



ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

C & L COSTAS PTY LTD

ON

PRELIMINARY STAGE 2 ENVIRONMENTAL SITE ASSESSMENT

FOR

PROPOSED MIXED USE DEVELOPMENT

AT

**41 BROADARROW ROAD,
NARWEE, NSW 2209**

2 February 2017

Ref: E25086KGrpt2



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EXECUTIVE SUMMARY

C & L Costas Pty Ltd ('the client') commissioned Environmental Investigation Services (EIS)¹ to undertake a Preliminary Stage 2 Environmental Site Assessment (Stage 2 ESA) for the Caltex service station at 41 Broadarrow Road, Narwee. The site location is shown on Figure 1 and the assessment was confined to the site boundaries as shown on Figure 2.

EIS installed three groundwater monitoring wells within the site in 2011 and tested the groundwater as recommended in the UPSS Regulation (2014²). Targeted contaminants above the site assessment criteria were not detected in the wells (Ref: E25086KG-Rpt dated 5 September 2011³). EIS also regularly screened groundwater in the three monitoring wells to identify the presence or absence of phase separated hydrocarbons (PSH) and inspect for visual or olfactory indications of petroleum hydrocarbons in the groundwater in the wells. The testing did not indicate visual evidence of PSH or hydrocarbon contamination in the wells. The assessment of soil contamination conditions was not undertaken by EIS in the past.

The objectives of the current Stage 2 ESA were to make a preliminary assessment of the soil and groundwater contamination conditions and assess whether the site is suitable or can be made suitable for the proposed development from a contamination viewpoint. EIS were unaware of the details of the proposed development at the time of the preparation of this report.

The site is located on the north-eastern corner of Broad Arrow Road and Hurst Place, Narwee, in Sydney's south-west. The local topography is gently undulating, generally sloping down towards the east. The site slopes gently down towards the east towards Wolli Creek, located approximately 1.5km east/north-east of the site.

At the time of the investigation, the site was used as a service station. Two buildings were located on-site, a two-storey workshop in the north-west of the site and an adjacent one-storey retail outlet. A canopy extended from the retail outlet approximately 15m to the south, close to the southern site boundary. Approximately six fuel dispensers were located beneath the canopy. Site surface observations indicated that approximately eleven underground storage tanks (USTs) were located on-site, as shown in Figure 2. Commercial properties were located across Hurst Place to the west, while a mixture of commercial and residential properties were located across Broad Arrow Road to the south. A rail corridor and railway tracks bordered the site to the north and the rail corridor bordered the site to the east.

The DBYD plans indicated that a sewer main extends through the north section of the site in an east-west direction and a Telstra line extends from Hurst Place to the middle of the site. There is a potential for the sewer and Telstra trenches to act as a preferential pathway for contamination migration (i.e. through relatively permeable backfill).

Surface water bodies were not identified in the immediate vicinity of the site. The closest surface water body is Wolli Creek located approximately 1.5km to the east/north-east of the site. This is considered to be a potential receptor.

The site appears to have been historically filled to achieve the existing levels. The fill may have been imported from various sources and could be contaminated. As the site is an active service station USTs were present at the site. The USTs may store diesel and petrol. Part of the site is used as a mechanics workshop. Fuels, oils and solvents may have been used during this site use. Hazardous building materials may be present in the existing buildings/ structures on site. Narwee railway station and associated rail lines were located at immediate north of the site. Coal, fuels and oils may have been used within the rail corridor.

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

² *Protection of Environment Operation (Underground Petroleum Storage Systems) Regulation*, NSW Government, 2014 (UPSS Regulation)

³ *Installation of Wells and UPSS Assessment Report*, (UPSS Report 2011)

Samples for this investigation were obtained from 4 sampling points as shown on the attached Figure 2. This density is approximately 67% of the minimum sampling density recommended by the EPA. Due to existing buildings, canopy and USTs it was not possible to sample the entire site at this stage.

Groundwater grab samples were obtained on 16 December 2016 from three existing monitoring wells installed in 2011.

Soil samples were obtained on 11 January 2017 in accordance with the standard sampling procedure (SSP) attached in the appendices. 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. Borehole logs attached in the appendices. On completion of the fieldwork, all the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures.

The assessment has identified the following data gaps:

- Areas beneath the existing buildings, canopy and close to the USTs have not been included in the assessment; and
- The presence of hazardous building materials in the existing buildings has not been assessed.

EIS consider that the report objectives have been addressed. Based on the scope of work undertaken, EIS are of the opinion that the Area of Environmental Concern identified in the Preliminary Conceptual Site Model pose relatively low risk to the site receptors under current configuration.

Based on the finding EIS consider that the site is suitable for ongoing use as a service station in the current configuration. If the site use is changed then the additional work described below will be necessary. Provided that this is resolved successfully the site should be suitable for the proposed development.

If the site use changes from the existing service station, EIS consider that the site can be made suitable for the proposed development provided that the following recommendations are implemented to address the data gaps and to characterise the risks:

1. Undertake a Hazardous Materials Assessment (Hazmat) for the existing buildings prior to the commencement of demolition work;
2. Once all the buildings, canopy and USTs have been removed undertake a soil sampling and assessment program; and
3. Undertake soil sampling and assessment from the base and walls of the UST pits and any other excavation pits.

Based on the findings of the above recommendations further works, including remediation and validation may be required.

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.

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
Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene	BTEXN
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 Assessment Criteria	EAC
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

ABBREVIATIONS

Photo-ionisation Detector	PID
Practical Quantitation Limit	PQL
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

C & L Costas Pty Ltd ('the client') commissioned Environmental Investigation Services (EIS)⁴ to undertake a Preliminary Stage 2 Environmental Site Assessment (Stage 2 ESA) for the Caltex service station at 41 Broadarrow Road, Narwee. The site location is shown on Figure 1 and the assessment was confined to the site boundaries as shown on Figure 2.

1.1 Background

EIS installed three groundwater monitoring wells within the site in 2011 and tested the groundwater as recommended in the UPSS Regulation (2014⁵). Targeted contaminants above the site assessment criteria were not detected in the wells (Ref: E25086KG-Rpt dated 5 September 2011⁶).

EIS also regularly screened groundwater in the three monitoring wells to identify the presence or absence of phase separated hydrocarbons (PSH) and inspect for visual or olfactory indications of petroleum hydrocarbons in the groundwater in the wells. The testing did not indicate visual evidence of PSH or hydrocarbon contamination in the wells. The assessment of soil contamination conditions was not undertaken by EIS in the past.

1.2 Objectives

The objectives of the current Stage 2 ESA were to make a preliminary assessment of the soil and groundwater contamination conditions and assess whether the site is suitable or can be made suitable for the proposed development from a contamination viewpoint.

EIS were unaware of the details of the proposed development at the time of the preparation of this report.

1.3 Scope of Work

The Stage 2 ESA was undertaken generally in accordance with an EIS proposal (Ref: EP4398KG) of 6 December 2016 and written acceptance from the client. The scope of work included the following:

- Drill four boreholes and sample the fill and natural soil based on field observations;
- Collect groundwater grab samples from three existing groundwater monitoring wells;
- Laboratory analysis of both soil and groundwater samples;
- Interpretation of the analytical results against the adopted site assessment criteria (SAC);
- Assessment of data quality; and
- Preparation of an ESA report presenting the results of the assessment.

⁴ Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)

⁵ *Protection of Environment Operation (Underground Petroleum Storage Systems) Regulation*, NSW Government, 2014 (UPSS Regulation)

⁶ *Installation of Wells and UPSS Assessment Report*, (UPSS Report 2011)

The report was prepared with reference to regulations/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) ⁷
State Environmental Planning Policy No.55 – Remediation of Land (1998) ⁸
Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998) ⁹
Guidelines for Consultants Reporting on Contaminated Sites (2011) ¹⁰
Guidelines for the NSW Site Auditor Scheme, 2nd Edition (2006) ¹¹
National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) ¹²

⁷ NSW Government Legislation, (1997). *Contaminated Land Management Act 1997*. (referred to as CLM Act 1997)

⁸ NSW Government, (1998). *State Environmental Planning Policy No. 55 – Remediation of Land*. (referred to as SEPP55)

⁹ Department of Urban Affairs and Planning, and Environment Protection Authority, (1998). *Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land*. (SEPP55 Planning Guidelines)

¹⁰ NSW Office of Environment and Heritage (OEH), (2011). *Guidelines for Consultants Reporting on Contaminated Sites*. (referred to as Reporting Guidelines 2011)

¹¹ NSW DEC, (2006). *Guidelines for the NSW Site Auditor Scheme, 2nd ed.* (referred to as Site Auditor Guidelines 2006)

¹² 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 **Site Identification**

Table 2-1: Site Identification

Site Address:	41 Broadarrow Road, Narwee
Lot & Deposited Plan:	Lot 10 in DP 875415
Current Land Use:	Service Station and Mechanical Workshop
Proposed Land Use:	Mixed Use (commercial/residential)
Local Government Authority (LGA):	City of Canterbury Bankstown
Site Area (m ²)(approx.):	1,670
RL (AHD in m) (approx.):	38
Geographical Location (decimal degrees) (approx.):	Latitude: -33.948182 Longitude: 151.071054

2.2 **Site Location and Regional Setting**

The site is located on the north-eastern corner of Broad Arrow Road and Hurst Place, Narwee, in Sydney's south-west.

2.3 **Topography**

The local topography is gently undulating, generally sloping down towards the east. The site slopes gently down towards the east towards Wolli Creek, located approximately 1.5km east/north-east of the site.

2.4 **Site Inspection**

At the time of the investigation, the site was used as a service station. Two buildings were located on-site, a two-storey workshop in the north-west of the site and an adjacent one-storey retail outlet. A canopy extended from the retail outlet approximately 15m to the south, close to the southern site boundary. Approximately six fuel dispensers were located beneath the canopy. Site surface observations indicated that approximately eleven underground storage tanks (USTs) were located on-site, as shown in Figure 2.

Commercial properties were located across Hurst Place to the west, while a mixture of commercial and residential properties were located across Broad Arrow Road to the south. A rail corridor and railway tracks bordered the site to the north and the rail corridor bordered the site to the east.

2.4.1 **Sensitive Environments**

Sensitive environments such as wetlands, ponds, creeks or extensive areas of natural vegetation were not identified on site or in the immediate surrounds.

2.5 Underground Services

The 'Dial Before You Dig' (DBYD) plans were reviewed for the assessment in order to establish whether any major underground services exist at the site or in the immediate vicinity that could act as a preferential pathway for contamination migration. The DBYD plans indicated that a sewer main extends through the north section of the site in an east-west direction and a Telstra line extends from Hurst Place to the middle of the site. There is a potential for the sewer and Telstra trenches to act as a preferential pathway for contamination migration (i.e. through relatively permeable backfill). Copies of the relevant plans are attached in the appendices.

3 GEOLOGY AND HYDROGEOLOGY

3.1 Regional Geology

A review of the regional geological map of Sydney (1983¹³), indicates that the site is underlain by Ashfield Shale of the Wianamatta Group, which typically consists of black to dark grey shale and laminite.

3.2 Receiving Water Bodies

Surface water bodies were not identified in the immediate vicinity of the site. The closest surface water body is Wolli Creek located approximately 1.5km to the east/north-east of the site. This is considered to be a potential receptor.

¹³ Department of Mineral Resources, (1983). *1:100,000 Geological Map of Sydney (Series 9130)*.

4 **CONCEPTUAL SITE MODEL**

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 site information (including the site inspection information) and the review of site history information. Reference should also be made to the figures attached in the appendices.

4.1 **Potential Contamination Sources and CoPC**

The potential contamination sources and Contaminants of Potential Concern (CoPC) are presented in the following table:

Table 4-1: Potential Contamination Sources and Contaminants of Potential Concern

Source / Area of Environmental Concern (AEC)	CoPC
<u>Fill material</u> - The site appears to have been historically filled to achieve the existing levels. The fill may have been imported from various sources and could be contaminated.	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.
<u>Fuel storage</u> – As the site is an active service station USTs were present at the site. The USTs may store diesel and petrol.	Lead, TRH, BTEX and PAHs.
<u>Mechanics Workshop</u> – Part of the site is used as a mechanics workshop. Fuels, oils and solvents may have been used during this site use.	Heavy metals, TRH, BTEX, volatile organic compounds (VOCs) possibly including chlorinated solvents such as trichloroethylene (TCE) which is commonly used as a degreaser.
<u>Hazardous Building Material</u> – Hazardous building materials may be present in the existing buildings/ structures on site.	Asbestos, lead and PCBs.
<u>Offsite: Railway Lines</u> - Narwee railway station and associated rail lines were located at immediate north of the site. Coal, fuels and oils may have been used within the rail corridor.	PAHs, PCBs, TRH and heavy metals.

