria. **HSLs:** All naphthalene results were below the HSL-A criteria. **ESLs:** All benzo(a)pyrene results were below the ESL-URPOS criteria, **EILs:** All naphthalene results were below the EIL-URPOS criteria. **Waste Classification:** All PAH results were less than the relevant CT1 and SCC1 criteria.
OCPs & OPPs	**HILs:** All OCP and OPP results were below the HIL-A criteria. **EILs:** All DDT results were below the EIL-URPOS criteria.

Analyte	Results Compared to SAC
	<u>Waste Classification:</u> All OCP and OPP results were less than the relevant CT1 and SCC1 criteria.
PCBs	**<u>HILs:</u>** All PCB results were below the HIL-A criterion. **<u>WC:</u>** All PCB results were less than the SCC1 criterion.
Asbestos	Asbestos (associated with a fragment of fibre cement) was detected in one fill soil sample, collected at a depth of 0.0m to 0.2m in BH1, which was located within the proposed COLA.

7 DATA QUALITY ASSESSMENT

As part of the data quality assessment the following data quality indicators (DQIs) were assessed: precision, accuracy, representativeness, completeness and comparability as outlined in the table below. Reference should be made to the appendices for an explanation of the individual DQI.

Table 7-1: Assessment of DQIs

Completeness

Field Considerations:

- The investigation was designed to target areas of the site where soil disturbance is proposed;
- Samples were obtained from various depths based on the subsurface conditions encountered at the sampling locations. All samples were recorded on the borehole logs. All sampling points are shown on the attached Figure 3;
- The investigation was undertaken by trained staff in accordance with the SSP; and
- Documentation maintained during the field work is attached in the appendices where applicable.

Laboratory Considerations:

- Selected samples were analysed for a range of CoPC;
- All samples were analysed by a NATA registered laboratory in accordance with the analytical methods outlined in NEPM 2013;
- Appropriate analytical methods and PQLs were used by the laboratory; and
- Appropriate sample preservation, handling, holding time and COC procedures were adopted for the investigation.

Comparability

Field Considerations:

- The investigation was undertaken by trained staff in accordance with the SSP; and
- Consistency was maintained during sampling in accordance with the SSP.

Laboratory Considerations:

- All samples were analysed in accordance with the analytical methods outlined in NEPM 2013;
- Appropriate PQLs were used by the laboratory for all analysis (other than those outlined above);
- All primary, intra-laboratory duplicates and other QA/QC samples were analysed by the same laboratory; and
- The same units were used by the laboratory for all of the analysis.

Representativeness

Field Considerations:

- The investigation was designed to obtain appropriate media encountered during the field work as outlined in the SAQP; and
- All media based on the subsurface conditions encountered during the field work was sampled.

Laboratory Considerations:

- All samples were analysed in accordance with the SAQP.

Precision

Field Considerations:

- The investigation was undertaken in accordance with the SSP.

Laboratory Considerations:

- Analysis of field QA/QC samples including inter-laboratory duplicate, trip blank and trip spike as outlined below;
- The field QA/QC frequency adopted for the investigation is outlined below;
- Calculation of the Relative Percentage Difference (RPD) from the primary and duplicate results (the RPD calculation equation is outlined in the attached appendices); and
- Assessment of RPD results against the acceptance criteria outlined in Section 4.1.

Intra-laboratory RPD Results:
Soil samples at a frequency of 10% of the primary samples:

- DUP1 is a soil duplicate of primary sample BH3 (0.0-0.2).

The intra-laboratory results are presented in the attached report tables. The results indicated that field precision was acceptable.

The RPD values for three heavy metals were outside the acceptance criteria. Values outside the acceptable limits have been attributed to sample heterogeneity and the difficulties associated with obtaining homogenous duplicate samples of heterogeneous matrices. As both the primary and duplicate sample results were less than the SAC, the exceedances are not considered to have had an adverse impact on the data set as a whole.

Trip Spike:
One soil trip spike was analysed for BTEX at a frequency of one spike per batch of volatiles. The results are presented in the attached report tables. The results ranged from 86% to 90% and indicated that field preservation methods were appropriate.

Trip Blank:
One soil trip blank was analysed for BTEX at a frequency of one blank per batch of volatiles. The results are presented in the attached report tables. The results were all less than the PQLs.

Accuracy

Field Considerations:

- The investigation was undertaken in accordance with the SSP.

Laboratory Considerations:

- The analytical quality assessment adopted by the laboratory was in accordance with the NATA and NEPM 2013 requirements as outlined in the analytical report;
- A review of the report indicates that the analytical results were generally within the acceptance criteria adopted by the laboratory. The laboratory RPD acceptance criteria was exceeded in one sample for lead. A triplicate result was issued to account for this.

8 WASTE CLASSIFICATION OF SOIL FOR OFF-SITE DISPOSAL

8.1 Waste Classification of Fill

Based on the results of the assessment, and at the time of reporting, the fill material is classified as **General Solid Waste (non-putrescible) containing Special Waste (asbestos)**. Surplus fill should be disposed of to a landfill that is licensed by the NSW EPA to receive this waste stream. The landfill should be contacted to obtain the required approvals prior to commencement of excavation.

8.2 Classification of Natural Soil and Bedrock

Based on the scope of work undertaken for this assessment, and at the time of reporting, EIS are of the opinion that the natural soil and bedrock at the site meets the definition of **VENM** for off-site disposal or re-use purposes. A surface clearance of the exposed natural soil should be undertaken by a licenced asbestos assessor prior to any excavation of VENM.

VENM is considered suitable for re-use on-site, or alternatively, the information included in this report may be used to assess whether the material is suitable for beneficial reuse at another site as fill material. In accordance with Part 1 of the Waste Classification Guidelines, the VENM is pre-classified as general solid waste and can also be disposed of accordingly to a facility that is licensed to accept it.

9 DISCUSSION

9.1 Tier 1 Risk Assessment and Review of CSM

9.1.1 Sources and Extent of Contamination

A fibre cement fragment (FCF) containing asbestos (chrysotile) was detected by the laboratory during the analysis of the sample from collected from BH1.

The source of the FCF is not known. It may have been imported onto the site along with the fill material, or may be associated with the construction and/or demolition of site structures.

EIS are of the opinion that the asbestos contamination is confined to the fill material at the site. The fill ranges in depth from approximately 0.2m to 0.35m. EIS considers that it is likely that additional undetected fibre cement fragments are located on the surface or within the fill material at the site. Accordingly, all fill material in the proposed development area is considered to be potentially contaminated with asbestos and should be treated accordingly.

9.1.2 Review of CSM

For a contaminant to represent a risk to a receptor, the following three conditions must be present:

1. Source – The presence of a contaminant;
2. Pathway – A mechanism or action by which a receptor can become exposed to the contaminant; and
3. Receptor – The human or ecological entity which may be adversely impacted following exposure to contamination.

If one of the above components is missing, the potential for adverse risks is relatively low.

For FCF containing asbestos, the potential exposure pathway for potential human receptors is via the inhalation of airborne asbestos fibres. EIS are of the opinion that the risk posed to human receptors is low to moderate and will require remediation.

9.1.3 Fate and Transport

The potential transport of asbestos fibres is associated with the disturbance of asbestos contaminated soils and the release of fibres into the atmosphere. This may occur during excavation works.

A number of studies have found that soils effectively filter out asbestos fibres and retain them within the soil matrix. The studies concluded that there is no significant migration of asbestos fibres, either through soil or groundwater.

9.2 Data Gaps

Groundwater was not encountered during the works undertaken.

EIS considers that the potential for groundwater contamination that may result in a risk to potential human or environment receptors at the site is low for the following reasons:

- CoPC that have the potential to leach into groundwater were not detected above the adopted SAC;
- As noted in Section 9.1.3, there is no significant migration of asbestos fibres through soil or into groundwater; and
- Based on the site conditions encountered, the risk of potential human receptors coming into contact with groundwater at the site is considered to be very low.

EIS considers that further assessment of groundwater within the proposed development areas is not required.

9.3 Decision Statements

The decision statements are addressed below:

Did the site inspection, or does the historical information identify potential contamination sources/AEC at the site?

- Yes, potential contamination sources and AEC were identified at the site.

Are any results above the SAC?

- Yes, asbestos was detected above the SAC in one fill soil sample.

Do potential risks associated with contamination exist, and if so, what are they?

- Yes, potential risks to human receptors are associated with the inhalation of asbestos fibres.

Is remediation required?

- Yes, EIS considers that remediation of the site is required.

Is the site characterisation sufficient to provide adequate confidence in the above decisions?

- Yes, EIS considers that the site characterisation is sufficient to provide confidence in the above decisions.

Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation?

- EIS considers that the site can be made suitable for the proposed development subject to remediation.

10 CONCLUSION

EIS consider that the report objectives outlined in Section 1.2 have been addressed.

Based on the scope of works undertaken, EIS are of the opinion that the asbestos identified at the site poses a risk to the potential receptors.

EIS consider that the site can be made suitable for the proposed development provided that the following recommendations are implemented to minimise the risks:

1. Prepare a Remediation Action Plan (RAP) to outline remedial measures for the site;
2. Prepare an Asbestos Management Plan to outline safety measures to be undertaken during the remedial works; and
3. Prepare a Validation Assessment report on completion of remediation.

In the event unexpected conditions are encountered during development work or between sampling locations that may pose a contamination risk, all works should stop and an environmental consultant should be engaged to inspect the site and address the issue.

10.1 Regulatory Requirement

The regulatory requirements applicable for the site are outlined in the following table:

Table 10-1: Regulatory Requirement

Guideline	Applicability
Duty to Report Contamination 2015[13]	At this stage, EIS consider that there is no requirement to notify the NSW EPA of the site contamination. After successful implementation of the RAP, the site contamination is unlikely to meet the notification triggers.
POEO Act 1997	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner.
Work Health and Safety Code of Practice 2011[14]	Sites contaminated with asbestos become a 'workplace' when work is carried out there and require a register and asbestos management plan.

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[13] NSW Department of Environment and Climate Change, (2015). *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.* (referred to as Duty to Report Contamination 2015)

[14] WorkCover NSW, (2011), *WHS Regulation: Code of Practice – How to Manage and Control Asbestos in the Workplace.*

11 LIMITATIONS

The report limitations are outlined below:

- EIS accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the EIS proposal; and terms of contract between EIS and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, EIS has not undertaken any verification process, except where specifically stated in the report;
- EIS has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- EIS accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- EIS have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or land use. EIS should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

LIST OF IN-TEXT TABLES

IMPORTANT INFORMATION ABOUT THIS REPORT

These notes have been prepared by EIS to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors

This report has been prepared in response to specific project requirements as stated in the EIS proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, e.g. addition of basement levels; or
- Ownership of the site changes.