4.2 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 are outlined in the following CSM table:

Table 4-2: CSM

Potential mechanism for contamination	<p>Potential mechanisms for contamination include:</p> <ul style="list-style-type: none"> • 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); • Fuel storage – ‘top-down’, spills (e.g. during filling of the tanks and/or dispensing activities), or sub-surface release (e.g. from leaking tank or pipework); • Mechanics workshop - ‘top-down’, spills (e.g. leaks through cracks in the pavement), or sub-surface release (e.g. from leaking separator/grease pits or sewer pipework); • Hazardous building materials – ‘top-down’ (e.g. demolition resulting in surficial impacts in unpaved areas); • Offsite Rail Lines – ‘top-down’, spill or sub-surface release. Impacts to the site could occur via migration of contaminated groundwater.
Affected media	Soil and groundwater have been identified as potentially affected media.
Receptor identification	Human receptors include site occupants/users and maintenance workers. Off-site human receptors include adjacent land users, groundwater users and recreational water users within Wolli Creek area.
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 the construction and excavation works and basement (i.e. vapour inhalation or incidental contact with groundwater seepage).
Presence of preferential pathways for contaminant movement	The sewer and Telstra services and associated trench/trench backfill is a potential preferential pathway for contaminant migration. This could occur via groundwater/seepage if present, or via soil/vapour migration through the trench backfill.

4.3 Assessment of Data Gaps

EIS has undertaken a preliminary data gap analysis based on the findings of assessment. The data gaps and our comments outlined in the following table:

Table 4-3: Data Gap Assessment

Data Gap	EIS Comments
Historical land use search	Historical land use search and desktop assessment (Phase 1 ESA) was not included in the Phase 2 ESA. However, as the site currently used as a service station/mechanical workshop EIS consider that the current site use and configuration as the worst-case scenario for the site. This together with the fact that a broad range contamination screen was undertaken was considered to be adequate reason to omit the historical land use search.
Inaccessibility for Sampling	More than 50% of the site area was occupied by buildings, canopy and/or USTs and this area was excluded from sampling due to safety and accessibility issues. All sampling locations (both soil and groundwater) were limited to the near-boundary areas of the site.

5 SAMPLING, ANALYSIS AND QUALITY PLAN

5.1 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 5-1: 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	<p>The data collection is project specific and has been designed based on the following information:</p> <ul style="list-style-type: none"> • Review of site information; • CoPC, receptors, pathways and medium identified in the CSM; • Development of SAC for each media; and • The use of decision statements outlined below: <ol style="list-style-type: none"> 1. Are any of the soil and/or groundwater results above the SAC? 2. Was asbestos detected in any of the soil samples? 3. Is further investigation required? 4. Is the site suitable for proposed development? <p>The data will be assessed in the following manner:</p> <ol style="list-style-type: none"> 1) Statistical analysis will be used to assess the laboratory data against the SAC. The following criteria will be adopted: <ul style="list-style-type: none"> ➤ The 95% Upper Confidence Limit (UCL) value of the arithmetic mean concentration of each contaminant should be less than the SAC; ➤ The standard deviation (SD) of the results must be less than 50% of the SAC; and ➤ No single value exceeds 250% of the relevant SAC. 2) Statistical calculations will not be undertaken if all results are below the SAC; and 3) Statistical calculations will not be undertaken on the following: <ul style="list-style-type: none"> ➤ Health Screening Levels (HSLs) – elevated point source contamination associated with petroleum hydrocarbons can pose a vapour risk to receptors; ➤ Groundwater Investigation Levels (GILs) – elevated GILs can indicate a wider groundwater contamination risk.

Step	Input
Identify Information Inputs	<p>The following information will be collected:</p> <ul style="list-style-type: none"> • Soil samples based on subsurface conditions; • Groundwater samples from existing monitoring wells; • 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; • 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	<p>The sampling will be confined to the site boundaries as shown in Figure 2.</p>
Develop the analytical approach (or decision rule)	<p>The following acceptable limits will be adopted for the data quality assessment:</p> <ul style="list-style-type: none"> • The following acceptance criteria will be used to assess the RPD results: <ul style="list-style-type: none"> ➤ 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 (TS), Trip Blanks (TB) and Field Rinsate (FR) samples. Non-compliance to be documented in the report; • The following acceptance criteria will be used to assess the laboratory QA/QC results. Non-compliance to be documented: <ul style="list-style-type: none"> ➤ <u>RPDs</u>: <ul style="list-style-type: none"> - 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>: <ul style="list-style-type: none"> - 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>: <ul style="list-style-type: none"> - 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	<p>NEPM 2013 defines decision errors as '<i>incorrect decisions caused by using data which is not representative of site conditions</i>'. This can arise from errors during sampling or analytical testing. A combination of these errors is referred to as '<i>total study error</i>'. The study error can be managed through the correct choice of sample design and measurement.</p>

Step	Input
	<p>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.</p> <p>The null hypothesis is an assumption that is assumed to be true in the absence of contrary evidence. In this case, for example, the PCC identified in the PCSM is considered to pose a risk to receptors unless proven not to. The null hypothesis has been adopted for this assessment.</p>
Optimise the design for obtaining data	The most resource-effective design will be used in an optimum manner to achieve the assessment objectives.

5.2 Soil Sampling Plan and Methodology

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

Table 5-2: Soil Sampling Plan and Methodology

Aspect	Input
Sampling Density	<p>The NSW EPA Contaminated Sites Sampling Design Guidelines (1995¹⁴) 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.</p> <p>The guidelines recommend sampling from a minimum of 6 evenly spaced sampling points for this site with an area of approximately 1,670m².</p> <p>Samples for this investigation were obtained from 4 sampling points as shown on the attached Figure 2. This density is approximately 67% of the minimum sampling density recommended by the EPA. Due to existing buildings, canopy and USTs it was not possible to sample the entire site at this stage.</p>
Sampling Plan	The sampling locations were placed on accessible locations close to the site boundaries.
Exclusion Areas (Data Gaps)	Sampling was not undertaken in inaccessible areas of the site such as beneath existing buildings, canopy and near USTs. These areas have been excluded from the investigation.
Sampling Equipment	Soil samples were obtained on 11 January 2017 in accordance with the standard sampling procedure (SSP) attached in the appendices.

¹⁴ NSW EPA, (1995), *Contaminated Sites Sampling Design Guidelines*. (referred to as EPA Sampling Design Guidelines 1995)

Aspect	Input
	<p>Sampling locations were cleared for underground services by an external contractor prior to sampling as outlined in the SSP.</p> <p>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. Borehole logs attached in the appendices.</p>
Sampling Collection and Field QA/QC	<p>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.</p> <p>During sampling, soil at selected depths was split into primary and duplicate samples for field QA/QC analysis.</p> <p>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.</p> <p>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.</p>
Field PID Screening for VOCs	<p>A portable Photoionisation Detector (PID) was used to screen the samples for the presence of VOCs and to assist with selection of samples for hydrocarbon analysis.</p> <p>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 portable PID is best used semi-quantitatively to compare samples contaminated by the same hydrocarbon source.</p> <p>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 field check records are maintained in the job file.</p> <p>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.</p>
Decontamination and Sample Preservation	<p>The decontamination procedure adopted during sampling is outlined in the SSP.</p> <p>Where applicable, the sampling equipment was decontaminated using a scrubbing brush and potable water and Decon 90 solution (phosphate free detergent) followed by rinsing with potable water. Rinsate samples were obtained during the decontamination process as part of the field QA/QC.</p>

Aspect	Input
	<p>Soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with the SSP.</p> <p>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.</p>

5.3 Groundwater Sampling Plan and Methodology

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

Table 5-3: Groundwater Sampling Plan and Methodology

Aspect	Input
Sampling Plan	<p>Groundwater monitoring wells were installed by EIS, in three separate locations, in 2011. The locations of the groundwater monitoring wells are shown on Figure 2.</p> <p>The monitoring well locations were chosen, in 2011, based on subsurface conditions to target potential contamination sources where applicable.</p>
Exclusion Areas (Data Gaps)	<p>Sampling was not undertaken in inaccessible areas of the site such as beneath existing buildings, canopy and near the USTs. These areas have been excluded from the investigation.</p>
Groundwater Sampling	<p>Groundwater grab samples were obtained on 16 December 2016 from the existing monitoring wells installed in 2011.</p> <p>Prior to sampling, the monitoring wells were checked for the presence of Light Non-Aqueous Phase Liquids (LNAPLs) using an inter-phase probe electronic dip meter and confirmed with dedicated disposable PVC bailer.</p> <p>The samples were obtained using a dedicated disposable PVC bailer. During sampling, the following parameters were monitored using calibrated field instruments (see SSP):</p> <ul style="list-style-type: none"> • Standing water level (SWL) using an electronic dip meter; and • pH, temperature, electrical conductivity (EC), dissolved oxygen (DO) and redox potential (Eh) using a YSI Multi-probe water quality meter. <p>Groundwater samples were obtained directly from the bailer and placed in the sample containers.</p> <p>A duplicate sample was obtained by alternate filling of sample containers. This technique was adopted to minimise disturbance of the samples and loss of volatile contaminants associated with mixing of liquids in secondary containers, etc.</p>

Aspect	Input
	Groundwater removed from the wells during development and sampling was transported to EIS in jerry cans and stored in holding drums prior to collection by a licensed waste water contractor for off-site disposal.
Sample Preservation	<p>The samples were preserved in accordance with water sampling requirements detailed in NEPM 2013 and placed in an insulated container with ice in accordance with the SSP.</p> <p>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.</p>

5.4 Analytical Schedule

The analytical schedule is outlined in the following table:

Table 5-4: Analytical Schedule

CoPC	Fill Samples	Natural Soil Samples	Groundwater Samples
Heavy Metals	4	0	3
Lead	4	4	-
TRH/BTEXN	4	4	3
PAHs	4	0	3
OCPs/OPPs	4	0	0
PCBs	4	0	0
Asbestos	4	0	0

5.4.1 Laboratory Analysis

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

Table 5-5: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples and field QA/QC samples including (intra-laboratory duplicates, trip blanks, trip spike and field rinsate samples)	EnviroLab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	159437 and 160278

6 SITE ASSESSMENT CRITERIA (SAC)

The SAC adopted for the Stage 2 ESA is outlined in the table below. The SAC has 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 6-1: SAC Adopted for this Investigation

Guideline	Applicability
Health Investigation Levels (HILs) (NEPM 2013)	The HIL-D criteria for 'Commercial/Industrial' have been adopted for this assessment.
Health Screening Levels (HSLs) (NEPM 2013)	The HSL-D criteria for 'Commercial/Industrial' have been adopted for this assessment.
Asbestos in Soil	The 'presence/absence' of asbestos in soil has been adopted as the assessment criterion for the Preliminary Site Investigation (PSI).
Groundwater Investigation Levels (GILs)	<p>The NSW Department of Environment and Conservation (now EPA) Guidelines for the Assessment and Management of Groundwater Contamination (2007¹⁵) require an assessment of environmental values including:</p> <p>1. <u>Aquatic Ecosystems:</u></p> <p>The closest receiving water body of the site is Wolli Creek. This water body predominantly sustains a freshwater ecosystem. Hence the freshwater trigger values presented in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000¹⁶) have been adopted for the assessment (referred to as GIL-ANZECC-Fresh).</p> <p>The NSW EPA promotes the use of trigger values for the protection of 95% of aquatic ecosystems, except where the contaminants have the potential to bio-accumulate, in which case the 99% trigger values are recommended. The 95% trigger values have been adopted for this assessment. Where necessary, the low reliability trigger values are quoted.</p> <p>2. <u>Health Risk in Non-use Scenarios:</u></p> <p>Health risks in non-use scenarios are usually associated with the presence of vapours associated with volatile contaminants.</p> <p>The HSL-D for 'Commercial/Industrial' have been adopted for this investigation.</p>

¹⁵ NSW DEC (2007), *Guidelines for the Assessment and Management of Groundwater Contamination* (referred to as Groundwater Guidelines 2011)

¹⁶ ANZECC, (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. (referred to as ANZECC 2000)

7 **INVESTIGATION RESULTS**

7.1 **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 7-1: Summary of Subsurface Conditions

Profile	Description (m in bgl)
Pavement	Concrete pavement was encountered in all boreholes (BH101 to BH104). The thickness of the concrete pavement ranged from 170mm to 190mm.
Fill	Fill material was encountered beneath the pavement in all boreholes and extended to depths of approximately 0.5m to 1.5m. The fill typically comprised of silty sandy gravel, silty clay and gravelly clay. The fill contained inclusions of ironstone gravel.
Natural Soil	Silty clay was encountered at depths ranging from 0.5m to 1.5m.
Bedrock	Shale bedrock was encountered in all boreholes below the natural soil at depths ranging from 3.4m to 3.8m and extended to a maximum depth of the investigation (approximately 5.5m).
Groundwater	Groundwater seepage was not encountered in the boreholes during drilling. All boreholes remained dry on completion of drilling and a short time after.