EIS/J&K will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by EIS to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions

Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data

Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations

Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report

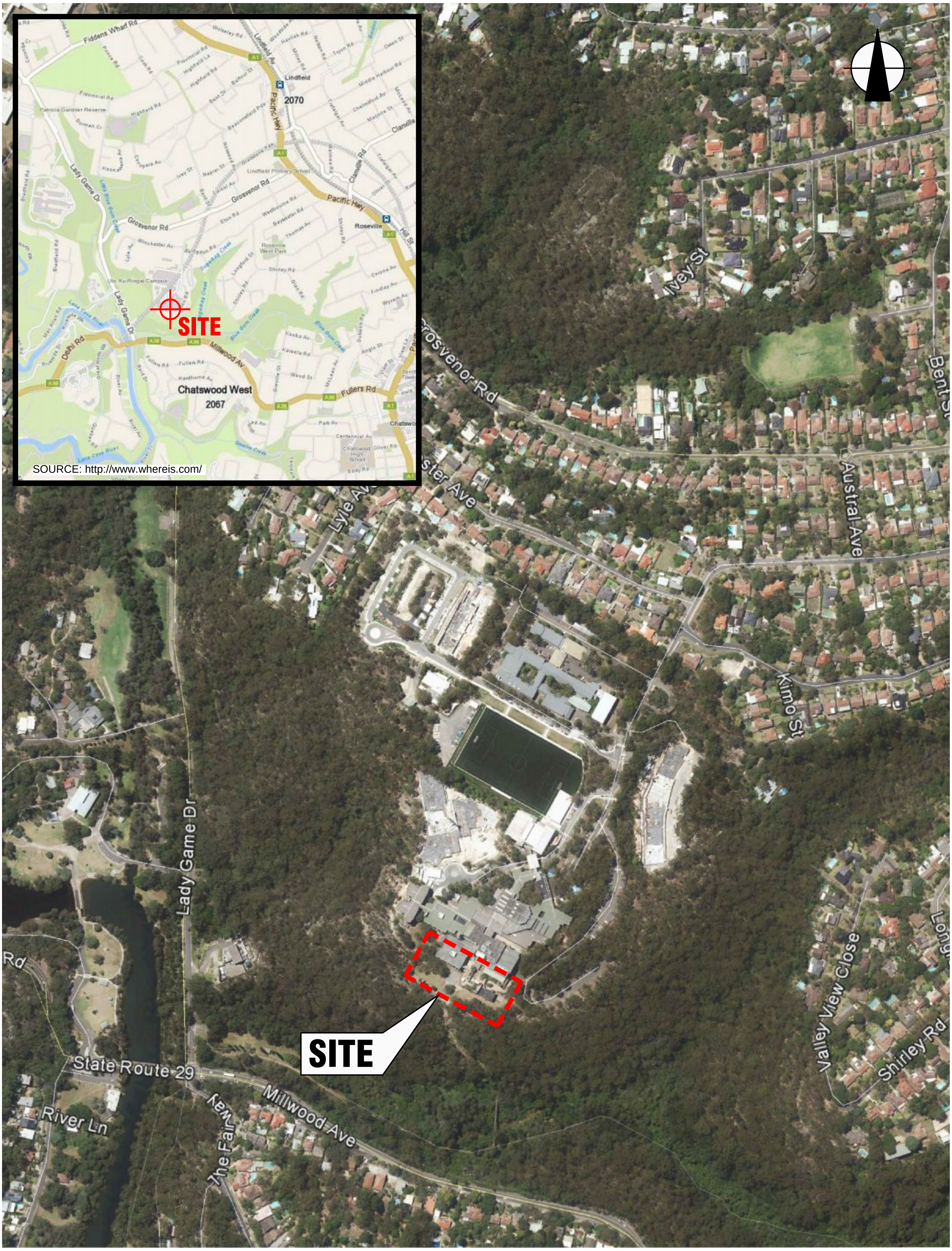
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely

Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

REPORT FIGURES



AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.5.1557
AERIAL IMAGE ©: 2015 GOOGLE INC.

This plan should be read in conjunction with the EIS report.

Title:

SITE LOCATION PLAN

Location: ETON ROAD
LINDFIELD, NSW

Report No: E30295KM

Figure No: 1

ENVIRONMENTAL INVESTIGATION SERVICES

EIS

PLOT DATE: 9/10/2017 6:09:30 PM DWG FILE: S:\5 EIS\5C EIS JOBS\30000'S\E30259KM LINDFIELD\CAD\E30295KM.DWG

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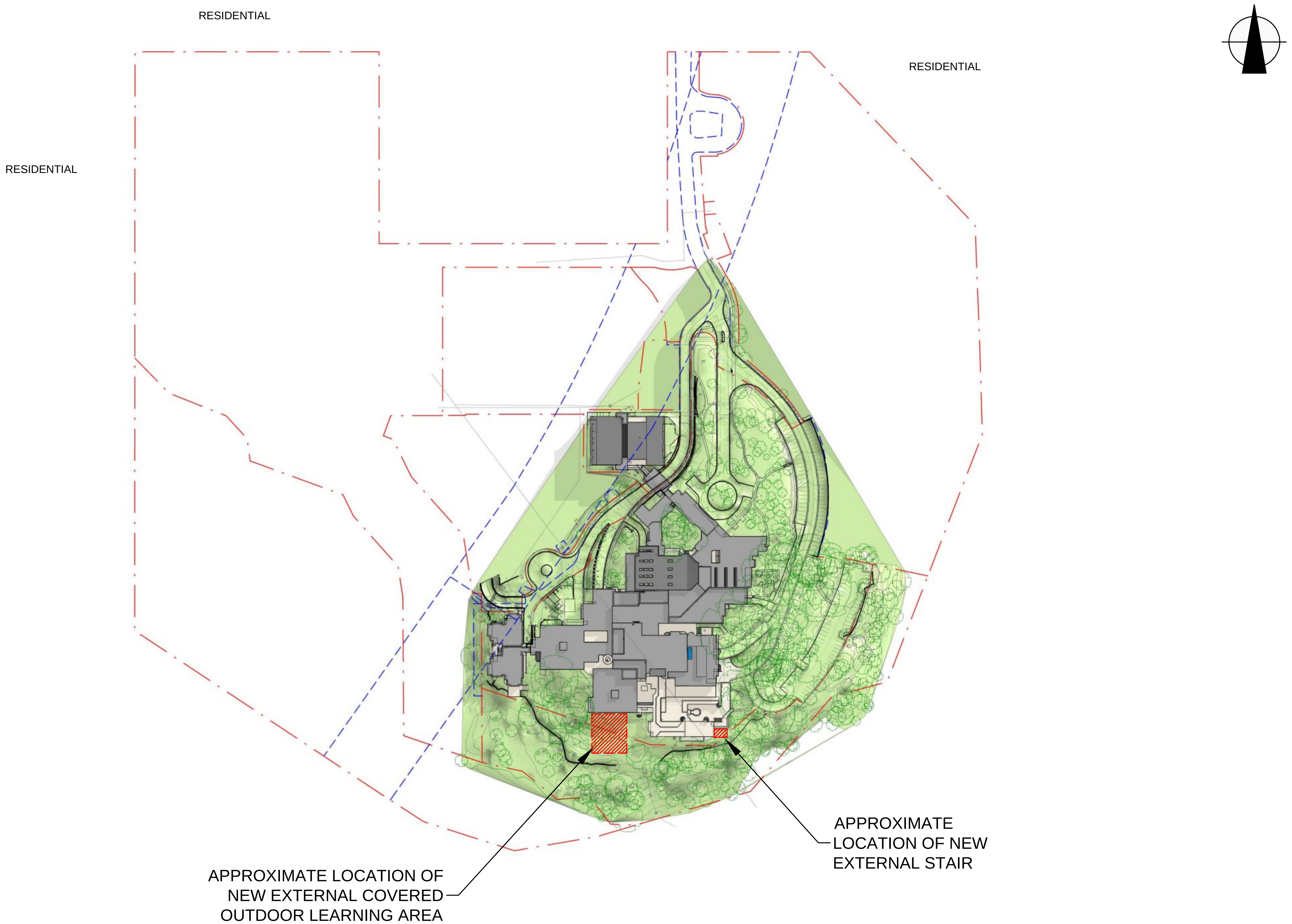

0 25 50 75 100 125

SCALE 1:2500 @A3 METRES

This plan should be read in conjunction with the EIS report.

Title:

PROPOSED DEVELOPMENT PLAN

Location: ETON ROAD
LINDFIELD, NSW

Report No: E30295KM

Figure No: 2

ENVIRONMENTAL INVESTIGATION SERVICES

EIS

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LEGEND

● BH (Fill Depth) BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

⊕ BH/MW(Fill Depth) BOREHOLE AND GROUND WATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m)

0 5 10 15 20 25
SCALE 1:500 @A3 METRES

This plan should be read in conjunction with the EIS report.

Title:
SAMPLE LOCATION PLAN

Location: ETON ROAD
LINDFIELD, NSW

Report No: E30295KM
Figure No: 3

ENVIRONMENTAL INVESTIGATION SERVICES

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LABORATORY SUMMARY TABLES

TABLE A
SOIL LABORATORY RESULTS COMPARED TO HILs
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)		
			Arsenic	Cadmium	Chromium VI [2]	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P TEQ [3]	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos	TOTAL PCBs	ASBESTOS FIBRES
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC) [1]			100	20	100	6000	300	40	400	7400	300	3	10	270	300	6	50	240	6	160	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH1	0.0-0.2	Fill: silty sand	LPQL	LPQL	8	16	48	LPQL	9	44	0.06	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	**Chrysotile asbestos detected.**
BH1	0.3-0.5	Silty sand	LPQL	LPQL	6	3	10	LPQL	LPQL	6	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0.0-0.2	Fill: silty sand	5	LPQL	17	5	14	LPQL	3	17	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not detected.
BH2	0.3-0.5	Silty sand	LPQL	LPQL	9	2	11	LPQL	2	12	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH3	0.0-0.2	Fill: silty sand	LPQL	LPQL	11	4	12	LPQL	3	18	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not detected.
BH3	0.6-0.8	Silty sand	LPQL	LPQL	12	LPQL	6	LPQL	LPQL	3	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH4	0.0-0.2	Fill: silty sand	LPQL	LPQL	10	14	20	LPQL	7	36	1.3	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not detected.
BH4	0.5-0.95	Silty sand	LPQL	LPQL	10	1	11	LPQL	1	30	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH5	0.0-0.2	Fill: silty sand	LPQL	LPQL	12	78	25	LPQL	9	48	LPQL	LPQL	LPQL	LPQL	LPQL	1.5	LPQL	LPQL	LPQL	LPQL	LPQL	Not detected.
BH5	0.3-0.5	Silty sand	LPQL	LPQL	10	3	11	LPQL	3	19	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Number of Samples			10	10	10	10	10	10	10	10	10	10	5	5	5	5	5	5	5	5	5	5
Maximum Value			5	LPQL	17	78	48	LPQL	9	48	1.3	LPQL	LPQL	LPQL	LPQL	1.5	LPQL	LPQL	LPQL	LPQL	LPQL	NC

Explanation:

1 - Site Assessment Criteria (SAC): NEPM 2013, HIL-A: 'Residential with garden/accessible soils; children's day care centers; preschools; and primary schools'

2 - The results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.