7.2 **Field Screening**

A summary of the field screening results are presented in the table below:

Table 7-2: Summary of Field Screening

Aspect	Details (m in bgl)
PID Screening of Soil Samples for VOCs	PID soil sample headspace readings are presented in attached report tables, bore logs and the COC documents attached in the appendices. All results were 0 ppm equivalent isobutylene which indicates a lack of PID detectable VOCs.
Groundwater Depth & Flow	Groundwater seepage was not encountered in boreholes during the drilling on 11 January 2017. However the standing water levels (SWLs) in existing groundwater monitoring wells (installed in 2011) were measured at depths ranging from 0.825m to 1.983m below the concrete surface level.

Aspect	Details (m in bgl)
	Groundwater contour plot was not prepared during the current assessment. The groundwater flow direction was already established in the UPSS Report 2011 as flowing to an easterly direction.
Groundwater Field Parameters	Field measurements recorded during sampling are as follows: <ul style="list-style-type: none"> - pH ranged from 5.21 to 5.84; - EC ranged from 3,204µS/cm to 12,027µS/cm; - Eh ranged from 137mV to 200mV; and - DO ranged from 4.3ppm to 7.2ppm.
LNAPLs petroleum hydrocarbons	Free phase LNAPLs were not detected using the interphase probe during groundwater sampling.

7.3 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 7-3: Summary of Soil Laboratory Results

Analyte	Results Compared to SAC
Heavy Metals	<u>HILs:</u> All heavy metal results were below the HIL-D criteria.
TRH	<u>HSLs:</u> All TRH results were below the HSL-D criteria and PQLs.
BTEXN	<u>HSLs:</u> All BTEXN results were below the HSL-D criteria and PQLs.
PAHs	<u>HILs:</u> All total PAH and B(a)P TEQ results were below the HIL-D criteria. <u>HSLs:</u> All naphthalene results were below the HSL-D criteria and PQLs.
OCPs & OPPs	<u>HILs:</u> All OCP and OPP results were below the HIL-D criteria and PQLs.
PCBs	<u>HILs:</u> All PCB results were below the HIL-D criterion and PQL.
Asbestos	Asbestos was not detected in the samples analysed for the investigation.

7.4 Groundwater Laboratory Results

The groundwater laboratory results are presented in the attached report tables. A summary of the results assessed against the SAC is presented below.

Table 7-4: Summary of Groundwater Laboratory Results

Analyte	Results Compared to SAC																							
Heavy Metals	<u>GIL-ANZECC-Fresh:</u> Elevated concentrations of individual metals were encountered above the GIL-ANZECC criteria as outlined below:																							
	<table><tr><th>Analyte</th><th>Sample</th><th>GIL (µg/L)</th><th>Concentration (µg/L)</th></tr><tr><td>Cadmium</td><td>MW1, MW2 and MW3</td><td>0.2</td><td>2, 0.2 and 0.3</td></tr><tr><td>Copper</td><td>MW1, MW2 and MW3</td><td>1.4</td><td>6, 4 and 15</td></tr><tr><td>Nickel</td><td>MW1, MW2 and MW3</td><td>11</td><td>110, 55 and 40</td></tr><tr><td>Zinc</td><td>MW1, MW2 and MW3</td><td>8</td><td>300, 340 and 240</td></tr></table>				Analyte	Sample	GIL (µg/L)	Concentration (µg/L)	Cadmium	MW1, MW2 and MW3	0.2	2, 0.2 and 0.3	Copper	MW1, MW2 and MW3	1.4	6, 4 and 15	Nickel	MW1, MW2 and MW3	11	110, 55 and 40	Zinc	MW1, MW2 and MW3	8	300, 340 and 240
	Analyte	Sample	GIL (µg/L)	Concentration (µg/L)																				
	Cadmium	MW1, MW2 and MW3	0.2	2, 0.2 and 0.3																				
	Copper	MW1, MW2 and MW3	1.4	6, 4 and 15																				
	Nickel	MW1, MW2 and MW3	11	110, 55 and 40																				
Zinc	MW1, MW2 and MW3	8	300, 340 and 240																					
All other heavy metal results were below the GIL-ANZECC criteria.																								
TRH & BTEXN	<u>GIL-ANZECC-Fresh:</u> All BTEXN results were below the GIL-ANZECC criteria.																							
	<u>HSLs:</u> All TRH and BTEXN results were below the practical quantitation limit of the analytical technique. EIS note that there are no HSL guideline values for groundwater that is less than 2m below the finished level of the development. If there are detection of hydrocarbons in these cases a site specific assessment is required.																							
PAHs	<u>GIL-ANZECC-Fresh:</u> All PAH results were below the GIL-ANZECC criteria.																							
	<u>HSLs:</u> All naphthalene results were below the practical quantitation limit of the analytical technique. See note above for scenario when groundwater is less than 2m below the final levels.																							

8 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 8-1: Assessment of DQIs

Completeness
<p><u>Field Considerations:</u></p> <ul style="list-style-type: none"> • The investigation was designed as a preliminary screening and sampling was confined to accessible areas of the site (see Figure 2); • Samples were obtained from various depths based on the subsurface conditions encountered at the sampling locations. All soil samples were recorded on the borehole logs. All sampling points are shown on the attached Figure 2; • 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. <p><u>Laboratory Considerations:</u></p> <ul style="list-style-type: none"> • Selected samples were analysed for a range of CoPC; • All samples were analysed by 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
<p><u>Field Considerations:</u></p> <ul style="list-style-type: none"> • The investigation was undertaken by trained staff in accordance with the SSP; • The climate conditions encountered during the field work were noted on the site description record maintained in the job file; and • Consistency was maintained during sampling in accordance with the SSP. <p><u>Laboratory Considerations:</u></p> <ul style="list-style-type: none"> • All samples were analysed in accordance with the analytical methods outlined in NEPM 2013; • Appropriate PQLs were used by the laboratory for all analysis; • 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. Dust and/or vapour sampling was outside the scope of this assessment; 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 intra-laboratory duplicates, trip blanks (TB), field rinsate (FR) and trip spikes (TS) 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);
- Assessment of RPD results against the acceptance criteria outlined in **Section 5.1**.

Intra-laboratory RPD Results:

Soil Samples at a frequency of 25% of the primary samples:

- Dup A is a soil duplicate of primary sample BH103 (0.2-0.4)

Groundwater Samples at a frequency of 33% of the primary samples:

- Dup 1 is a groundwater duplicate of primary sample MW1

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

Trip Spike (TS):

One soil Trip Spike was analysed for BTEX. The results are presented in the attached report tables.

The results ranged from 95% to 101% and indicated that field preservation methods were appropriate.

Field Rinsate (FR):

One Field Rinsate sample was obtained from the field equipment decontamination process were analysed for BTEXN. The results are presented in the attached report tables.

All results were below the PQL which indicates that cross-contamination artefacts associated with sampling equipment was not present.

Trip Blank (TB):

Two water Trip Blanks were analysed for BTEX. The results are presented in the attached report tables. All results were below the PQL which indicates that cross-contamination of the samples during field transport.

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; and
 - A review of the report indicates that the analytical results were generally within the acceptance criteria adopted by the laboratory.
-

9 TIER 1 RISK ASSESSMENT AND REVIEW OF PCSM

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.

9.1 Data Gaps

The assessment has identified the following data gaps:

- Areas beneath the existing buildings, canopy and close to the USTs have not been included in the assessment; and
- The presence of hazardous building materials in the existing buildings has not been assessed.

10 **CONCLUSION**

EIS consider that the report objectives outlined in **Section 1.2** have been addressed. Based on the scope of work undertaken, EIS are of the opinion that the Area of Environmental Concern identified in the Preliminary Conceptual Site Model pose relatively low risk to the site receptors under current configuration. The decision statements specified in Table 5.1 are addressed below:

Table 10-1: Decision Statement Address

Decision Concern	Address
Are any of the soil and/or groundwater results above the SAC?	<p>Yes.</p> <p>Cadmium, copper, nickel and zinc concentrations in groundwater in all three wells were above the site assessment criteria. EIS are of the opinion that the elevated heavy metals could be general regional groundwater condition rather than site specific due to following reasons:</p> <ul style="list-style-type: none"> a) Both up-gradient and down-gradient wells were impacted. If the source of the heavy metal contamination is based on the site, up-gradient wells should not be impacted; b) Lead concentrations in all the wells were below the site assessment criteria. Lead is one of the common contaminants found in service station sites; and c) Elevated concentrations of heavy metals in groundwater are very common in urban groundwater as a result of leaking infrastructure.
Was asbestos identified in any of the samples?	No.
Is further investigation required?	<p>No.</p> <p>Further investigations will not be required if the site continues its operations as a service station under current configurations. However, if the underground petroleum storage system (UPSS) is to be removed for any future development then remediation and validation in the immediate vicinity of the UPSS may be required.</p>
Is the site suitable for the proposed development?	<p>The site is suitable for ongoing use as a service station in the current configuration.</p> <p>If the site use is changed then the additional work described below will be necessary. Provided that this is resolved successfully the site should be suitable for the proposed development.</p>

11 RECOMENDATIONS

If the site use changes from the existing service station, EIS consider that the site can be made suitable for the proposed development provided that the following recommendations are implemented to address the data gaps and to characterise the risks:

4. Undertake a Hazardous Materials Assessment (Hazmat) for the existing buildings prior to the commencement of demolition work;
5. Once all the buildings, canopy and USTs have been removed undertake a soil sampling and assessment program; and
6. Undertake soil sampling and assessment from the base and walls of the UST pits and any other excavation pits.

Based on the findings of the above recommendations further works, including remediation and validation may be required.

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.

11.1 Regulatory Requirement

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

Table 11-1: Regulatory Requirement

Guideline	Applicability
Duty to Report Contamination 2015 ¹⁷	At this stage, EIS consider that there is no requirement to notify the NSW EPA of the site contamination status.
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.
UPSS Regulation 2008	The regulation states that 'A storage system must not be used unless groundwater monitoring wells are installed on the storage site' and that the wells should be located 'with a view to maximising the likelihood that the wells will intercept contaminated groundwater'. Installation of groundwater wells and subsequent monitoring is a requirement for new and existing underground fuel storage systems as of 1 June 2008. The groundwater wells should be monitored every 6 months.

¹⁷ NSW Environment Protection Authority, (2015), *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. (referred to as Duty to Report Contamination 2015)

Guideline	Applicability
	Under the regulation and the AS4976-2008 ¹⁸ , all storage systems must be removed from the site in compliance with Section 5 of the standards. In-situ abandonment should only be considered in special circumstances, e.g. where removal will cause serious risks to adjoining tanks, underground structures and adjoining buildings. Approval from the applicable authorities (i.e. WorkCover, Council, NSW EPA) may be required under these circumstances.
Work Health and Safety Code of Practice 2011 ¹⁹	Sites contaminated with asbestos become a 'workplace' when work is carried out there and require a register and asbestos management plan.
Dewatering Consent	In the event groundwater is intercepted during excavation works, dewatering may be required. Council, NSW Office of Water (NOW) and other relevant approvals (from discharge authorities like Sydney Water etc.) should be obtained prior to the commencement of dewatering.

¹⁸ Standards Australia, (2008), *The Removal and Disposal of Underground Petroleum Storage Tanks*. (referred to as AS4976-2008)

¹⁹ WorkCover NSW, (2011), *WHS Regulation: Code of Practice – How to Manage and Control Asbestos in the Workplace*.

12 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 landuse. 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.

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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, eg 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

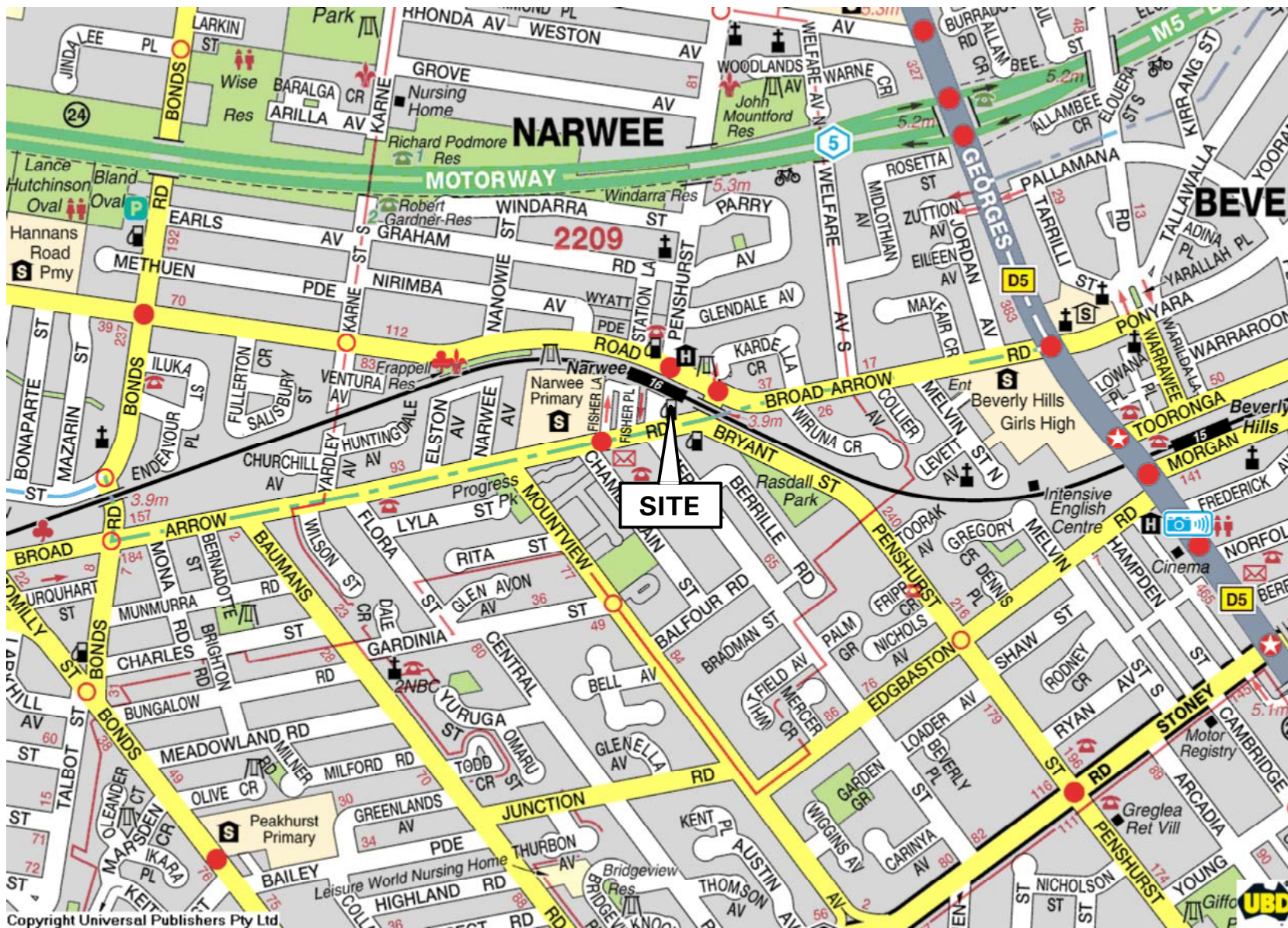
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other 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



NOTES:
Figure 1 has been recreated from UBD on disc (version 5.0). Figure is not to scale.

UBD Map ref: Sydney 272P14

Reference should be made to the report text for a full understanding of this plan.

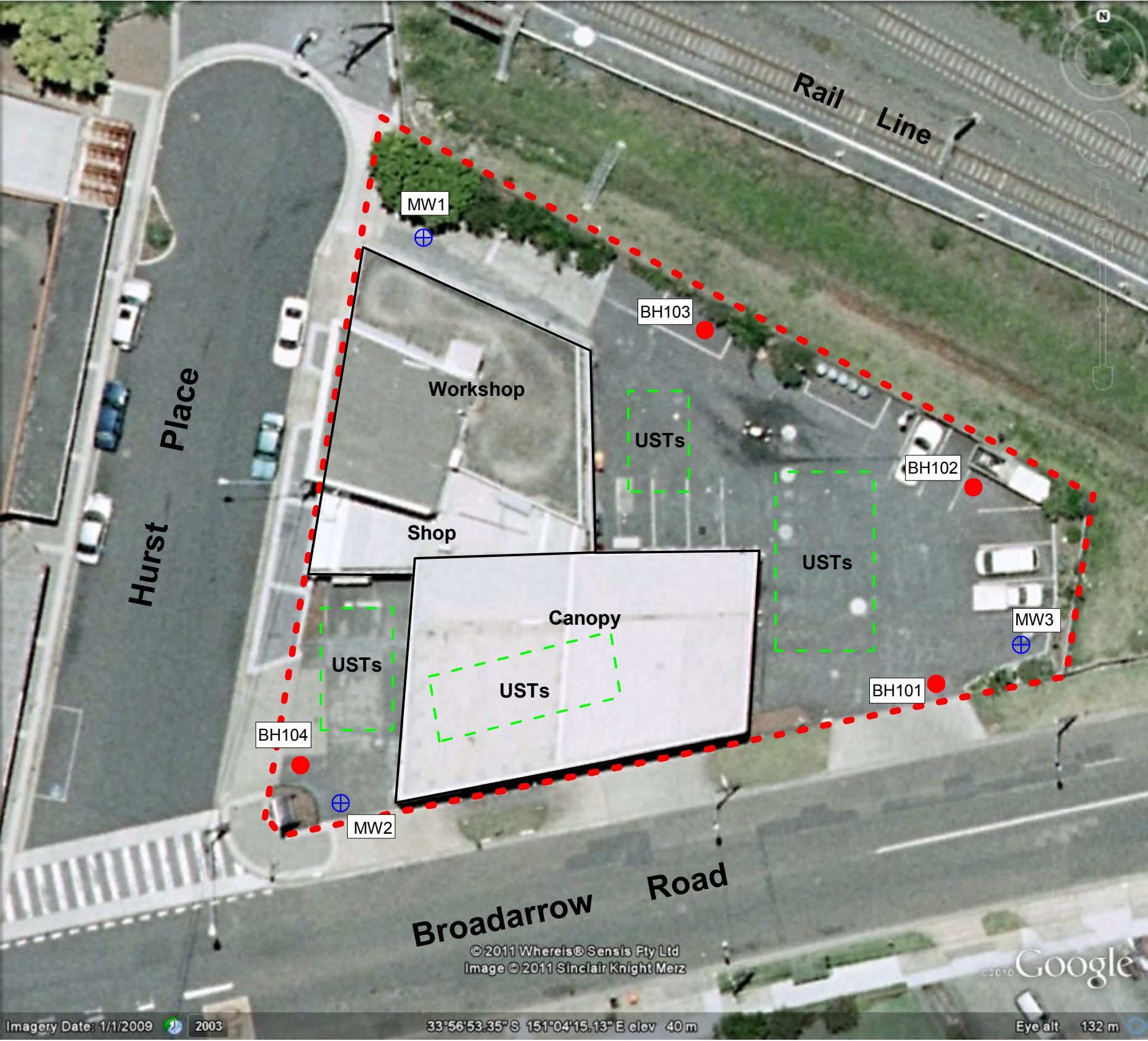
EIS
ENVIRONMENTAL
INVESTIGATION
SERVICES

Project Number:
E25086KG

Figure:
1

Title:
SITE LOCATION PLAN

Address:
**41 BROAD ARROW ROAD,
NARWEE, NSW**



LEGEND:

Approximate site boundary

Groundwater monitoring well

Soil Borehole Location

NOTES:
Figure 2 has been recreated from Google Earth

The borehole locations presented on this plan have been established from site measurements only and should not be construed as survey points.

Reference should be made to the report text for a full understanding of this plan.

Approximate Scale (m):

0 3 6 9 12 15

EIS
ENVIRONMENTAL
INVESTIGATION
SERVICES

Project Number: E25086KG	Title: Sampling Location Plan
Figure: 2	Address: 41 BROADARROW ROAD NARWEE, NSW 2209

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)	TOTAL PCBs	ASBESTOS FIBRES	
			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			
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	0.1	100
Site Assessment Criteria (SAC) ¹			3000	900	3600	240000	1500	730	6000	400000	4000	40	80	2000	2500	45	530	3600	50	2000	7	Detected/Not Detected	
Sample Reference	Sample Depth	Sample Description																					
BH101	0.2-0.4	Fill-Gravel	4	LPQL	17	28	17	LPQL	13	40	2.4	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected	
BH101	4.3-4.5	Nat-Shale	NA	NA	NA	NA	18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
BH102	0.2-0.4	Fill-Gravel	4	LPQL	16	29	19	LPQL	14	37	2.4	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected	
BH102	3.6-3.8	Nat-Clay	NA	NA	NA	NA	16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
BH103	0.2-0.4	Fill-Clay	32	2	18	49	120	LPQL	25	240	2.5	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected	
BH103	4.3-4.5	Nat-Shale	NA	NA	NA	NA	18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
BH104	0.2-0.4	Fill-Clay	8	LPQL	17	17	25	LPQL	5	36	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected	
BH104	4.3-4.5	Nat-Shale	NA	NA	NA	NA	17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total Number of Samples			4	4	4	4	8	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Maximum Value			32	2	18	49	120	LPQL	25	240	2.5	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NC	

Explanation:

1 - Site Assessment Criteria (SAC): NEPM 2013, HIL-D: 'Commercial/Industrial'

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

Standard deviation exceeds data assessment criteria

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

<p>TABLE B SOIL LABORATORY RESULTS COMPARED TO HSLs All data in mg/kg unless stated otherwise</p>												
					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					COMMERCIAL/INDUSTRIAL							
Sample Reference	Sample Depth	Sample Description	Depth Category	Soil Category								
BH101	0.2-0.4	Fill-Gravel	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH101	4.3-4.5	Nat-Shale	4m+	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH102	0.2-0.4	Fill-Gravel	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH102	3.6-3.8	Nat-Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH103	0.2-0.4	Fill-Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH103	4.3-4.5	Nat-Shale	4m+	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH104	0.2-0.4	Fill-Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH104	4.3-4.5	Nat-Shale	4m+	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
Total Number of Samples					8	8	8	8	8	8	8	8
Maximum Value					LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
<p>Explanation: 1 - Site Assessment Criteria (SAC): NEPM 2013 2 - Field PID values obtained during the investigation</p> <p>Concentration above the SAC VALUE The guideline corresponding to the elevated value is highlighted in grey in the Site Assessment Criteria Table below</p> <p>Abbreviations: UCL: Upper Level Confidence Limit on Mean Value HSLs: Health Screening Levels NA: Not Analysed</p> <p>NC: Not Calculated NL: Not Limiting SAC: Site Assessment Criteria</p> <p>PQL: Practical Quantitation Limit LPQL: Less than PQL NEPM: National Environmental Protection Measure</p>												

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					COMMERCIAL/INDUSTRIAL							
Sample Reference	Sample Depth	Sample Description	Depth Category	Soil Category								
BH101	0.2-0.4	Fill-Gravel	0m to < 1m	Clay	310	NL	4	NL	NL	NL	NL	
BH101	4.3-4.5	Nat-Shale	4m+	Clay	NL	NL	20	NL	NL	NL	NL	
BH102	0.2-0.4	Fill-Gravel	0m to < 1m	Clay	310	NL	4	NL	NL	NL	NL	
BH102	3.6-3.8	Nat-Clay	2m to <4m	Clay	NL	NL	9	NL	NL	NL	NL	
BH103	0.2-0.4	Fill-Clay	0m to < 1m	Clay	310	NL	4	NL	NL	NL	NL	
BH103	4.3-4.5	Nat-Shale	4m+	Clay	NL	NL	20	NL	NL	NL	NL	
BH104	0.2-0.4	Fill-Clay	0m to < 1m	Clay	310	NL	4	NL	NL	NL	NL	
BH104	4.3-4.5	Nat-Shale	4m+	Clay	NL	NL	20	NL	NL	NL	NL	

TABLE C GROUNDWATER LABORATORY RESULTS COMPARED TO HSLs All data in µg/L unless stated otherwise											
				C ₆ -C ₁₀ (F1)	>C ₁₀ -C ₁₆ (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID ²
PQL - Envirolab Services				10	50	1	1	1	3	1	
Land Use Category ¹				COMMERCIAL/INDUSTRIAL							
Sample Reference	Water Depth	Depth Category ³	Soil Category								
MW1	0.825	0m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
MW2	1.341	0m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
MW3	1.983	0m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
Total Number of Samples				3	3	3	3	3	3	3	0
Raw max				0	0	0	0	0	0	0	0
Maximum Value				LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
Explanation: 1 - Groundwater Investigation Levels (GILs): NEPM 2013 2 - Field PID values obtained from the monitoring well headspace during the investigation Concentration above the SAC VALUE Site specific assesment (SSA) required 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 PQL: Practical Quantitation Limit HSLs: Health Screening Levels LPQL: Less than PQL NA: Not Analysed SAC: Site Assessment Criteria NC: Not Calculated NEPM: National Environmental Protection Measure NL: Not Limiting SSA: Site Specific Assessment											