3 - B(a)P TEQ - Benzo(a)pyrene Toxicity Equivalence Quotient has been calculated based on 8 carcinogenic PAHs and their Toxic Equivalence Factors (TEFs) outlined in NEPM 2013

Concentration above the SAC	**VALUE**

Abbreviations:

PAHs: Polycyclic Aromatic Hydrocarbons	UCL: Upper Level Confidence Limit on Mean Value
B(a)P: Benzo(a)pyrene	HILs: Health Investigation Levels
PQL: Practical Quantitation Limit	NA: Not Analysed
LPQL: Less than PQL	NC: Not Calculated
OPP: Organophosphorus Pesticides	NSL: No Set Limit
OCP: Organochlorine Pesticides	SAC: Site Assessment Criteria
PCBs: Polychlorinated Biphenyls	NEPM: National Environmental Protection Measure

TABLE B
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID[2]
PQL - Envirolab Services					25	50	0.2	0.5	1	3	1	
HSL Land Use Category[1]					**RESIDENTIAL WITH ACCESSIBLE SOIL**							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
BH1	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH1	0.3-0.5	Silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH2	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH2	0.3-0.5	Silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH3	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH3	0.6-0.8	Silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH4	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH4	0.5-0.95	Silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH5	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH5	0.3-0.5	Silty sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
Total Number of Samples					10	10	10	10	10	10	10	10
Maximum Value					LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL

Explanation:
1 - Site Assessment Criteria (SAC): NEPM 2013
2 - Field PID values obtained during the investigation

Concentration above the SAC **VALUE**
The guideline corresponding to the elevated value is highlighted in grey in the Site Assessment Criteria Table below

Abbreviations:
UCL: Upper Level Confidence Limit on Mean Value
HSLs: Health Screening Levels
NA: Not Analysed
NC: Not Calculated
NL: Not Limiting
SAC: Site Assessment Criteria
PQL: Practical Quantitation Limit
LPQL: Less than PQL
NEPM: National Environmental Protection Measure

SITE ASSESSMENT CRITERIA

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
PQL - Envirolab Services					25	50	0.2	0.5	1	3	1
HSL Land Use Category[1]					**RESIDENTIAL WITH ACCESSIBLE SOIL**						
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**							
BH1	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH1	0.3-0.5	Silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH2	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH2	0.3-0.5	Silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH3	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH3	0.6-0.8	Silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH4	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH4	0.5-0.95	Silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH5	0.0-0.2	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH5	0.3-0.5	Silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3

TABLE C
SOIL LABORATORY RESULTS COMPARED TO EILs AND ESLs
All data in mg/kg unless stated otherwise

Land Use Category [1]				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																			
							AGED HEAVY METALS-EILs						EILs		ESLs								
				pH	CEC (cmol$_c$/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	0.1	0.1	25	50	100	100	0.2	0.5	1	3	0.05
Ambient Background Concentration (ABC) [2]				-	-	-	NSL	8	18	104	5	77	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																				
BH1	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	LPQL	8	16	48	9	44	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0.06
BH1	0.3-0.5	Silty sand	Coarse	NA	NA	NA	LPQL	6	3	10	LPQL	6	LPQL	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH2	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	5	17	5	14	3	17	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH2	0.3-0.5	Silty sand	Coarse	NA	NA	NA	LPQL	9	2	11	2	12	LPQL	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH3	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	LPQL	11	4	12	3	18	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH3	0.6-0.8	Silty sand	Coarse	NA	NA	NA	LPQL	12	LPQL	6	LPQL	3	LPQL	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH4	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	LPQL	10	14	20	7	36	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0.1
BH4	0.5-0.95	Silty sand	Coarse	NA	NA	NA	LPQL	10	1	11	1	30	LPQL	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH5	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	LPQL	12	78	25	9	48	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH5	0.3-0.5	Silty sand	Coarse	NA	NA	NA	LPQL	10	3	11	3	19	LPQL	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
Total Number of Samples				0	0	0	10	10	10	10	10	10	10	5	10	10	10	10	10	10	10	10	10
Maximum Value				LPQL	LPQL	LPQL	5	17	78	48	9	48	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0.1

Explanation:

1 - Site Assessment Criteria (SAC): NEPM 2013

2 - ABC Values for selected metals has been adopted from the published background concentrations presented in Olszowy et. al., (1995), Trace Element Concentrations in Soils from Rural and Urban New South Wales (the 25th percentile values for old suburbs with low traffic have been quoted)

Concentration above the SAC	🟩 VALUE

The guideline corresponding to the elevated value is highlighted in grey in the EIL and ESL Assessment Criteria Table below

Abbreviations:

EILs: Ecological Investigation Levels	UCL: Upper Level Confidence Limit on Mean Value	LPQL: Less than PQL	NC: Not Calculated
B(a)P: Benzo(a)pyrene	ESLs: Ecological Screening Levels	SAC: Site Assessment Criteria	NSL: No Set Limit
PQL: Practical Quantitation Limit	NA: Not Analysed	NEPM: National Environmental Protection Measure	ABC: Ambient Background Concentration

EIL AND ESL ASSESSMENT CRITERIA

Land Use Category [1]				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																			
							AGED HEAVY METALS-EILs						EILs		ESLs								
				pH	CEC (cmol$_c$/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	0.1	0.1	25	50	100	100	0.2	0.5	1	3	0.05
Ambient Background Concentration (ABC) [2]				-	-	-	NSL	8	18	104	5	77	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																				
BH1	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	180	180	120	300	2800	50	85	70	105	33
BH1	0.3-0.5	Silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	--	180	120	300	2800	50	85	70	105	33
BH2	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	180	180	120	300	2800	50	85	70	105	33
BH2	0.3-0.5	Silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	--	180	120	300	2800	50	85	70	105	33
BH3	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	180	180	120	300	2800	50	85	70	105	33
BH3	0.6-0.8	Silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	--	180	120	300	2800	50	85	70	105	33
BH4	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	180	180	120	300	2800	50	85	70	105	33
BH4	0.5-0.95	Silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	--	180	120	300	2800	50	85	70	105	33
BH5	0.0-0.2	Fill: silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	180	180	120	300	2800	50	85	70	105	33
BH5	0.3-0.5	Silty sand	Coarse	NA	NA	NA	100	198	78	1204	35	147	170	--	180	120	300	2800	50	85	70	105	33

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TABLE D
SOIL LABORATORY RESULTS COMPARED TO WASTE CLASSIFICATION GUIDELINES
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		OC/OP PESTICIDES				Total PCBs	TRH					BTEX COMPOUNDS				ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P	Total Endosulfans	Chloropyrifos	Total Moderately Harmful [2]	Total Scheduled[3]		C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05	0.1	0.1	0.1	0.1	0.1	25	50	100	100	250	0.2	0.5	1	3	100
General Solid Waste CT1 [1]			100	20	100	NSL	100	4	40	NSL	200	0.8	60	4	250	<50	<50	650	NSL			10,000	10	288	600	1,000	-
General Solid Waste SCC1 [1]			500	100	1900	NSL	1500	50	1050	NSL	200	10	108	7.5	250	<50	<50	650	NSL			10,000	18	518	1,080	1,800	-
Restricted Solid Waste CT2 [1]			400	80	400	NSL	400	16	160	NSL	800	3.2	240	16	1000	<50	<50	2600	NSL			40,000	40	1,152	2,400	4,000	-
Restricted Solid Waste SCC2 [1]			2000	400	7600	NSL	6000	200	4200	NSL	800	23	432	30	1000	<50	<50	2600	NSL			40,000	72	2,073	4,320	7,200	-
Sample Reference	**Sample Depth**	**Sample Description**																									
BH1	0.0-0.2	Fill: silty sand	LPQL	LPQL	8	16	48	LPQL	9	44	0.06	0.06	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Chrysotile asbestos detected.
BH1	0.3-0.5	Silty sand	LPQL	LPQL	6	3	10	LPQL	LPQL	6	LPQL	LPQL	NA	NA	NA	NA	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
BH2	0.0-0.2	Fill: silty sand	5	LPQL	17	5	14	LPQL	3	17	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not detected.
BH2	0.3-0.5	Silty sand	LPQL	LPQL	9	2	11	LPQL	2	12	LPQL	LPQL	NA	NA	NA	NA	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
BH3	0.0-0.2	Fill: silty sand	LPQL	LPQL	11	4	12	LPQL	3	18	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not detected.
BH3	0.6-0.8	Silty sand	LPQL	LPQL	12	LPQL	6	LPQL	LPQL	3	LPQL	LPQL	NA	NA	NA	NA	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
BH4	0.0-0.2	Fill: silty sand	LPQL	LPQL	10	14	20	LPQL	7	36	1.3	0.1	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not detected.
BH4	0.5-0.95	Silty sand	LPQL	LPQL	10	1	11	LPQL	1	30	LPQL	LPQL	NA	NA	NA	NA	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
BH5	0.0-0.2	Fill: silty sand	LPQL	LPQL	12	78	25	LPQL	9	48	LPQL	LPQL	LPQL	LPQL	LPQL	1.5	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not detected.
BH5	0.3-0.5	Silty sand	LPQL	LPQL	10	3	11	LPQL	3	19	LPQL	LPQL	NA	NA	NA	NA	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
Total Number of samples			10	10	10	10	10	10	10	10	10	10	5	5	5	5	5	10	10	10	10	10	10	10	10	10	5
Maximum Value			5	LPQL	17	78	48	LPQL	9	48	1.3	0.1	LPQL	LPQL	LPQL	1.5	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NC

Explanation:

[1] - NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (2014)

[2] - Assessment of Total Moderately Harmful pesticides includes: Dichlorovos, Dimethoate, Fenitrothion, Ethion, Malathion and Parathion

[3] - Assessment of Total Scheduled pesticides include: HBC, alpha-BHC, gamma-BHC, beta-BHC, Heptachlor, Aldrin, Heptachlor Epoxide, gamma-Chlordane, alpha-chlordane, pp-DDE, Dieldrin, Endrin, pp-DDD, pp-DDT, Endrin Aldehyde

Concentration above the CT1	🟩 **VALUE**
Concentration above SCC1	🟧 **VALUE**
Concentration above the SCC2	🟥 **VALUE**