HSL GROUNDWATER ASSESSMENT CRITERIA

				C ₆ -C ₁₀ (F1)	>C ₁₀ -C ₁₆ (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
PQL - Envirolab Services				10	50	1	1	1	3	1
Land Use Category ¹				COMMERCIAL/INDUSTRIAL						
Sample Reference	Water Depth	Depth Category ³	Soil Category							
MW1	0.825	0m to <2m	Clay	SSA	SSA	SSA	SSA	SSA	SSA	SSA
MW2	1.341	0m to <2m	Clay	SSA	SSA	SSA	SSA	SSA	SSA	SSA
MW3	1.983	0m to <2m	Clay	SSA	SSA	SSA	SSA	SSA	SSA	SSA

TABLE D

	PQL Envirolab Services	GIL - ANZECC 2000 ¹ Fresh Waters	SAMPLES		
			MW1	MW2	MW3
			16-Dec-16	16-Dec-16	16-Dec-16
Metals and Metalloids					
Arsenic (As III)	1	24	LPQL	LPQL	LPQL
Cadmium	0.1	0.2	2	0.2	0.3
Chromium (III)	1	3.3 ^a	LPQL	LPQL	LPQL
Copper	1	1.4	6	4	15
Lead	1	3.4	LPQL	LPQL	3
Total Mercury (inorganic)	0.05	0.06	LPQL	LPQL	LPQL
Nickel	1	11	110	55	40
Zinc	1	8	300	340	240
Total Recoverable Hydrocarbons (TRH)					
C ₆ -C ₉ (assessed using F1)	10	NSL	LPQL	LPQL	LPQL
>C ₉ -C ₁₄ (assessed using F2)	50	NSL	LPQL	LPQL	LPQL
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)					
Benzene	1	950	LPQL	LPQL	LPQL
Toluene	1	180 ^a	LPQL	LPQL	LPQL
Ethylbenzene	1	80 ^a	LPQL	LPQL	LPQL
m+p-xylene	2	75 ^m	LPQL	LPQL	LPQL
o-xylene	1	350 ^a	LPQL	LPQL	LPQL
Total xylenes	2	NSL	LPQL	LPQL	LPQL
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	0.2	16 ^a	LPQL	LPQL	LPQL
Acenaphthylene	0.1	NSL	LPQL	LPQL	LPQL
Acenaphthene	0.1	NSL	LPQL	LPQL	LPQL
Fluorene	0.1	NSL	LPQL	LPQL	LPQL
Phenanthrene	0.1	0.6 ^c	LPQL	LPQL	LPQL
Anthracene	0.1	0.01 ^c	LPQL	LPQL	LPQL
Fluoranthene	0.1	1 ^c	LPQL	LPQL	LPQL
Pyrene	0.1	NSL	LPQL	LPQL	LPQL
Benzo(a)anthracene	0.1	NSL	LPQL	LPQL	LPQL
Chrysene	0.1	NSL	LPQL	LPQL	LPQL
Benzo(b,j,k)fluoranthene	0.2	NSL	LPQL	LPQL	LPQL
Benzo(a)pyrene	0.1	0.1 ^c	LPQL	LPQL	LPQL
Indeno(1,2,3-c,d)pyrene	0.1	NSL	LPQL	LPQL	LPQL
Dibenzo(a,h)anthracene	0.1	NSL	LPQL	LPQL	LPQL
Benzo(g,h,i)perylene	0.1	NSL	LPQL	LPQL	LPQL
Explanation:					
1 - ANZECC Australian Water Quality Guidelines for Fresh Waters (ANZECC 2000) - Trigger Values for protection of 95% of species					
a - In the absence of a high reliability guideline concentration, the moderate or low reliability guideline concentration has been quoted					
c - 99% trigger values adopted due to the potential for bioaccumulation effects					
m - Guideline value adopted for m-Xylene. We note that the m-Xylene guideline value is 75ug/L and the p-Xylene guideline value is 200ug/L. However these two isomers cannot be distinguished analytically, therefore EIS have adopted the more conservative guideline value					
Concentration above the GIL		VALUE			
Abbreviations:					
NA: Not Analysed		PQL: Practical Quantitation Limit			
NSL: No Set Limit		LPQL: Less than Practical Quantitation Limit			
GIL - Groundwater Investigation Levels		(-) : Not Applicable			

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 = BH103 (0.2-0.4) Dup Ref = Dup A EnviroLab Report: 160278	Arsenic	4	32	15	24	72
	Cadmium	0.4	2	2	2.0	0
	Chromium	1	18	12	15	40
	Copper	1	49	44	47	11
	Lead	1	120	110	115	9
	Mercury	0.1	LPQL	LPQL	NC	NC
	Nickel	1	25	22	24	13
	Zinc	1	240	220	230	9
	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	0.2	LPQL	0.2	NC
	Anthracene	0.1	LPQL	LPQL	NC	NC
	Fluoranthene	0.1	0.6	LPQL	0.6	NC
	Pyrene	0.1	0.6	LPQL	0.6	NC
	Benzo(a)anthracene	0.1	0.3	LPQL	0.3	NC
	Chrysene	0.1	0.2	LPQL	0.2	NC
	Benzo(b,j,k)fluoranthene	0.2	0.4	LPQL	0.4	NC
	Benzo(a)pyrene	0.05	0.2	LPQL	0.2	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	0.1	LPQL	0.1	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

LPQL: Less than PQL

NA: Not Analysed

NC: Not Calculated

OCP: Organochlorine Pesticides

OPP: Organophosphorus Pesticides

PCBs: Polychlorinated Biphenyls

TRH: Total Recoverable Hydrocarbons

TABLE F
GROUNDWATER INTRA-LABORATORY DUPLICATE RESULTS & RPD CALCULATIONS
All results in µg/L unless stated otherwise

SAMPLE	ANALYSIS	Envirolab PQL	INITIAL	REPEAT	MEAN	RPD %
Sample Ref = MW2 Dup Ref = Dup 1 Envirolab Report: 159437	Arsenic	1	LPQL	LPQL	NC	NC
	Cadmium	0.1	0.2	0.2	0	0
	Chromium	1	LPQL	LPQL	NC	NC
	Copper	1	4	4	4	0
	Lead	1	LPQL	LPQL	NC	NC
	Mercury	0.05	LPQL	LPQL	NC	NC
	Nickel	1	55	55	55	0
	Zinc	1	340	340	340	0
	TRH C6-C10 (F1)	10	LPQL	LPQL	NC	NC
	TRH >C10-C16 (F2)	50	LPQL	LPQL	NC	NC
	TRH >C16-C34 (F3)	100	LPQL	LPQL	NC	NC
	TRH >C34-C40 (F4)	100	LPQL	LPQL	NC	NC
	Benzene	1	LPQL	LPQL	NC	NC
	Toluene	1	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

LPQL: Less than PQL

NA: Not Analysed

NC: Not Calculated

OCP: Organochlorine Pesticides

OPP: Organophosphorus Pesticides

PCBs: Polychlorinated Biphenyls

TRH: Total Recoverable Hydrocarbons

TABLE G
SUMMARY OF FIELD QA/QC RESULTS

ANALYSIS	Envirolab PQL		TB1 ^w	TB-A ^w	FR-A ^w	TS-A ^s
	mg/kg	µg/L	16-Dec-16	11-Jan-17	11-Jan-17	11-Jan-17
			µg/L	µg/L	µg/L	% Recovery
Benzene	1	1	LPQL	LPQL	LPQL	99
Toluene	1	1	LPQL	LPQL	LPQL	101
Ethylbenzene	1	1	LPQL	LPQL	LPQL	97
m+p-xylene	2	2	LPQL	LPQL	LPQL	95
o-xylene	1	1	LPQL	LPQL	LPQL	95

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

TB: Trip Blank

LPQL: Less than PQL

TS: Trip Spike

NA: Not Analysed

RS: Rinsate Sample

NC: Not Calculated

TRH: Total Recoverable Hydrocarbons

Appendix A: Borehole Logs



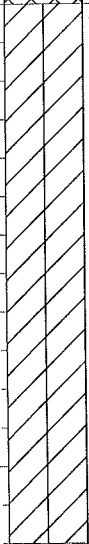
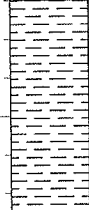
Environmental logs are not to be used for geotechnical purposes

Location: 41 BROADARROW ROAD, NARWEE, NSW

R.L. Surface: N/A

Datum:

Logged/Checked by: P.B./G.F.

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					PID=0	0		-	CONCRETE: 180mm.t				
					PID=0	1			FILL: Silty sandy gravel, fine to medium grained, grey.	D			
					PID=0	2		CL-CH	SILTY CLAY: medium to high plasticity, grey mottled brown, trace of fine to medium grained ironstone gravel.	MC≈PL			
					PID=0	3							
					PID=0	4		-	SHALE: grey.	DW			
						5			END OF BOREHOLE AT 4.5m				
						6							
						7							

ENVIRONMENTAL LOG

Borehole No.
102
1/1

Environmental logs are not to be used for geotechnical purposes

Client: CALTEX NARWEE Project: PRELIMINARY STAGE 2 ENVIRONMENTAL SITE ASSESSMENT Location: 41 BROADARROW ROAD, NARWEE, NSW												
Job No. E25086KG Date: 11-1-17		Method: SPIRAL AUGER JK500			R.L. Surface: N/A Datum: Logged/Checked by: P.B./G.F.							
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	SAL									
DRY ON COMPLETION				PID=0	0		-	CONCRETE: 180mm.t				
							CH	FILL: Silty sandy gravel, fine to medium grained, grey.	D			
				PID=0				SILTY CLAY: high plasticity, brown, trace of fine to medium grained ironstone gravel.	MC≈PL			
				PID=0			CL-CH	SILTY CLAY: medium to high plasticity, grey mottled brown, trace of fine to medium grained ironstone gravel.				
				PID=0			-	SHALE: grey.	DW			
					4			END OF BOREHOLE AT 4.5m				
					5							
					6							
					7							

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: CALTEX NARWEE

Project: PRELIMINARY STAGE 2 ENVIRONMENTAL SITE ASSESSMENT

Location: 41 BROADARROW ROAD, NARWEE, NSW

Job No. E25086KG

Date: 11-1-17

Method: SPIRAL AUGER
JK500

Logged/Checked by: P.B./G.F.

R.L. Surface: N/A

Datum:

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					PID=0	0		-	CONCRETE: 190mm.t				
									FILL: Silty sandy gravelly clay, low plasticity, dark grey.	MC<PL			
									FILL: Silty clay, high plasticity, brown mottled grey and orange, trace of fine to medium grained siltstone gravel.	MC≈PL			
					PID=0	1							
					PID=0	2		CL-CH	SILTY CLAY: medium to high plasticity, grey mottled brown, trace of fine to medium grained ironstone gravel.	MC≈PL			
						3							
					PID=0	4		-	SHALE: grey.	DW			
					PID=0				END OF BOREHOLE AT 4.5m				
						5							
						6							
						7							

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: CALTEX NARWEE

Project: PRELIMINARY STAGE 2 ENVIRONMENTAL SITE ASSESSMENT

Location: 41 BROADARROW ROAD, NARWEE, NSW

Job No. E25086KG

Date: 11-1-17

Method: SPIRAL AUGER
JK500

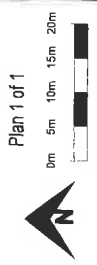
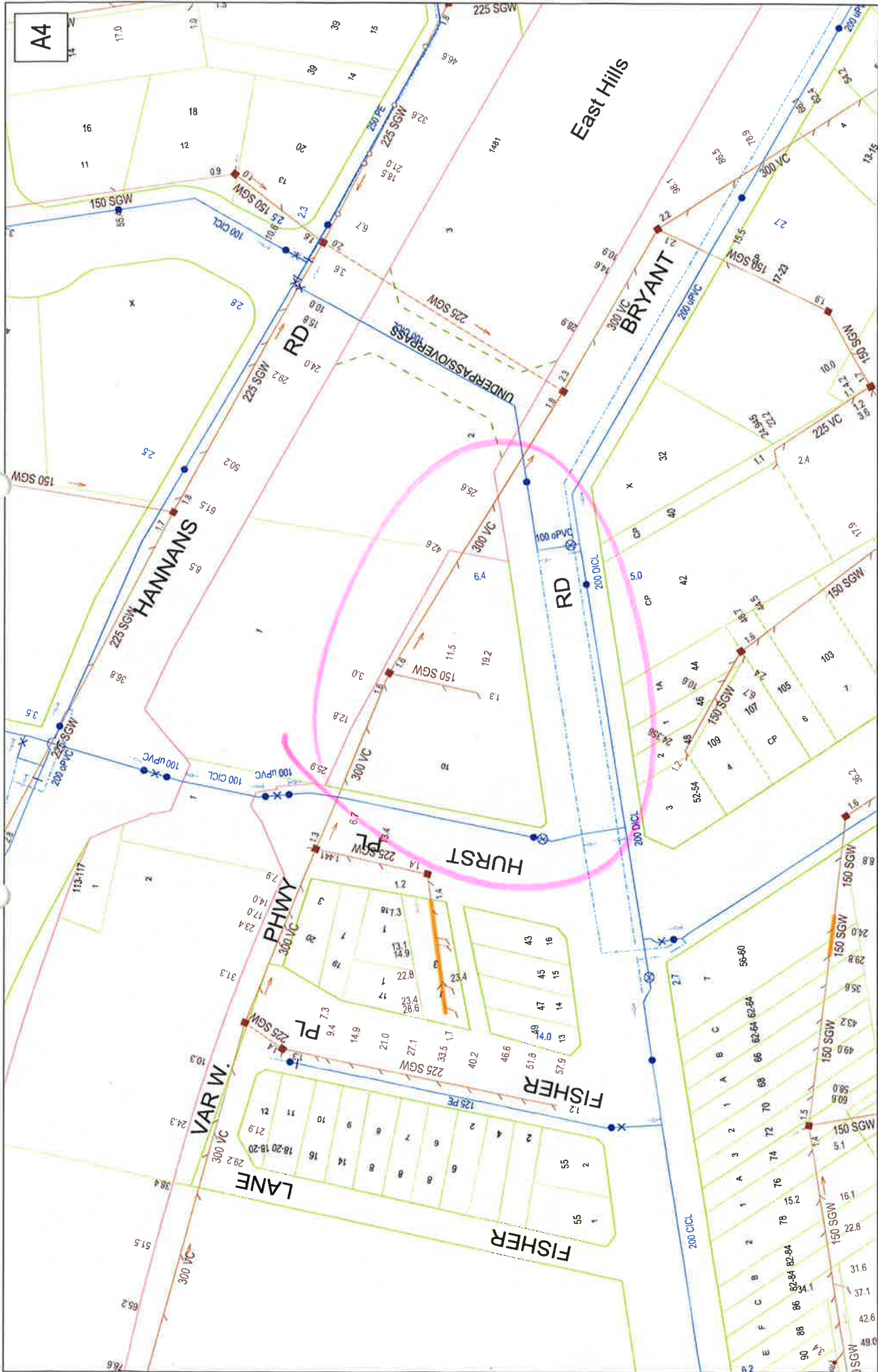
Logged/Checked by: P.B./G.F.

R.L. Surface: N/A

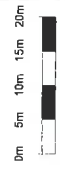
Datum:

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									
DRY ON COMPLETION				PID=0	0		-	CONCRETE: 170mm.t FILL: Silty clay, medium to high plasticity, dark brown, trace of ironstone gravel.	MC≈PL			
				PID=0	1		CH	SILTY CLAY: high plasticity, brown, trace of fine to medium grained ironstone gravel.	MC<PL			
				PID=0	3			SILTY CLAY: medium to high plasticity, grey mottled brown, trace of fine to medium grained ironstone gravel.	MC≈PL			
				PID=0	4		-	SHALE: grey.	DW			
					5			END OF BOREHOLE AT 4.5m				
					6							
					7							

COPYRIGHT



Plan 1 of 1



Scale: 1:1000

Date of Production: 07/12/2016

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SYDNEY WATER CORPORATION

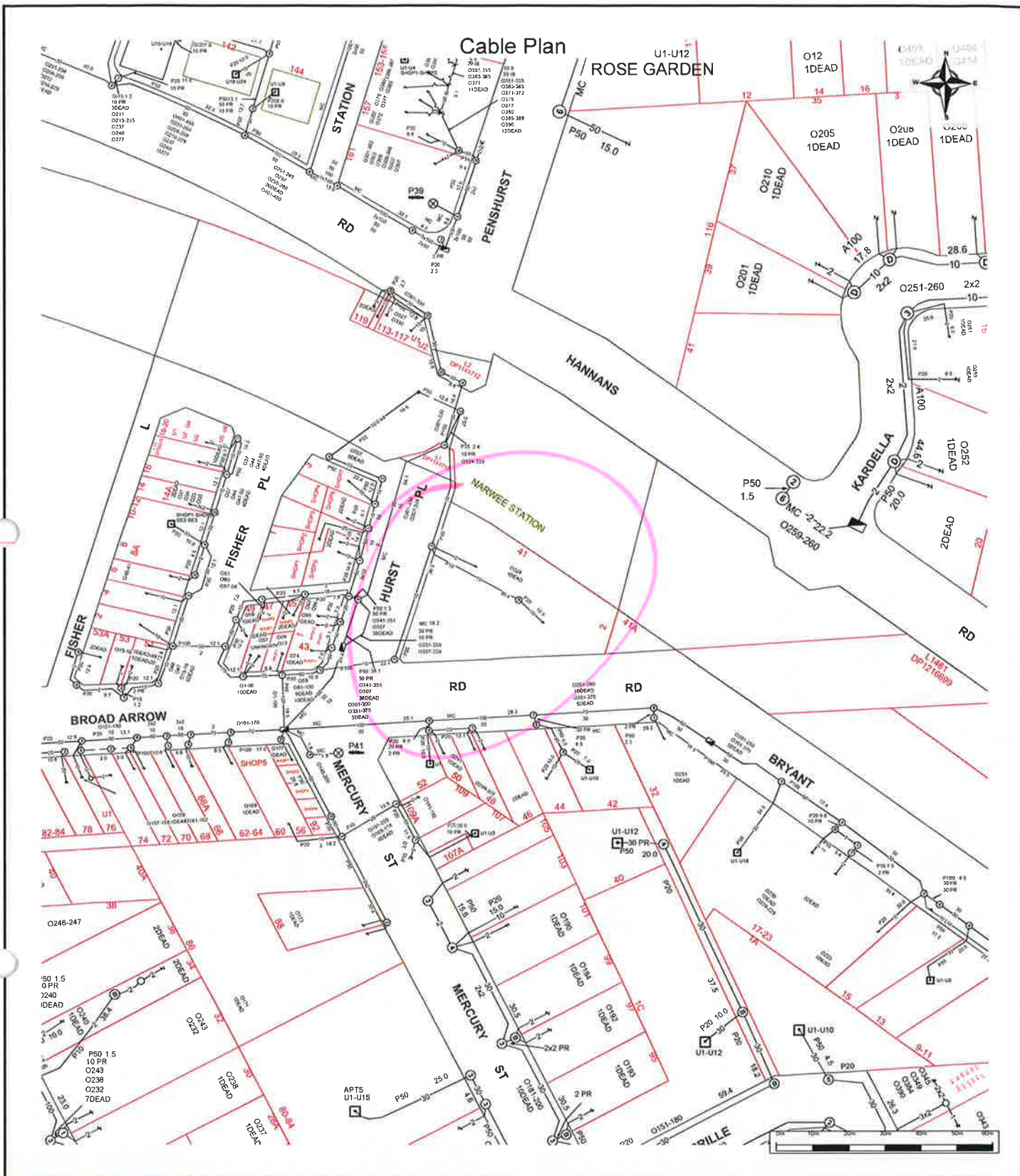
DBYD Job No: 11616279


DBYD Sequence No: 57577957

DBYD Address:
41 Broadarrow Road
Narwee NSW 2209

Legend

Sewer		Property Details	
Sewer Main (with flow arrow & size type text)		Boundary Line	
Disused Main		Easement Line	
Rising Main		House Number	
Maintenance Hole (with upstream depth to Invert)		Lot Number	
Sub-surface chamber		Proposed Land	
Maintenance Hole with Overflow chamber		Sydney Water Heritage Site (please call 132 092 and ask for the Heritage Unit)	
Ventshaft EDUCT			
Ventshaft INDUCT			
Property Connection Point (with chainage to downstream MH)			
Concrete Encased Section			
Terminal Maintenance Shaft			
Maintenance Shaft			
Rodding Point			
Lamphole			
Vertical			
Pumping Station			
Sewer Rehabilitation			
Pressure Sewer		Water	
Pressure Sewer Main		WaterMain - Potable (with size type text)	
Pump Unit (Alarm, Electrical Cable, Pump Unit)		Disconnected Main - Potable	
Property Valve Boundary Assembly		Proposed Main - Potable	
Stop Valve		Water Main - Recycled	
Reducer / Taper		Special Supply Conditions - Potable	
Flushing Point		Special Supply Conditions - Recycled	
Vacuum Sewer		Restrained Joints - Potable	
Pressure Sewer Main		Restrained Joints - Recycled	
Division Valve		Hydrant	
Vacuum Chamber		Maintenance Hole	
Clean Out Point		Stop Valve	
Stormwater		Stop Valve with By-pass	
Stormwater Pipe		Stop Valve with Tapers	
Stormwater Channel		Closed Stop Valve	
Stormwater Gully		Air Valve	
Stormwater Maintenance Hole		Valve	
		Scour	
		Reducer / Taper	
		Vertical Bends	
		Reservoir	
		Recycled Water is shown as per Potable above. Colour as Indicated	
Private Mains		Potable Water Main	
		Recycled Water Main	
		Sewer Main	
		Symbols for Private Mains shown grey	



	<p>For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)</p>	<p>Sequence Number: 57577953</p> <p>CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.</p>
<p>TELSTRA CORPORATION LIMITED A.C.N. 051 775 556</p> <p>Generated On 07/12/2016 11:47:39</p>		

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

Please read and understand the information supplied in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

Appendix B: Laboratory Reports & COC Documents



12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS

159437

Client:

Environmental Investigation Services

PO Box 976

North Ryde BC

NSW 1670

Attention: Para Bokalawela

Sample log in details:

Your Reference:

E25086KG, Narwee

No. of samples:

5 waters

Date samples received / completed instructions received

19/12/2016

/ 19/12/2016

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: / Issue Date:

3/12/17

/ 22/12/16

Date of Preliminary Report:

Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing

Tests not covered by NATA are denoted with *.

Results Approved By:

David Springer
General Manager



Envirolab Reference: 159437

Revision No: R 00

vTRH(C6-C10)/BTEXN in Water						
Our Reference:	UNITS	159437-1	159437-2	159437-3	159437-4	159437-5
Your Reference	-----	MW1	MW2	MW3	Dup 1	TB 1
Date Sampled	-					
Type of sample	-----	16/12/2016	16/12/2016	16/12/2016	16/12/2016	16/12/2016
		Waters	Waters	Waters	Waters	Waters
Date extracted	-	21/12/2016	21/12/2016	21/12/2016	21/12/2016	21/12/2016
Date analysed	-	22/12/2016	22/12/2016	22/12/2016	22/12/2016	22/12/2016
TRHC ₆ - C ₉	µg/L	<10	<10	<10	<10	[NA]
TRHC ₆ - C ₁₀	µg/L	<10	<10	<10	<10	[NA]
TRHC ₆ - C ₁₀ less BTEX (F1)	µg/L	<10	<10	<10	<10	[NA]
Benzene	µg/L	<1	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2	<2
o-xylene	µg/L	<1	<1	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1	<1	[NA]
Surrogate Dibromofluoromethane	%	129	129	129	130	130
Surrogate toluene-d8	%	94	95	94	94	95
Surrogate 4-BFB	%	79	77	78	78	78

svTRH (C10-C40) in Water					
Our Reference:	UNITS	159437-1	159437-2	159437-3	159437-4
Your Reference	-----	MW1	MW2	MW3	Dup 1
	-				
Date Sampled	-----	16/12/2016	16/12/2016	16/12/2016	16/12/2016
Type of sample		Waters	Waters	Waters	Waters
Date extracted	-	21/12/2016	21/12/2016	21/12/2016	21/12/2016
Date analysed	-	22/12/2016	22/12/2016	22/12/2016	22/12/2016
TRHC ₁₀ - C ₁₄	µg/L	<50	<50	<50	<50
TRHC ₁₅ - C ₂₈	µg/L	<100	<100	<100	<100
TRHC ₂₉ - C ₃₆	µg/L	<100	<100	<100	<100
TRH>C ₁₀ - C ₁₆	µg/L	<50	<50	<50	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	µg/L	<50	<50	<50	<50
TRH>C ₁₆ - C ₃₄	µg/L	<100	<100	<100	<100
TRH>C ₃₄ - C ₄₀	µg/L	<100	<100	<100	<100
Surrogate o-Terphenyl	%	76	88	84	78