Abbreviations:

PAHs: Polycyclic Aromatic Hydrocarbons
B(a)P: Benzo(a)pyrene
PQL: Practical Quantitation Limit
LPQL: Less than PQL
PID: Photoionisation Detector
PCBs: Polychlorinated Biphenyls
UCL: Upper Level Confidence Limit on Mean Value
NA: Not Analysed
NC: Not Calculated
NSL: No Set Limit
SAC: Site Assessment Criteria
TRH: Total Recoverable Hydrocarbons
CT: Contaminant Threshold
SCC: Specific Contaminant Concentration
HILs: Health Investigation Levels
NEPM: National Environmental Protection Measure
BTEX: Monocyclic Aromatic Hydrocarbons

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TABLE E
SOIL INTRA-LABORATORY DUPLICATE RESULTS & RPD CALCULATIONS
All results in mg/kg unless stated otherwise

SAMPLE	ANALYSIS	Envirolab PQL	INITIAL	REPEAT	MEAN	RPD %
Sample Ref = BH3 (0.0-0.2)	Arsenic	4	LPQL	LPQL	NC	NC
Dup Ref = DUP1	Cadmium	0.4	LPQL	LPQL	NC	NC
	Chromium	1	11	29	20.0	90
Envirolab Report: #175353	Copper	1	4	9	6.5	77
	Lead	1	12	10	11.0	18
	Mercury	0.1	LPQL	LPQL	NC	NC
	Nickel	1	3	26	14.5	159
	Zinc	1	18	24	21.0	29
	Naphthalene	0.1	LPQL	LPQL	NC	NC
	Acenaphthylene	0.1	LPQL	LPQL	NC	NC
	Acenaphthene	0.1	LPQL	LPQL	NC	NC
	Fluorene	0.1	LPQL	LPQL	NC	NC
	Phenanthrene	0.1	LPQL	LPQL	NC	NC
	Anthracene	0.1	LPQL	LPQL	NC	NC
	Fluoranthene	0.1	LPQL	LPQL	NC	NC
	Pyrene	0.1	LPQL	LPQL	NC	NC
	Benzo(a)anthracene	0.1	LPQL	LPQL	NC	NC
	Chrysene	0.1	LPQL	LPQL	NC	NC
	Benzo(b,j+k)fluoranthene	0.2	LPQL	LPQL	NC	NC
	Benzo(a)pyrene	0.05	LPQL	LPQL	NC	NC
	Indeno(123-cd)pyrene	0.1	LPQL	LPQL	NC	NC
	Dibenzo(ah)anthracene	0.1	LPQL	LPQL	NC	NC
	Benzo(ghi)perylene	0.1	LPQL	LPQL	NC	NC
	TRH C_6-C_{10} (F1)	25	LPQL	LPQL	NC	NC
	TRH >C_{10}-C_{16} (F2)	50	LPQL	LPQL	NC	NC
	TRH >C_{16}-C_{34} (F3)	100	LPQL	LPQL	NC	NC
	TRH >C_{34}-C_{40} (F4)	100	LPQL	LPQL	NC	NC
	Benzene	0.5	LPQL	LPQL	NC	NC
	Toluene	0.5	LPQL	LPQL	NC	NC
	Ethylbenzene	1	LPQL	LPQL	NC	NC
	m+p-xylene	2	LPQL	LPQL	NC	NC
	o-xylene	1	LPQL	LPQL	NC	NC

Explanation:

The RPD value is calculated as the absolute value of the difference between the initial and repeat results divided by the average value expressed as a percentage. The following acceptance criteria will be used to assess the RPD results:

Results > 10 times PQL = RPD value <= 50% are acceptable
Results between 5 & 10 times PQL = RPD value <= 75% are acceptable
Results < 5 times PQL = RPD value <= 100% are acceptable

If result is LPQL then 50% of the PQL is used for the calculation

RPD Results Above the Acceptance Criteria	VALUE

Abbreviations:

PQL: Practical Quantitation Limit	OCP: Organochlorine Pesticides
LPQL: Less than PQL	OPP: Organophosphorus Pesticides
NA: Not Analysed	PCBs: Polychlorinated Biphenyls
NC: Not Calculated	TRH: Total Recoverable Hydrocarbons

TABLE F
SUMMARY OF FIELD QA/QC RESULTS

ANALYSIS	**Envirolab PQL**		TB^{S}	TS^{S}
	mg/kg	**µg/L**	11/09/2017	11/09/2017
			mg/kg	% Recovery
Benzene	1	1	LPQL	86%
Toluene	1	1	LPQL	89%
Ethylbenzene	1	1	LPQL	89%
m+p-xylene	2	2	LPQL	90%
o-xylene	1	1	LPQL	90%

Explanation:

^{W} Sample type (water)

^{S} Sample type (sand)

BTEX concentrations in trip spikes are presented as % recovery

Values above PQLs/Acceptance criteria **VALUE**

Abbreviations:

PQL: Practical Quantitation Limit
LPQL: Less than PQL
NA: Not Analysed
NC: Not Calculated

TB: Trip Blank
TS: Trip Spike
RS: Rinsate Sample
TRH: Total Recoverable Hydrocarbons

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REPORT APPENDICES

Appendix A: Borehole Logs

Borehole No.
1
1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: DESIGNINC SYDNEY PTY LTD
Project: PROPOSED LINDFIELD LEARNING VILLAGE DEVELOPMENT
Location: ETON ROAD, LINDFIELD, NSW

Job No.: E30259KM **Method:** SPIRAL AUGER **R.L. Surface:** N/A
Date: 8/9/17 **Datum:** AHD
Plant Type: JK300 **Logged/Checked By:** R.M./A.K.

Groundwater Record	SAMPLES				Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
	ES	ASS	ASB	SAL									
DRY ON COMPLETION	■		■						FILL: Silty sand, fine to medium grained, dark brown, trace of gravel.	D			
	■		■					SM	SILTY SAND: fine to medium grained, light brown.	D			
	■		■		N = 9 6,4,5	1			SANDSTONE: fine to medium grained, yellow brown, with iron indurated bands.				
						2 3 4 5 6			END OF ENVIRONMENTAL HOLE AT 1.60 m				'TC' BIT REFUSAL ON BEDROCK

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Borehole No.
2
1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: DESIGNINC SYDNEY PTY LTD
Project: PROPOSED LINDFIELD LEARNING VILLAGE DEVELOPMENT
Location: ETON ROAD, LINDFIELD, NSW

Job No.: E30259KM
Method: SPIRAL AUGER
R.L. Surface: N/A
Date: 8/9/17
Datum: AHD
Plant Type: JK300
Logged/Checked By: R.M./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■		■				▩		FILL: Silty sand, fine to medium grained, brown, trace of gravel and root fibres.	D			
	■		■				▒	SM	SILTY SAND: fine to medium grained, brown, trace of clay.	M			
	■		■		N = 7 7,4,3	1	▨		CLAYEY SILTY SAND: fine to medium grained, brown, with weathered sandstone bands.				
							░		SANDSTONE: fine to medium grained, yellow grey.				
						2 3 4 5 6			END OF ENVIRONMENTAL HOLE AT 1.70 m				'TC' BIT REFUSAL MONITORING WELL INSTALLED TO 1.70m: BOTTOM CAP AT BASE FROM 1.55m TO m; MACHINE SLOTTED WELL SCREEN FROM 0.70m TO 1.70m; 2MM SAND FROM 0.50m TO 0.70m; BENTONITE SEAL FROM 0.20m TO 0.50m; CASING FROM 0.15m TO m; FROM 0.01m TO 0.20m; FROM 0.00m TO 0.70m

JK_LIB_CURRENT - V8.00.GLB Log J & K AUGERHOLE - MASTER E30259KM LINDFIELD.GPJ <<DrawingFile>> 16/10/2017 14:29 Produced by gINT Professional, Developed by Datgel

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Borehole No.
3
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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: DESIGNINC SYDNEY PTY LTD
Project: PROPOSED LINDFIELD LEARNING VILLAGE DEVELOPMENT
Location: ETON ROAD, LINDFIELD, NSW

Job No.: E30259KM **Method:** SPIRAL AUGER **R.L. Surface:** N/A
Date: 8/9/17 **Datum:** AHD
Plant Type: JK300 **Logged/Checked By:** R.M./A.K.

Groundwater Record	SAMPLES				Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
	ES	ASS	ASB	SAL									
DRY ON COMPLETION	■		■						FILL: Silty sand, fine to medium grained, brown, with igneous gravel.	D			
	■ ■		■ ■		N = 8 4,3,5	1		SM	SILTY SAND: fine to medium grained, brown, trace of clay.	M			
									SANDSTONE: fine to medium grained, yellow grey.				
						2 3 4 5 6			END OF ENVIRONMENTAL HOLE AT 1.70 m				'TC' BIT REFUSAL ON BEDROCK

JK_LIB_CURRENT - V8.00.GLB Log J & K AUGERHOLE - MASTER E30259KM LINDFIELD.GPJ <<DrawingFile>> 16/10/2017 14:29 Produced by gINT Professional, Developed by Datgel

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Borehole No.
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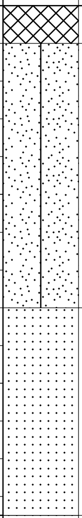
ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: DESIGNINC SYDNEY PTY LTD
Project: PROPOSED LINDFIELD LEARNING VILLAGE DEVELOPMENT
Location: ETON ROAD, LINDFIELD, NSW

Job No.: E30259KM
Method: SPIRAL AUGER
R.L. Surface: N/A
Date: 8/9/17
Datum: AHD
Plant Type: JK300
Logged/Checked By: R.M./A.K.



Groundwater Record	SAMPLES ES	ASS	ASB	SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									FILL: Silty sand, fine grained, brown, trace of igneous gravel.	D			
					N = 16 8,8,8	1		SM	SILTY SAND: fine grained, orange brown, with weathered sandstone bands.	D			
						2			SANDSTONE: fine grained, yellow grey.				
						3 4 5 6			END OF ENVIRONMENTAL HOLE AT 2.70 m				'TC' BIT REFUSAL MONITORING WELL INSTALLED TO 2.70m: BOTTOM CAP AT BASE FROM 2.55m TO m; 2MM SAND FROM 1.00m TO m; MACHINE SLOTTED WELL SCREEN FROM 0.70m TO 2.70m; CASING FROM 0.60m TO m; FROM 0.50m TO 0.70m; BENTONITE SEAL FROM 0.20m TO 0.50m; GATIC COVER AND LOCKABLE CAP FROM 0.02m TO m; FROM 0.01m TO 0.20m; FROM 0.00m TO 0.70m

JK_LIB_CURRENT - V8.00.GLB Log J & K AUGERHOLE - MASTER E30259KM LINDFIELD.GPJ <<DrawingFile>> 16/10/2017 14:30 Produced by gINT Professional, Developed by Datgel

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Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No.
5
1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: DESIGNINC SYDNEY PTY LTD
Project: PROPOSED LINDFIELD LEARNING VILLAGE DEVELOPMENT
Location: ETON ROAD, LINDFIELD, NSW

Job No.: E30259KM **Method:** SPIRAL AUGER **R.L. Surface:** N/A
Date: 8/9/17 **Datum:** AHD
Plant Type: JK300 **Logged/Checked By:** R.M./A.K.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■		■				☒		FILL: Silty sand, fine grained, brown, with sandstone gravel.	D			
	■ ■		■				▨	SM	SILTY SAND: fine grained, light brown.	D			
	■		■			1 2	▨		SANDSTONE: fine grained, grey, yellow and red, with iron indurated bands.				
						3 4 5 6			END OF ENVIRONMENTAL HOLE AT 2.60 m				'TC' BIT REFUSAL

JK_LIB_CURRENT - V8.00.GLB Log J & K AUGERHOLE - MASTER E30259KM LINDFIELD.GPJ <<DrawingFile>> 16/10/2017 14:30 Produced by gINT Professional, Developed by Datgel

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EXPLANATORY NOTES – ENVIRONMENTAL LOGS

INTRODUCTION

These notes have been provided to supplement the environmental report with regards to drilling and field logging. Not all notes are necessarily relevant to all reports. Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and manmade processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies involve gathering and assimilating limited facts about these characteristics and properties in order to understand the ground on a particular site under certain conditions. These conditions are directly relevant only to the ground at the place where, and time when, the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, the SAA Site Investigation Code. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the grading of other particles present (e.g. sandy clay) as set out below (note that unless stated in the report, the soil classification is based on a qualitative field assessment, not laboratory testing):

Soil Classification	Particle Size
Clay	less than 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2mm
Gravel	2 to 60mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose	less than 4
Loose	4 – 10
Medium dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, laboratory testing or engineering examination. The strength terms are defined as shown in the following table:

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 – 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 – 400
Hard	Greater than 400
Friable	Strength not attainable – soil crumbles

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'Shale' is used to describe thinly bedded to laminated siltstone.

DRILLING OR EXCAVATION METHODS

The following is a brief summary of drilling and excavation methods currently adopted by the Company, and some comments on their use and application. All except test pits and hand auger drilling require the use of a mechanical drilling rig.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descend into the pit. The depth of penetration is limited to approximately 3m for a backhoe and up to 6m for an excavator. Limitations of test pits include problems associated with disturbance and difficulty of reinstatement; and the consequent effects on nearby structures. Care must be taken if construction is to be carried out near test pit locations to either properly re-compact the backfill during construction, or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Premature refusal of the hand augers can occur on a variety of materials such as fill, hard clay, gravel or ironstone, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock fragments. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term ‘mud’ encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (e.g. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, an NMLC triple tube core barrel, which gives a core of about 50mm diameter, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS. The locations of losses are determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the top end of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, “Methods of Testing Soils for Engineering Purposes” – Test F3.1.

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

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as: N = 13 (4, 6, 7)
- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as: N>30 (15, 30/40mm)

The results of the test can be related empirically to the engineering properties of the soil. Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

A modification to the SPT test is where the same driving system is used with a solid 60 tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as "Nc” on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

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

The attached explanatory notes define the terms and symbols used in preparation of the logs.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than “straight line” variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

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

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

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

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (e.g. bricks, concrete, plastic, slag/ash, steel etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes

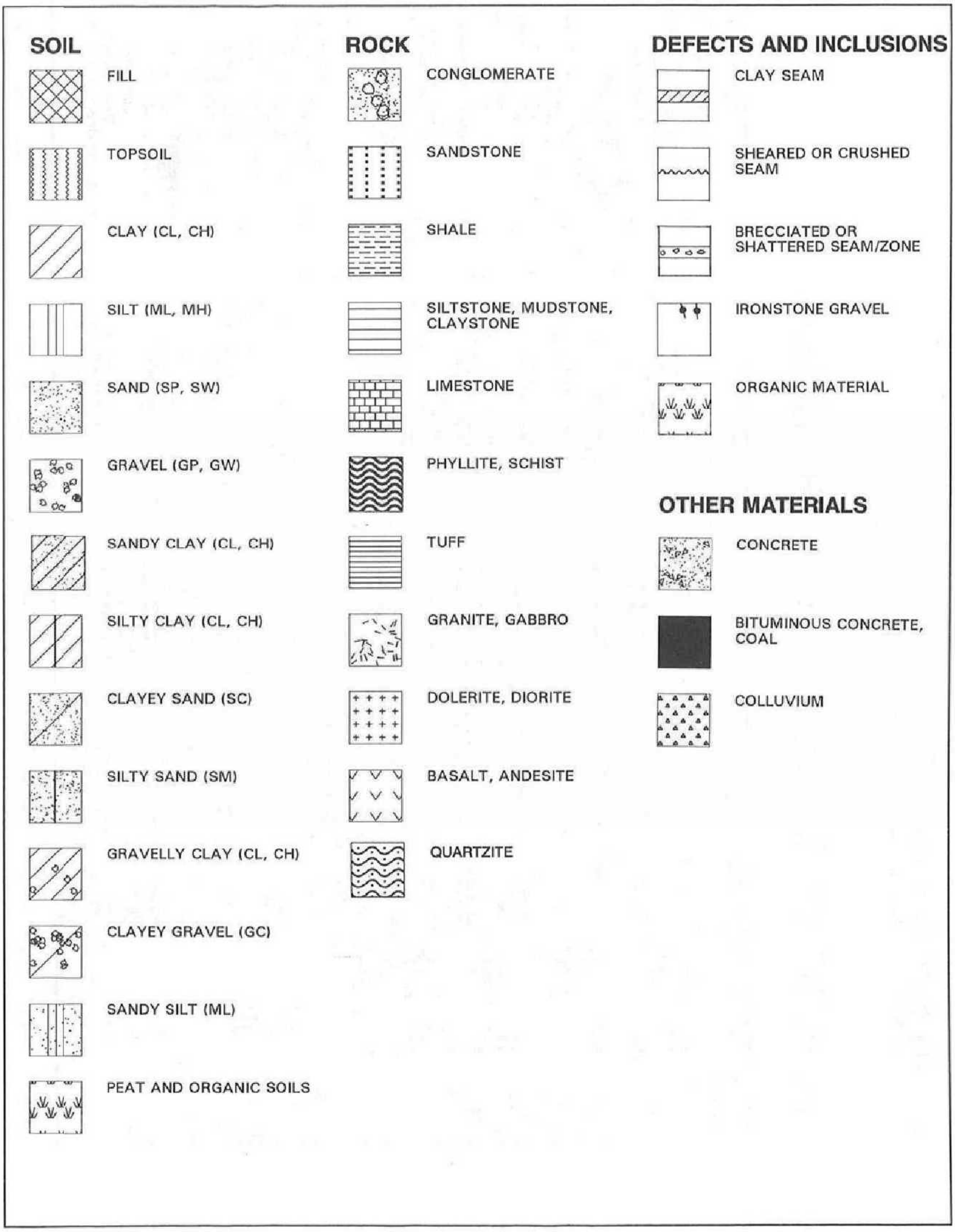
LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classifications and rocks strengths indicated on the environmental logs unless noted in the report.

SITE ANOMALIES

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, EIS should be notified immediately.

GRAPHIC LOG SYMBOLS FOR SOIL AND ROCKS



SOIL

- FILL
- TOPSOIL
- CLAY (CL, CH)
- SILT (ML, MH)
- SAND (SP, SW)
- GRAVEL (GP, GW)
- SANDY CLAY (CL, CH)
- SILTY CLAY (CL, CH)
- CLAYEY SAND (SC)
- SILTY SAND (SM)
- GRAVELLY CLAY (CL, CH)
- CLAYEY GRAVEL (GC)
- SANDY SILT (ML)
- PEAT AND ORGANIC SOILS

ROCK

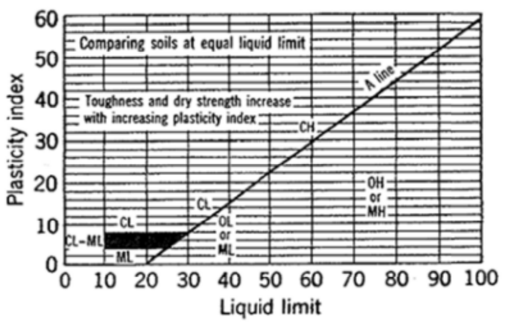
- CONGLOMERATE
- SANDSTONE
- SHALE
- SILTSTONE, MUDSTONE, CLAYSTONE
- LIMESTONE
- PHYLLITE, SCHIST
- TUFF
- GRANITE, GABBRO
- DOLERITE, DIORITE
- BASALT, ANDESITE
- QUARTZITE

DEFECTS AND INCLUSIONS

- CLAY SEAM
- SHEARED OR CRUSHED SEAM
- BRECCIATED OR SHATTERED SEAM/ZONE
- IRONSTONE GRAVEL
- ORGANIC MATERIAL

OTHER MATERIALS

- CONCRETE
- BITUMINOUS CONCRETE, COAL
- COLLUVIUM

Field Identification Procedures (Excluding particles larger than 75 μm and basing fractions on estimated weights)						Group Symbols a	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria			
Coarse-grained soils More than half of material is *larger* than 75 μm sieve size^{b} (The 75 μm sieve size is about the smallest particle visible to naked eye)	Gravels More than half of coarse fraction is larger than 4 mm sieve size	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles 12 mm maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (*SM*)	Use grain size curve in identifying the fractions as given under field identification	Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5% *GW, GP, SW, SP* More than 12% *GM, GC, SM, SC* 5% to 12% *Borderline* cases requiring use of dual symbols	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing			*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines				Not meeting all gradation requirements for *GW*	
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)			*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures				Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)			*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures				Atterberg limits above "A" line, with *PI* greater than 7	
	Sands More than half of coarse fraction is smaller than 4 mm sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes			*SW*	Well graded sands, gravelly sands, little or no fines				$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing			*SP*	Poorly graded sands, gravelly sands, little or no fines				Not meeting all gradation requirements for *SW*	
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)			*SM*	Silty sands, poorly graded sand-silt mixtures				Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)			*SC*	Clayey sands, poorly graded sand-clay mixtures				Atterberg limits below "A" line with *PI* greater than 7	
Fine-grained soils More than half of material is *smaller* than 75 μm sieve size	Identification Procedures on Fraction Smaller than 380 μm Sieve Size									 Plasticity chart for laboratory classification of fine grained soils		
			Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)							
	Silts and clays liquid limit less than 50		None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)				
			Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays					
			Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity					
	Silts and clays liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts					
			High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays					
			Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity					
Highly Organic Soils			Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils					

Note: 1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines).
2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity.