PAHs in Water - Low Level Our Reference: Your Reference	UNITS ----- -	159437-1 MW1	159437-2 MW2	159437-3 MW3
Date Sampled Type of sample	----- -----	16/12/2016 Waters	16/12/2016 Waters	16/12/2016 Waters
Date extracted	-	21/12/2016	21/12/2016	21/12/2016
Date analysed	-	21/12/2016	21/12/2016	21/12/2016
Naphthalene	µg/L	<0.2	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1
Benzo(b,j,k)fluoranthene	µg/L	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate <i>p</i> -Terphenyl-d14	%	74	77	70

PAHs in Water		
Our Reference:	UNITS	159437-4
Your Reference	-----	Dup 1
	-	
Date Sampled	-----	16/12/2016
Type of sample		Waters
Date extracted	-	21/12/2016
Date analysed	-	21/12/2016
Naphthalene	µg/L	<1
Acenaphthylene	µg/L	<1
Acenaphthene	µg/L	<1
Fluorene	µg/L	<1
Phenanthrene	µg/L	<1
Anthracene	µg/L	<1
Fluoranthene	µg/L	<1
Pyrene	µg/L	<1
Benzo(a)anthracene	µg/L	<1
Chrysene	µg/L	<1
Benzo(b,j+k)fluoranthene	µg/L	<2
Benzo(a)pyrene	µg/L	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1
Dibenzo(a,h)anthracene	µg/L	<1
Benzo(g,h,i)perylene	µg/L	<1
Benzo(a)pyrene TEQ	µg/L	<5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate <i>p</i> -Terphenyl-d14	%	70

HM in water - dissolved					
Our Reference:	UNITS	159437-1	159437-2	159437-3	159437-4
Your Reference	-----	MW1	MW2	MW3	Dup 1
	-				
Date Sampled	-----	16/12/2016	16/12/2016	16/12/2016	16/12/2016
Type of sample		Waters	Waters	Waters	Waters
Date prepared	-	20/12/2016	20/12/2016	20/12/2016	20/12/2016
Date analysed	-	20/12/2016	20/12/2016	20/12/2016	20/12/2016
Arsenic-Dissolved	µg/L	<1	<1	<1	<1
Cadmium-Dissolved	µg/L	2.0	0.2	0.3	0.2
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Copper-Dissolved	µg/L	6	4	15	4
Lead-Dissolved	µg/L	<1	<1	3	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	110	55	40	55
Zinc-Dissolved	µg/L	300	340	240	340

MethodID	Methodology Summary
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)-BTX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
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-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.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021	Determination of Mercury by Cold Vapour AAS.

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
vTRH(C6-C10)/BTEXNin Water						Base II Duplicate II %RPD		
Date extracted	-			21/12/2016	[NT]	[NT]	LCS-W1	21/12/2016
Date analysed	-			22/12/2016	[NT]	[NT]	LCS-W1	22/12/2016
TRHC ₆ - C ₉	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	99%
TRHC ₆ - C ₁₀	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	99%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	102%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	94%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	89%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	106%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	107%
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	117	[NT]	[NT]	LCS-W1	106%
Surrogate toluene-d8	%		Org-016	93	[NT]	[NT]	LCS-W1	98%
Surrogate 4-BFB	%		Org-016	82	[NT]	[NT]	LCS-W1	105%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
svTRH (C10-C40) in Water						Base II Duplicate II %RPD		
Date extracted	-			21/12/2016	[NT]	[NT]	LCS-W1	21/12/2016
Date analysed	-			21/12/2016	[NT]	[NT]	LCS-W1	22/12/2016
TRHC ₁₀ - C ₁₄	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	96%
TRHC ₁₅ - C ₂₈	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	94%
TRHC ₂₉ - C ₃₆	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	108%
TRH>C ₁₀ - C ₁₆	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	96%
TRH>C ₁₆ - C ₃₄	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	94%
TRH>C ₃₄ - C ₄₀	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	108%
Surrogate o-Terphenyl	%		Org-003	92	[NT]	[NT]	LCS-W1	75%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Water - Low Level						Base II Duplicate II %RPD		
Date extracted	-			21/12/2016	[NT]	[NT]	LCS-W1	21/12/2016
Date analysed	-			21/12/2016	[NT]	[NT]	LCS-W1	21/12/2016
Naphthalene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	LCS-W1	95%
Acenaphthylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	101%
Phenanthrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	100%
Anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	97%
Pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	101%

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Water - Low Level						Base II Duplicate II %RPD		
Benzo(a)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(b,j +k)fluoranthene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	91%
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	92	[NT]	[NT]	LCS-W1	99%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Water						Base II Duplicate II %RPD		
Date extracted	-			21/12/2016	[NT]	[NT]	LCS-W1	21/12/2016
Date analysed	-			21/12/2016	[NT]	[NT]	LCS-W1	21/12/2016
Naphthalene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	95%
Acenaphthylene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	101%
Phenanthrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	100%
Anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	97%
Pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	101%
Benzo(a)anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Benzo(b,j +k)fluoranthene	µg/L	2	Org-012	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	91%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	92	[NT]	[NT]	LCS-W1	99%

Client Reference: E25086KG, Narwee

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
HM in water - dissolved						Base Duplicate %RPD		
Date prepared	-			20/12/2016	159437-1	20/12/2016 20/12/2016	LCS-W1	20/12/2016
Date analysed	-			20/12/2016	159437-1	20/12/2016 20/12/2016	LCS-W1	20/12/2016
Arsenic-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	159437-1	<1 <1	LCS-W1	102%
Cadmium-Dissolved	µg/L	0.1	Metals-022 ICP-MS	<0.1	159437-1	2.0 2.1 RPD: 5	LCS-W1	104%
Chromium-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	159437-1	<1 <1	LCS-W1	98%
Copper-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	159437-1	6 6 RPD: 0	LCS-W1	103%
Lead-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	159437-1	<1 <1	LCS-W1	104%
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	159437-1	<0.05 <0.05	LCS-W1	99%
Nickel-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	159437-1	110 110 RPD: 0	LCS-W1	103%
Zinc-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	159437-1	300 310 RPD: 3	LCS-W1	100%

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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.

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.

EIS

[illegible]



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Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS

160278

Client:

Environmental Investigation Services

PO Box 976

North Ryde BC

NSW 1670

Attention: Para Bokalawela

Sample log in details:

Your Reference:

E25086KG, Narwee

No. of samples:

10 soils, 2 Waters

Date samples received / completed instructions received

16/01/17 / 16/01/17

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: / Issue Date:

23/01/17 / 19/01/17

Date of Preliminary Report:

Not Issued

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Accredited for compliance with ISO/IEC 17025 - Testing

Tests not covered by NATA are denoted with *.

Results Approved By:

David Springer
General Manager

Envirolab Reference: 160278

Revision No: R 00



vTRH(C6-C10)/BTEXN in Soil Our Reference: Your Reference	UNITS ----- -	160278-1 BH101	160278-2 BH101	160278-3 BH102	160278-4 BH102	160278-5 BH103
Depth	-----	0.2-0.4	4.3-4.5	0.2-0.4	3.6-3.8	0.2-0.4
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	18/01/2017	18/01/2017	18/01/2017	18/01/2017	18/01/2017
TRHC ₆ - C ₉	mg/kg	<25	<25	<25	<25	<25
TRHC ₆ - C ₁₀	mg/kg	<25	<25	<25	<25	<25
vTPHC 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	%	105	96	102	107	96

vTRH(C6-C10)/BTEXN in Soil Our Reference: Your Reference	UNITS ----- -	160278-6 BH103	160278-7 BH104	160278-8 BH104	160278-9 Dup A	160278-10 TS A
Depth	-----	4.3-4.5	0.2-0.4	4.3-4.5	-	-
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	18/01/2017	18/01/2017	18/01/2017	18/01/2017	18/01/2017
TRHC ₆ - C ₉	mg/kg	<25	<25	<25	<25	[NA]
TRHC ₆ - C ₁₀	mg/kg	<25	<25	<25	<25	[NA]
vTPHC ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25	<25	<25	<25	[NA]
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	99%
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	101%
Ethylbenzene	mg/kg	<1	<1	<1	<1	97%
m+p-xylene	mg/kg	<2	<2	<2	<2	95%
o-Xylene	mg/kg	<1	<1	<1	<1	95%
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	[NA]
naphthalene	mg/kg	<1	<1	<1	<1	[NA]
Surrogate aaa-Trifluorotoluene	%	109	95	102	96	89

svTRH (C10-C40) in Soil						
Our Reference:	UNITS	160278-1	160278-2	160278-3	160278-4	160278-5
Your Reference	-----	BH101	BH101	BH102	BH102	BH103
	-					
Depth	-----	0.2-0.4	4.3-4.5	0.2-0.4	3.6-3.8	0.2-0.4
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
TRHC ₁₀ - C ₁₄	mg/kg	<50	<50	<50	<50	<50
TRHC ₁₅ - C ₂₈	mg/kg	<100	<100	<100	<100	<100
TRHC 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 (>C ₁₀ -C ₄₀)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	92	91	92	89	91

svTRH (C10-C40) in Soil					
Our Reference:	UNITS	160278-6	160278-7	160278-8	160278-9
Your Reference	-----	BH103	BH104	BH104	Dup A
	-				
Depth	-----	4.3-4.5	0.2-0.4	4.3-4.5	-
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
TRHC ₁₀ - C ₁₄	mg/kg	<50	<50	<50	<50
TRHC ₁₅ - C ₂₈	mg/kg	<100	<100	<100	<100
TRHC ₂₉ - C ₃₆	mg/kg	<100	<100	<100	<100
TRH>C ₁₀ -C ₁₆	mg/kg	<50	<50	<50	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH>C ₁₆ -C ₃₄	mg/kg	<100	<100	<100	<100
TRH>C ₃₄ -C ₄₀	mg/kg	<100	<100	<100	<100
Total +ve TRH (>C ₁₀ -C ₄₀)	mg/kg	<50	<50	<50	<50
Surrogate o-Terphenyl	%	90	88	89	89

PAHs in Soil Our Reference: Your Reference	UNITS ----- -	160278-1 BH101	160278-3 BH102	160278-5 BH103	160278-7 BH104	160278-9 Dup A
Depth	-----	0.2-0.4	0.2-0.4	0.2-0.4	0.2-0.4	-
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
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	0.2	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.4	0.4	0.6	<0.1	<0.1
Pyrene	mg/kg	0.5	0.4	0.6	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.2	0.2	0.3	<0.1	<0.1
Chrysene	mg/kg	0.2	0.2	0.2	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.4	0.4	0.4	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.2	0.2	0.2	<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	2.4	2.4	2.5	<0.05	<0.05
Surrogate p-Terphenyl-d14	%	105	107	107	107	106

Organochlorine Pesticides in soil	UNITS	160278-1	160278-3	160278-5	160278-7
Our Reference:	-----	BH101	BH102	BH103	BH104
Your Reference	-				
Depth	-----	0.2-0.4	0.2-0.4	0.2-0.4	0.2-0.4
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	108	94	91	83

Organophosphorus Pesticides					
Our Reference:	UNITS	160278-1	160278-3	160278-5	160278-7
Your Reference	-----	BH101	BH102	BH103	BH104
	-				
Depth	-----	0.2-0.4	0.2-0.4	0.2-0.4	0.2-0.4
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyrifos	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyrifos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	108	94	91	83

PCBs in Soil Our Reference: Your Reference	UNITS ----- -	160278-1 BH101	160278-3 BH102	160278-5 BH103	160278-7 BH104
Depth	-----	0.2-0.4	0.2-0.4	0.2-0.4	0.2-0.4
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	108	94	91	83

Acid Extractable metals in soil						
Our Reference:	UNITS	160278-1	160278-2	160278-3	160278-4	160278-5
Your Reference	-----	BH101	BH101	BH102	BH102	BH103
	-					
Depth	-----	0.2-0.4	4.3-4.5	0.2-0.4	3.6-3.8	0.2-0.4
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	19/01/2017
Arsenic	mg/kg	4	[NA]	4	[NA]	32
Cadmium	mg/kg	<0.4	[NA]	<0.4	[NA]	2
Chromium	mg/kg	17	[NA]	16	[NA]	18
Copper	mg/kg	28	[NA]	29	[NA]	49
Lead	mg/kg	17	18	19	16	120
Mercury	mg/kg	<0.1	[NA]	<0.1	[NA]	<0.1
Nickel	mg/kg	13	[NA]	14	[NA]	25
Zinc	mg/kg	40	[NA]	37	[NA]	240