LOG SYMBOLS

LOG COLUMN	SYMBOL	DEFINITION
Groundwater Record	▼	Standing water level. Time delay following completion of drilling may be shown.
	C	Extent of borehole collapse shortly after drilling.
	▶	Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	ES	Soil sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos screening.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual show blows per 150mm penetration. 'R' as noted below.
	N_c = 5 7 3 R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60 degree solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of Undrained Shear Strength.
	PID = 100	Photoionisation detector reading in ppm (Soil sample heads pace test).
Moisture (Cohesive Soils)	MC>PL	Moisture content estimated to be greater than plastic limit.
	MC≈PL	Moisture content estimated to be approximately equal to plastic limit.
	MC<PL	Moisture content estimated to be less than plastic limit.
(Cohesionless)	D	DRY – Runs freely through fingers.
	M	MOIST – Does not run freely but no free water visible on soil surface.
	W	WET – Free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – Unconfined compressive strength less than 25kPa
	S	SOFT – Unconfined compressive strength 25-5 0kPa
	F	FIRM – Unconfined compressive strength 50-1 00kPa
	St	STIFF – Unconfined compressive strength 100- 200kPa
	VSt	VERY STIFF – Unconfined compressive strength 200- 400kPa
	H	HARD – Unconfined compressive strength greater than 400kPa
	( )	Bracketed symbol indicates estimated consistency based o n tactile examination or other tests.
Density Index/ Relative Density (Cohesionless Soils)		**Density Index (ID) Range (%)** **SPT ' N' Value Range (Blows/300mm)**
	VL	Very Loose <15 0-4
	L	Loose 15-35 4-10
	MD	Medium Dense 35-65 10-30
	D	Dense 65-85 30-50
	VD	Very Dense >85 >50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other tests.
Hand Penetrometer Readings	300 250	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Tungsten carbide wing bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.

LOG SYMBOLS CONTINUED

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the bedding. The test procedure is described by the International Journal of Rock Mechanics, Mining and Geomechanics Abstract Volume 22, No 2, 1985.

TERM	SYMBOL	Is (50) MPa	FIELD GUIDE
Extremely Low:	EL		Easily remoulded by hand to a material with soil properties.
Very Low:	VL	0.03	May be crumbled in the hand. Sandstone is “sugary” and friable.
Low:	L	0.1	A piece of core 150 mm long x 50mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
Medium Strength:	M	0.3	A piece of core 150 mm long x 50mm dia. can be broken by hand with difficulty. Readily scored with knife.
High:	H	1	A piece of core 150 mm long x 50mm dia. core cannot be broken by hand, can be slightly scratched or scored with knife; rock rings under hammer.
Very High:	VH	3	A piece of core 150 mm long x 50mm dia. may be broken with hand-held pick after more than one blow. Cannot be scratched with pen knife; rock rings under hammer.
Extremely High:	EH	10	A piece of core 150 mm long x 50mm dia. is very difficult to break with h and-held hammer . Rings when struck with a hammer.

ROCK STRENGTH

ABBREVIATION	DESCRIPTION	NOTES
Be	Bedding Plane Parting	Defect orientations measured relative to the normal to (i.e. relative to horizontal for vertical holes)
CS	Clay Seam	
J	Joint	
P	Planar	
Un	Undulating	
S	Smooth	
R	Rough	
IS	Iron stained	
XWS	Extremely Weathered Seam	
Cr	Crushed Seam	
60t	Thickness of defect in millimetres	

Appendix B: Laboratory Reports & COC Documents

SAMPLE AND CHAIN OF CUSTODY FORM

TO:
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen

EIS Job Number: **E30259KM**

Date Results Required: **STANDARD**

Page: 1 of 1

FROM:
EIS
ENVIRONMENTAL
INVESTIGATION
SERVICES
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention: **Rob Muller**

Location: **Lindfield**

Sampler: **Rob Muller**

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 2	Combo 3	Combo 6	Combo 6a	8 Metals	PAHs	TRH/BTEX	BTEX	Asbestos			
11/09/2017	1	BH1	0.0-0.2	G, A	0	Fill: silty sand				X								
11/09/2017	2	BH1	0.3-0.5	G	0	Silty sand		X										
11/09/2017	3	BH2	0.0-0.2	G, A	0	Fill: silty sand				X								
11/09/2017	4	BH2	0.3-0.5	G	0	Silty sand		X										
11/09/2017	5	BH3	0.0-0.2	G, A	0	Fill: silty sand				X								
11/09/2017	6	BH3	0.6-0.8	G	0	Silty sand		X										
11/09/2017	7	BH4	0.0-0.2	G, A	0	Fill: silty sand				X								
11/09/2017	8	BH4	0.5-0.95	G	0	Silty sand		X										
11/09/2017	9	BH5	0.0-0.2	G, A	0	Fill: silty sand				X								
11/09/2017	10	BH5	0.3-0.5	G	0	Silty sand		X										
11/09/2017	11	TB	-	G (125ml)	-	Trip blank								X				
11/09/2017	12	TS	-	V	-	Trip spike								X				
11/09/2017	13	DUP1	-	G	-	Soil duplicate		X										

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 175353.
Date Received: 11/9.
Time Received: 16:10.
Received by: AZ.
Temp: [✓ Cool]/Ambient
Cooling: Ice/[✓ Icepack]
Security: [✓ Intact]/Broken/None

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By: Rob Muller
Date: 11/9/17
Time: 10:10am
Received By:
Date:

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

SAMPLE RECEIPT ADVICE

Client Details	
Client	Environmental Investigation Services
Attention	Rob Muller

Sample Login Details	
Your reference	E30259KM, Lindfield
Envirolab Reference	175353
Date Sample Received	11/09/2017
Date Instructions Received	11/09/2017
Date Results Expected to be Reported	18/09/2017

Sample Condition	
Samples received in appropriate condition for analysis	YES
No. of Samples Provided	13 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	11.5
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments
Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticidesin soil	Organophosphorus Pesticides	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils
BH1-0.0-0.2	✓	✓	✓	✓	✓	✓	✓	✓
BH1-0.3-0.5	✓	✓	✓				✓	
BH2-0.0-0.2	✓	✓	✓	✓	✓	✓	✓	✓
BH2-0.3-0.5	✓	✓	✓				✓	
BH3-0.0-0.2	✓	✓	✓	✓	✓	✓	✓	✓
BH3-0.6-0.8	✓	✓	✓				✓	
BH4-0.0-0.2	✓	✓	✓	✓	✓	✓	✓	✓
BH4-0.5-0.95	✓	✓	✓				✓	
BH5-0.0-0.2	✓	✓	✓	✓	✓	✓	✓	✓
BH5-0.3-0.5	✓	✓	✓				✓	
TB	✓							
TS	✓							
Dup1	✓	✓	✓				✓	

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

Additional Info

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

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

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CERTIFICATE OF ANALYSIS 175353

Client Details

Client	Environmental Investigation Services
Attention	Rob Muller
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E30259KM, Lindfield**
Number of Samples	13 Soil
Date samples received	11/09/2017
Date completed instructions received	11/09/2017

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

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

Report Details

Date results requested by	18/09/2017
Date of Issue	18/09/2017

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

Results Approved By
Giovanni Agosti, Group Technical Manager
Jeremy Faircloth, Organics Supervisor
Paul Ching, Senior Analyst

Authorised By

David Springer, General Manager

vTRH(C6-C10)/BTEXN in Soil

Our Reference		175353-1	175353-2	175353-3	175353-4	175353-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.0-0.2	0.3-0.5	0.0-0.2	0.3-0.5	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	99	105	99	104	96

vTRH(C6-C10)/BTEXN in Soil

Our Reference		175353-6	175353-7	175353-8	175353-9	175353-10
Your Reference	UNITS	BH3	BH4	BH4	BH5	BH5
Depth		0.6-0.8	0.0-0.2	0.5-0.95	0.0-0.2	0.3-0.5
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	104	102	108	94	96

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		175353-11	175353-12	175353-13
Your Reference	UNITS	TB	TS	Dup1
Depth		-	-	-
Date Sampled		11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	12/09/2017	12/09/2017	12/09/2017
TRH C_6 - C_9	mg/kg	[NA]	[NA]	<25
TRH C_6 - C_{10}	mg/kg	[NA]	[NA]	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	[NA]	[NA]	<25
Benzene	mg/kg	<0.2	86%	<0.2
Toluene	mg/kg	<0.5	89%	<0.5
Ethylbenzene	mg/kg	<1	89%	<1
m+p-xylene	mg/kg	<2	90%	<2
o-Xylene	mg/kg	<1	90%	<1
Total +ve Xylenes	mg/kg	[NA]	[NA]	<1
naphthalene	mg/kg	[NA]	[NA]	<1
Surrogate aaa-Trifluorotoluene	%	105	86	110

svTRH (C10-C40) in Soil						
Our Reference		175353-1	175353-2	175353-3	175353-4	175353-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.0-0.2	0.3-0.5	0.0-0.2	0.3-0.5	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017	13/09/2017	13/09/2017	13/09/2017
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	81	81	104	88	87

svTRH (C10-C40) in Soil						
Our Reference		175353-6	175353-7	175353-8	175353-9	175353-10
Your Reference	UNITS	BH3	BH4	BH4	BH5	BH5
Depth		0.6-0.8	0.0-0.2	0.5-0.95	0.0-0.2	0.3-0.5
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017	13/09/2017	13/09/2017	13/09/2017
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	84	89	87	89	127

svTRH (C10-C40) in Soil		
Our Reference		175353-13
Your Reference	UNITS	Dup1
Depth		-
Date Sampled		11/09/2017
Type of sample		Soil
Date extracted	-	12/09/2017
Date analysed	-	13/09/2017
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	83

PAHs in Soil						
Our Reference		175353-1	175353-2	175353-3	175353-4	175353-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.0-0.2	0.3-0.5	0.0-0.2	0.3-0.5	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017	13/09/2017	13/09/2017	13/09/2017
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.06	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	mg/kg	0.06	<0.05	<0.05	<0.05	<0.05
Surrogate p-Terphenyl-d14	%	98	86	99	99	84

PAHs in Soil						
Our Reference	UNITS	175353-6	175353-7	175353-8	175353-9	175353-10
Your Reference		BH3	BH4	BH4	BH5	BH5
Depth		0.6-0.8	0.0-0.2	0.5-0.95	0.0-0.2	0.3-0.5
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017	13/09/2017	13/09/2017	13/09/2017
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	0.1	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	mg/kg	<0.05	1.3	<0.05	<0.05	<0.05
Surrogate p-Terphenyl-d14	%	95	88	87	86	90

PAHs in Soil		
Our Reference		175353-13
Your Reference	UNITS	Dup1
Depth		-
Date Sampled		11/09/2017
Type of sample		Soil
Date extracted	-	12/09/2017
Date analysed	-	13/09/2017
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Total +ve PAH's	mg/kg	<0.05
Surrogate p-Terphenyl-d14	%	85

Organochlorine Pesticides in soil						
Our Reference		175353-1	175353-3	175353-5	175353-7	175353-9
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.0-0.2	0.0-0.2	0.0-0.2	0.0-0.2	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	1.5
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	86	107	109	99	116

Organophosphorus Pesticides						
Our Reference		175353-1	175353-3	175353-5	175353-7	175353-9
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.0-0.2	0.0-0.2	0.0-0.2	0.0-0.2	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	86	107	109	99	116

PCBs in Soil						
Our Reference		175353-1	175353-3	175353-5	175353-7	175353-9
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.0-0.2	0.0-0.2	0.0-0.2	0.0-0.2	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	86	107	109	99	116

Acid Extractable metals in soil						
Our Reference		175353-1	175353-2	175353-3	175353-4	175353-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.0-0.2	0.3-0.5	0.0-0.2	0.3-0.5	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017	13/09/2017	13/09/2017	13/09/2017
Arsenic	mg/kg	<4	<4	5	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	8	6	17	9	11
Copper	mg/kg	16	3	5	2	4
Lead	mg/kg	48	10	14	11	12
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	9	<1	3	2	3
Zinc	mg/kg	44	6	17	12	18

Acid Extractable metals in soil						
Our Reference		175353-6	175353-7	175353-8	175353-9	175353-10
Your Reference	UNITS	BH3	BH4	BH4	BH5	BH5
Depth		0.6-0.8	0.0-0.2	0.5-0.95	0.0-0.2	0.3-0.5
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017	13/09/2017	13/09/2017	13/09/2017
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	12	10	10	12	10
Copper	mg/kg	<1	14	1	78	3
Lead	mg/kg	6	20	11	25	11
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<1	7	1	9	3
Zinc	mg/kg	3	36	30	48	19

Acid Extractable metals in soil			
Our Reference		175353-13	175353-14
Your Reference	UNITS	Dup1	BH1 - [TRIPLICATE]
Depth		-	0.0-0.2
Date Sampled		11/09/2017	11/09/2017
Type of sample		Soil	Soil
Date prepared	-	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017
Arsenic	mg/kg	<4	<4
Cadmium	mg/kg	<0.4	<0.4
Chromium	mg/kg	29	9
Copper	mg/kg	9	19
Lead	mg/kg	10	15
Mercury	mg/kg	<0.1	<0.1
Nickel	mg/kg	26	12
Zinc	mg/kg	24	37

Moisture						
Our Reference		175353-1	175353-2	175353-3	175353-4	175353-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		0.0-0.2	0.3-0.5	0.0-0.2	0.3-0.5	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017	13/09/2017	13/09/2017	13/09/2017
Moisture	%	6.7	6.5	8.1	8.2	7.0

Moisture						
Our Reference		175353-6	175353-7	175353-8	175353-9	175353-10
Your Reference	UNITS	BH3	BH4	BH4	BH5	BH5
Depth		0.6-0.8	0.0-0.2	0.5-0.95	0.0-0.2	0.3-0.5
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/09/2017	12/09/2017	12/09/2017	12/09/2017	12/09/2017
Date analysed	-	13/09/2017	13/09/2017	13/09/2017	13/09/2017	13/09/2017
Moisture	%	12	3.7	5.1	4.9	5.4

Moisture		
Our Reference		175353-13
Your Reference	UNITS	Dup1
Depth		-
Date Sampled		11/09/2017
Type of sample		Soil
Date prepared	-	12/09/2017
Date analysed	-	13/09/2017
Moisture	%	6.5

Asbestos ID - soils						
Our Reference		175353-1	175353-3	175353-5	175353-7	175353-9
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.0-0.2	0.0-0.2	0.0-0.2	0.0-0.2	0.0-0.2
Date Sampled		11/09/2017	11/09/2017	11/09/2017	11/09/2017	11/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	15/09/2017	15/09/2017	15/09/2017	15/09/2017	15/09/2017
Sample mass tested	g	25.68g	Approx. 20g	Approx. 25g	Approx. 35g	Approx. 15g
Sample Description	-	Brown sandy soil	Brown sandy soil	Brown sandy soil	Brown sandy soil & rocks	Brown sandy soil
Asbestos ID in soil	-	Chrysotile asbestos detected Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

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

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

Client Reference: E30259KM, Lindfield

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	175353-3
Date extracted	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Date analysed	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	104	103
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	104	103
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	107	105
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	107	108
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	102	101
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	101	101
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	102	103
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	112	1	99	105	6	111	105

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Date analysed	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	[NT]	9	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	[NT]	9	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-016	[NT]	9	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-016	[NT]	9	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-016	[NT]	9	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-016	[NT]	9	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-016	[NT]	9	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-014	[NT]	9	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	[NT]	9	94	104	10	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	175353-3
Date extracted	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Date analysed	-			13/09/2017	1	13/09/2017	13/09/2017		13/09/2017	13/09/2017
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	112	103
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	118	93
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	106	88
TRH $>C_{10}$-C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	112	103
TRH $>C_{16}$-C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	118	93
TRH $>C_{34}$-C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	106	88
Surrogate o-Terphenyl	%		Org-003	95	1	81	81	0	106	104

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Date analysed	-			[NT]	9	13/09/2017	13/09/2017		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	[NT]	9	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	[NT]	9	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	[NT]	9	<100	<100	0	[NT]	[NT]
TRH $>C_{10}$-C_{16}	mg/kg	50	Org-003	[NT]	9	<50	<50	0	[NT]	[NT]
TRH $>C_{16}$-C_{34}	mg/kg	100	Org-003	[NT]	9	<100	<100	0	[NT]	[NT]
TRH $>C_{34}$-C_{40}	mg/kg	100	Org-003	[NT]	9	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-003	[NT]	9	89	96	8	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	175353-3
Date extracted	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Date analysed	-			13/09/2017	1	13/09/2017	13/09/2017		13/09/2017	13/09/2017
Naphthalene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	96	97
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	107	107
Phenanthrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	104	106
Anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	100	112
Pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	102	108
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	119	120
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	1	0.06	<0.05	18	108	107
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	89	1	98	86	13	91	102

QUALITY CONTROL: PAHs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Date analysed	-			[NT]	9	13/09/2017	13/09/2017		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	[NT]	9	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	[NT]	9	<0.05	<0.05	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	[NT]	9	86	88	2	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	175353-3
Date extracted	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Date analysed	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
HCB	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	92	95
gamma-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	91	86
Heptachlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	78	82
delta-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	85	88
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	84	84
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	99	104
Dieldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	98	102
Endrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	82	84
pp-DDD	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	99	105
Endosulfan II	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	73	81
Methoxychlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	86	1	86	86	0	107	111

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Date analysed	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
HCB	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-005	[NT]	9	1.5	1.3	14	[NT]	[NT]
Endrin	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-005	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	[NT]	9	116	108	7	[NT]	[NT]

QUALITY CONTROL: Organophosphorus Pesticides					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	175353-3
Date extracted	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Date analysed	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	85	88
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	88	86
Dimethoate	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	107	99
Fenitrothion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	82	118
Malathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	92	102
Parathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	89	91
Ronnel	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	100	103
Surrogate TCMX	%		Org-008	86	1	86	86	0	98	96

QUALITY CONTROL: Organophosphorus Pesticides					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Date analysed	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Dimethoate	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Fenitrothion	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Malathion	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Parathion	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-008	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-008	[NT]	9	116	108	7	[NT]	[NT]

QUALITY CONTROL: PCBs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	175353-3
Date extracted	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Date analysed	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	102	105
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	86	1	86	86	0	98	96

QUALITY CONTROL: PCBs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Date analysed	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	[NT]	9	116	108	7	[NT]	[NT]

Client Reference: E30259KM, Lindfield

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	175353-3
Date prepared	-			12/09/2017	1	12/09/2017	12/09/2017		12/09/2017	12/09/2017
Date analysed	-			13/09/2017	1	13/09/2017	13/09/2017		13/09/2017	13/09/2017
Arsenic	mg/kg	4	Metals-020	<4	1	<4	<4	0	107	90
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	92	86
Chromium	mg/kg	1	Metals-020	<1	1	8	10	22	101	79
Copper	mg/kg	1	Metals-020	<1	1	16	16	0	107	109
Lead	mg/kg	1	Metals-020	<1	1	48	17	95	97	93
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	110	109
Nickel	mg/kg	1	Metals-020	<1	1	9	10	11	97	94
Zinc	mg/kg	1	Metals-020	<1	1	44	37	17	96	97

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	9	12/09/2017	12/09/2017		[NT]	[NT]
Date analysed	-			[NT]	9	13/09/2017	13/09/2017		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	9	<4	<4	0	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	9	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	9	12	12	0	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	9	78	78	0	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	9	25	24	4	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	9	9	8	12	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	9	48	46	4	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 175353-1 for Pb. Therefore a triplicate result has been issued as laboratory sample number 175353-14.

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples 175353-1, 3, 5, 7, 9 were sub-sampled from bags provided by the client.

Sample 175353-1; Chrysotile asbestos identified embedded in a fragment of fibre cement, it is estimated to be 3.25g/kg in 25.68g of soil (i.e. > reporting limit for the method of 0.1g/kg).

Appendix C: Report Explanatory Notes

STANDARD SAMPLING PROCEDURE (SSP)

These protocols specify the basic procedures to be used when sampling soils or groundwater for environmental site assessments undertaken by EIS.

The purpose of these protocols is to provide standard methods for: sampling, decontamination procedures for sampling equipment, sample preservation, sample storage and sample handling. Deviations from these procedures must be recorded.

Soil Sampling

- Prepare a borehole/test pit log or made a note of the sample description for stockpiles.
- Layout sampling equipment on clean plastic sheeting to prevent direct contact with ground surface. The work area should be at a distance from the drill rig/excavator such that the machine can operate in a safe manner.
- Ensure all sampling equipment has been decontaminated prior to use.
- Remove any surface debris from the immediate area of the sampling location.
- Collect samples and place in glass jar with a Teflon seal. This should be undertaken as quickly as possible to prevent the loss of any volatiles. If possible, fill the glass jars completely.
- Collect samples for asbestos analysis and place in a zip-lock plastic bag.
- Label the sampling containers with the EIS job number, sample location (e.g. BH1), sampling depth interval and date. If more than one sample container is used, this should also be indicated (e.g. 2 = Sample jar 1 of 2 jars).
- Photoionisation detector (PID) screening of volatile organic compounds (VOCs) should be undertaken on samples using the soil sample headspace method. Headspace measurements are taken following equilibration of the headspace gasses in partly filled zip-lock plastic bags. PID headspace data is recorded on the borehole/test pit log and the chain of custody forms.
- Record the lithology of the sample and sample depth on the borehole/test pit log generally in accordance with AS1726-1993[15].
- Store the sample in a sample container cooled with ice or chill packs. On completion of the sampling the sample container should be delivered to the lab immediately or stored in the refrigerator prior to delivery to the lab. All samples are preserved in accordance with the standards outlined in the report.
- Check for the presence of groundwater after completion of each borehole using an electronic dip metre or water whistle. Boreholes should be left open until the end of fieldwork. All groundwater levels in the boreholes should be rechecked on the completion of the fieldwork.
- Backfill the boreholes/test pits with the excavation cuttings or clean sand prior to leaving the site.

Decontamination Procedures for Soil Sampling Equipment

- All sampling equipment should be decontaminated between every sampling location. This excludes single use PVC tubing used for push tubes etc. Equipment and materials required for the decontamination include:
  - Phosphate free detergent (Decon 90);
  - Potable water;
  - Stiff brushes; and
  - Plastic sheets.

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[15] Standards Australia, (1993), *Geotechnical Site Investigations.* (AS1726-1993)

- Ensure the decontamination materials are clean prior to proceeding with the decontamination.
- Fill both buckets with clean potable water and add phosphate free detergent to one bucket.
- In the bucket containing the detergent, scrub the sampling equipment until all the material attached to the equipment has been removed.
- Rinse sampling equipment in the bucket containing potable water.
- Place cleaned equipment on clean plastic sheets.

If all materials are not removed by this procedure, high-pressure water cleaning is recommended. If any equipment is not completely decontaminated by both these processes, then the equipment should not be used until it has been thoroughly cleaned.

Groundwater Sampling

Groundwater samples are more sensitive to contamination than soil samples and therefore adhesion to this protocol is particularly important to obtain reliable, reproducible results. The recommendations detailed in AS/NZS 5667.1:1998 are considered to form a minimum standard.

The basis of this protocol is to maintain the security of the borehole and obtain accurate and representative groundwater samples. The following procedure should be used for collection of groundwater samples from previously installed groundwater monitoring wells.

- After monitoring well installation, at least three bore volumes should be pumped from the monitoring wells (well development) to remove any water introduced during the drilling process and/or the water that is disturbed during installation of the monitoring well. This should be completed prior to purging and sampling.
- Groundwater monitoring wells should then be left to recharge for at least three days before purging and sampling. Prior to purging or sampling, the condition of each well should observed and any anomalies recorded on the field data sheets. The following information should be noted: the condition of the well, noting any signs of damage, tampering or complete destruction; the condition and operation of the well lock; the condition of the protective casing and the cement footing (raised or cracked); and, the presence of water between protective casing and well.
- Take the groundwater level from the collar of the piezometer/monitoring well using an electronic dip meter. The collar level should be taken (if required) during the site visit using a dumpy level and staff.
- Purging and sampling of piezometers/monitoring wells is done on the same site visit when using micro-purge (or other low flow) techniques.
- Layout and organize all equipment associated with groundwater sampling in a location where they will not interfere with the sampling procedure and will not pose a risk of contaminating samples. Equipment generally required includes:
    - Micropore filtration system or Stericup single-use filters (for heavy metals samples);
    - Filter paper for Micropore filtration system; Bucket with volume increments;
    - Sample containers: teflon bottles with 1 ml nitric acid, 75mL glass vials with 1 mL hydrochloric acid, 1 L amber glass bottles;
    - Bucket with volume increments;
    - Flow cell;
    - pH/EC/Eh/T meters;
    - Plastic drums used for transportation of purged water;
    - Esky and ice;
    - Nitrile gloves;
    - Distilled water (for cleaning);
    - Electronic dip meter;

  - Low flow pump pack and associated tubing; and
  - Groundwater sampling forms.
- If single-use stericup filtration is not used, clean the Micropore filtration system thoroughly with distilled water prior to use and between each sample. Filter paper should be changed between samples. 0.45um filter paper should be placed below the glass fibre filter paper in the filtration system.
- Ensure all non-disposable sampling equipment is decontaminated or that new disposable equipment is available prior to any work commencing at a new location. The procedure for decontamination of groundwater equipment is outlined at the end of this section.
- Disposable gloves should be used whenever samples are taken to protect the sampler and to assist in avoidance of contamination.
- Groundwater samples are obtained from the monitoring wells using low flow/micro-purge sampling equipment to reduce the disturbance of the water column and loss of volatiles.
- During pumping to purge the well, the pH, temperature, conductivity, dissolved oxygen, redox potential and groundwater levels are monitored (where possible) using calibrated field instruments to assess the development of steady state conditions. Steady state conditions are generally considered to have been achieved when the difference in the pH measurements was less than 0.2 units and the difference in conductivity was less than 10%.
- All measurements are recorded on specific data sheets.
- Once steady state conditions are considered to have been achieved, groundwater samples are obtained directly from the pump tubing and placed in appropriate glass bottles, BTEX vials or plastic bottles.
- All samples are preserved in accordance with water sampling requirements detailed in the NEPM 2013 and placed in an insulated container with ice. Groundwater samples are preserved by immediate storage in an insulated sample container with ice as outlined in the report text.
- Record the sample on the appropriate log in accordance with AS1726:1993. At the end of each water sampling complete a chain of custody form.

Decontamination Procedures for Groundwater Sampling Equipment

- All equipment associated with the groundwater sampling procedure (other than single-use items) should be decontaminated between every sampling location.
- The following equipment and materials are required for the decontamination procedure:
  - Phosphate free detergent;
  - Potable water;
  - Distilled water; and
  - Plastic Sheets or bulk bags (plastic bags).
- Fill one bucket with clean potable water and phosphate free detergent, and one bucket with distilled water.
- Flush potable water and detergent through pump head. Wash sampling equipment and pump head using brushes in the bucket containing detergent until all materials attached to the equipment are removed.
- Flush pump head with distilled water.
- Change water and detergent solution after each sampling location.
- Rinse sampling equipment in the bucket containing distilled water.
- Place cleaned equipment on clean plastic sheets.
- If all materials are not removed by this procedure that equipment should not be used until it has been thoroughly cleaned

QA/QC DEFINITIONS

The QA/QC terms used in this report are defined below. The definitions are in accordance with US EPA publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (1994[16]) methods and those described in *Environmental Sampling and Analysis, A Practical Guide,* (H. Keith 1991[17]).

Practical Quantitation Limit (PQL), Limit of Reporting (LOR) & Estimated Quantitation Limit (EQL)

These terms all refer to the concentration above which results can be expressed with a minimum 95% confidence level. The laboratory reporting limits are generally set at ten times the standard deviation for the Method Detection limit (MDL) for each specific analyte. For the purposes of this report the LOR, PQL, and EQL are considered to be equivalent.

When assessing laboratory data it should be borne in mind that values at or near the PQL have two important limitations.

"The uncertainty of the measurement value can approach, and even equal, the reported value. Secondly, confirmation of the analytes reported is virtually impossible unless identification uses highly selective methods. These issues diminish when reliably measurable amounts of analytes are present. Accordingly, legal and regulatory actions should be limited to data at or above the reliable detection limit" Keith 1991.

Precision

The degree to which data generated from repeated measurements differ from one another due to random errors. Precision is measured using the standard deviation or Relative Percent Difference (RPD). Acceptable targets for precision in this report will be less than 50% RPD for concentrations greater than ten times the PQL, less than 75% RPD for concentrations between five and ten times the PQL and less than 100% RPD for concentrations that are less than five times the PQL.

Accuracy

Accuracy is a measure of the agreement between an experimental result and the true value of the parameter being measured. The assessment of accuracy for an analysis can be achieved through the analysis of known reference materials or assessed by the analysis of surrogates, field blanks, trip spikes and matrix spikes.

The proximity of an averaged result to the true value, where all random errors have been statistically removed. Accuracy is measured by percent recovery. Acceptable limits for accuracy generally lie between 70% to 130% recoveries. Certain laboratory methods may allow for values that lie outside these limits.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is primarily dependent upon the design and implementation of the sampling program. Representativeness of the data is partially ensured by the avoidance of contamination, adherence to sample handing and analysis protocols and use of proper chain-of-custody and documentation procedures.

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[16] US EPA, (1994), *SW-846: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* (US EPA SW-846)

[17] Keith, H. (1991), *Environmental Sampling and Analysis, A Practical Guide.*

Completeness

Completeness is a measure of the number of valid measurements in a data set compared to the total number of measurements made and overall performance against DQIs. The following information is assessed for completeness:

- Chain-of-custody forms; Sample receipt form;
- All sample results reported; All blank data reported;
- All laboratory duplicate and RPDs calculated;
- All surrogate spike data reported;
- All matrix spike and lab control spike (LCS) data reported and RPDs calculated;
- Spike recovery acceptable limits reported; and
- NATA stamp on reports.

Comparability

Comparability is the evaluation of the similarity of conditions (e.g. sample depth, sample homogeneity) under which separate sets of data are produced. Data comparability checks include a bias assessment that may arise from the following sources:

- Collection and analysis of samples by different personnel; Use of different techniques;
- Collection and analysis by the same personnel using the same methods but at different times; and
- Spatial and temporal changes (due to environmental dynamics).

Blanks

The purpose of laboratory and field blanks is to check for artifacts and interferences that may arise during sampling and analysis.

Matrix Spikes

Samples are spiked with laboratory grade standards to detect interactive effects between the sample matrix and the analytes being measured. Matrix Spikes are reported as a percent recovery and are prepared for 1 in every 20 samples. Sample batches that contain less than 20 samples may be reported with a Matrix Spike from another batch. The percent recovery is calculated using the formula below. Acceptable recovery limits are 70% to 130%.

$$\frac{(\text{Spike Sample Result} - \text{Sample Result}) \times 100}{\text{Concentration of Spike Added}}$$

Surrogate Spikes

Samples are spiked with a known concentration of compounds that are chemically related to the analyte being investigated but unlikely to be detected in the environment. The purpose of the Surrogate Spikes is to check the accuracy of the analytical technique. Surrogate Spikes are reported as percent recovery.

Duplicates

Laboratory duplicates measure precision, expressed as Relative Percent Difference. Duplicates are prepared from a single field sample and analysed as two separate extraction procedures in the laboratory. The RPD is calculated using the formula where D1 is the sample concentration and D2 is the duplicate sample concentration:

$$\frac{(D1 - D2) \times 100}{\{(D1 + D2)/2\}}$$