Acid Extractable metals in soil						
Our Reference:	UNITS	160278-6	160278-7	160278-8	160278-9	160278-13
Your Reference	-----	BH103	BH104	BH104	Dup A	BH101 -
	-					[TRIPLICATE]
Depth	-----	4.3-4.5	0.2-0.4	4.3-4.5	-	0.2-0.4
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	19/01/2017	17/01/2017
Arsenic	mg/kg	[NA]	8	[NA]	15	5
Cadmium	mg/kg	[NA]	<0.4	[NA]	2	<0.4
Chromium	mg/kg	[NA]	17	[NA]	12	16
Copper	mg/kg	[NA]	17	[NA]	44	33
Lead	mg/kg	18	25	17	110	22
Mercury	mg/kg	[NA]	<0.1	[NA]	<0.1	<0.1
Nickel	mg/kg	[NA]	5	[NA]	22	14
Zinc	mg/kg	[NA]	36	[NA]	220	47

Moisture Our Reference: Your Reference	UNITS ----- -	160278-1 BH101	160278-2 BH101	160278-3 BH102	160278-4 BH102	160278-5 BH103
Depth Date Sampled Type of sample	----- ----- -----	0.2-0.4 11/01/17 Soil	4.3-4.5 11/01/17 Soil	0.2-0.4 11/01/17 Soil	3.6-3.8 11/01/17 Soil	0.2-0.4 11/01/17 Soil
Date prepared	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	18/01/2017	18/01/2017	18/01/2017	18/01/2017	18/01/2017
Moisture	%	13	8.5	9.5	9.9	24

Moisture Our Reference: Your Reference	UNITS ----- -	160278-6 BH103	160278-7 BH104	160278-8 BH104	160278-9 Dup A
Depth Date Sampled Type of sample	----- ----- -----	4.3-4.5 11/01/17 Soil	0.2-0.4 11/01/17 Soil	4.3-4.5 11/01/17 Soil	- 11/01/17 Soil
Date prepared	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Date analysed	-	18/01/2017	18/01/2017	18/01/2017	18/01/2017
Moisture	%	9.5	20	13	24

Asbestos ID - soils					
Our Reference:	UNITS	160278-1	160278-3	160278-5	160278-7
Your Reference	-----	BH101	BH102	BH103	BH104
	-				
Depth	-----	0.2-0.4	0.2-0.4	0.2-0.4	0.2-0.4
Date Sampled		11/01/17	11/01/17	11/01/17	11/01/17
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	17/01/2017	17/01/2017	17/01/2017	17/01/2017
Sample mass tested	g	Approx. 30g	Approx. 40g	Approx. 35g	Approx. 45g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
		Organic fibres detected	Organic fibres detected	Organic fibres detected	Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

BTEX in Water Our Reference: Your Reference	UNITS ----- -	160278-11 TB A	160278-12 FR A
Depth	-----	-	-
Date Sampled		11/01/17	11/01/17
Type of sample		Water	Water
Date extracted	-	17/01/2017	17/01/2017
Date analysed	-	18/01/2017	18/01/2017
Benzene	µg/L	<1	<1
Toluene	µg/L	<1	<1
Ethylbenzene	µg/L	<1	<1
m+p-xylene	µg/L	<2	<2
o-xylene	µg/L	<1	<1
Surrogate Dibromofluoromethane	%	102	101
Surrogate toluene-d8	%	95	94
Surrogate 4-BFB	%	96	95

MethodID	Methodology Summary
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)-BTX 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)-BTX 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.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
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-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. 'TEQ 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. 'TEQ 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. 'TEQ 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-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-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
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.

Method ID	Methodology Summary
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
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.

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results
vTRH(C6-C10)/BTEXN in Soil						Base II Duplicate II %RPD
Date extracted	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Date analysed	-			18/01/2017	160278-1	18/01/2017 18/01/2017
TRHC ₆ - C ₉	mg/kg	25	Org-016	<25	160278-1	<25 <25
TRHC ₆ - C ₁₀	mg/kg	25	Org-016	<25	160278-1	<25 <25
Benzene	mg/kg	0.2	Org-016	<0.2	160278-1	<0.2 <0.2
Toluene	mg/kg	0.5	Org-016	<0.5	160278-1	<0.5 <0.5
Ethylbenzene	mg/kg	1	Org-016	<1	160278-1	<1 <1
m+p-xylene	mg/kg	2	Org-016	<2	160278-1	<2 <2
o-Xylene	mg/kg	1	Org-016	<1	160278-1	<1 <1
naphthalene	mg/kg	1	Org-014	<1	160278-1	<1 <1
Surrogate aaa-Trifluorotoluene	%		Org-016	105	160278-1	105 104 RPD: 1
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results
svTRH (C10-C40) in Soil						Base II Duplicate II %RPD
Date extracted	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Date analysed	-			17/01/2017	160278-1	17/01/2017 17/01/2017
TRHC ₁₀ - C ₁₄	mg/kg	50	Org-003	<50	160278-1	<50 <50
TRHC ₁₅ - C ₂₈	mg/kg	100	Org-003	<100	160278-1	<100 <100
TRHC ₂₈ - C ₃₆	mg/kg	100	Org-003	<100	160278-1	<100 <100
TRH>C ₁₀ -C ₁₆	mg/kg	50	Org-003	<50	160278-1	<50 <50
TRH>C ₁₆ -C ₃₄	mg/kg	100	Org-003	<100	160278-1	<100 <100
TRH>C ₃₄ -C ₄₀	mg/kg	100	Org-003	<100	160278-1	<100 <100
Surrogate o-Terphenyl	%		Org-003	92	160278-1	92 92 RPD: 0
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results
PAHs in Soil						Base II Duplicate II %RPD
Date extracted	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Date analysed	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Naphthalene	mg/kg	0.1	Org-012	<0.1	160278-1	<0.1 <0.1
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	160278-1	<0.1 <0.1
Acenaphthene	mg/kg	0.1	Org-012	<0.1	160278-1	<0.1 <0.1
Fluorene	mg/kg	0.1	Org-012	<0.1	160278-1	<0.1 <0.1
Phenanthrene	mg/kg	0.1	Org-012	<0.1	160278-1	0.1 0.1 RPD: 0
Anthracene	mg/kg	0.1	Org-012	<0.1	160278-1	<0.1 <0.1
Fluoranthene	mg/kg	0.1	Org-012	<0.1	160278-1	0.4 0.4 RPD: 0
Pyrene	mg/kg	0.1	Org-012	<0.1	160278-1	0.5 0.4 RPD: 22
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	160278-1	0.2 0.2 RPD: 0
Chrysene	mg/kg	0.1	Org-012	<0.1	160278-1	0.2 0.2 RPD: 0
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	160278-1	0.4 0.4 RPD: 0

Client Reference: E25086KG, Narwee

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results
PAHs in Soil						Base II Duplicate II %RPD
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	160278-1	0.2 0.2 RPD: 0
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	160278-1	0.1 0.1 RPD: 0
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	160278-1	<0.1 <0.1
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	160278-1	0.1 0.1 RPD: 0
Surrogate p-Terphenyl-d14	%		Org-012	108	160278-1	105 98 RPD: 7
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results
Organochlorine Pesticides in soil						Base II Duplicate II %RPD
Date extracted	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Date analysed	-			17/01/2017	160278-1	17/01/2017 17/01/2017
HCB	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
alpha-BHC	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
gamma-BHC	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
beta-BHC	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Heptachlor	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
delta-BHC	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Aldrin	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Endosulfan I	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
pp-DDE	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Dieldrin	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Endrin	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
pp-DDD	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Endosulfan II	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
pp-DDT	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Methoxychlor	mg/kg	0.1	Org-005	<0.1	160278-1	<0.1 <0.1
Surrogate TCMX	%		Org-005	106	160278-1	108 82 RPD: 27

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results
Organophosphorus Pesticides						Base II Duplicate II %RPD
Date extracted	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Date analysed	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Chlorpyrifos	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Chlorpyrifos-methyl	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Diazinon	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Dichlorvos	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Dimethoate	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Ethion	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Fenitrothion	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Malathion	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Parathion	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Ronnel	mg/kg	0.1	Org-008	<0.1	160278-1	<0.1 <0.1
Surrogate TCMX	%		Org-008	106	160278-1	108 82 RPD: 27
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results
PCBs in Soil						Base II Duplicate II %RPD
Date extracted	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Date analysed	-			17/01/2017	160278-1	17/01/2017 17/01/2017
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	160278-1	<0.1 <0.1
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	160278-1	<0.1 <0.1
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	160278-1	<0.1 <0.1
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	160278-1	<0.1 <0.1
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	160278-1	<0.1 <0.1
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	160278-1	<0.1 <0.1
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	160278-1	<0.1 <0.1
Surrogate TCLMX	%		Org-006	106	160278-1	108 82 RPD: 27

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results		
Acid Extractable metals in soil						Base II Duplicate II %RPD		
Date prepared	-			17/01/2017	160278-1	17/01/2017 17/01/2017		
Date analysed	-			17/01/2017	160278-1	17/01/2017 17/01/2017		
Arsenic	mg/kg	4	Metals-020	<4	160278-1	4 5 RPD: 22		
Cadmium	mg/kg	0.4	Metals-020	<0.4	160278-1	<0.4 <0.4		
Chromium	mg/kg	1	Metals-020	<1	160278-1	17 14 RPD: 19		
Copper	mg/kg	1	Metals-020	<1	160278-1	28 110 RPD: 119		
Lead	mg/kg	1	Metals-020	<1	160278-1	17 15 RPD: 12		
Mercury	mg/kg	0.1	Metals-021	<0.1	160278-1	<0.1 <0.1		
Nickel	mg/kg	1	Metals-020	<1	160278-1	13 10 RPD: 26		
Zinc	mg/kg	1	Metals-020	<1	160278-1	40 74 RPD: 60		
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
BTEX in Water						Base II Duplicate II %RPD		
Date extracted	-			17/01/2017	[NT]	[NT]	LCS-W1	17/01/2017
Date analysed	-			18/01/2017	[NT]	[NT]	LCS-W1	18/01/2017
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	94%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	94%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	96%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	96%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	95%
Surrogate Dibromofluoromethane	%		Org-016	102	[NT]	[NT]	LCS-W1	103%
Surrogate toluene-d8	%		Org-016	97	[NT]	[NT]	LCS-W1	102%
Surrogate 4-BFB	%		Org-016	97	[NT]	[NT]	LCS-W1	100%
QUALITYCONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	Dup. Sm#		Duplicate Base + Duplicate + %RPD		Spike Sm#	Spike % Recovery	
Date extracted	-	[NT]		[NT]		LCS-2	17/01/2017	
Date analysed	-	[NT]		[NT]		LCS-2	18/01/2017	
TRHC ₆ - C ₉	mg/kg	[NT]		[NT]		LCS-2	86%	
TRHC ₆ - C ₁₀	mg/kg	[NT]		[NT]		LCS-2	86%	
Benzene	mg/kg	[NT]		[NT]		LCS-2	96%	
Toluene	mg/kg	[NT]		[NT]		LCS-2	94%	
Ethylbenzene	mg/kg	[NT]		[NT]		LCS-2	80%	
m+p-xylene	mg/kg	[NT]		[NT]		LCS-2	81%	
o-Xylene	mg/kg	[NT]		[NT]		LCS-2	80%	
naphthalene	mg/kg	[NT]		[NT]		[NR]	[NR]	
Surrogate aaa-Trifluorotoluene	%	[NT]		[NT]		LCS-2	100%	

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	LCS-2	17/01/2017
Date analysed	-	[NT]	[NT]	LCS-2	17/01/2017
TRHC ₁₀ - C ₁₄	mg/kg	[NT]	[NT]	LCS-2	105%
TRHC ₁₅ - C ₂₈	mg/kg	[NT]	[NT]	LCS-2	110%
TRHC ₂₈ - C ₃₆	mg/kg	[NT]	[NT]	LCS-2	106%
TRH>C ₁₀ -C ₁₆	mg/kg	[NT]	[NT]	LCS-2	105%
TRH>C ₁₆ -C ₃₄	mg/kg	[NT]	[NT]	LCS-2	110%
TRH>C ₃₄ -C ₄₀	mg/kg	[NT]	[NT]	LCS-2	106%
Surrogate o-Terphenyl	%	[NT]	[NT]	LCS-2	96%
QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	LCS-2	17/01/2017
Date analysed	-	[NT]	[NT]	LCS-2	17/01/2017
Naphthalene	mg/kg	[NT]	[NT]	LCS-2	92%
Acenaphthylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	[NT]	[NT]	LCS-2	98%
Phenanthrene	mg/kg	[NT]	[NT]	LCS-2	103%
Anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	[NT]	[NT]	LCS-2	104%
Pyrene	mg/kg	[NT]	[NT]	LCS-2	104%
Benzo(a)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	[NT]	[NT]	LCS-2	95%
Benzo(b,j,k)fluoranthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	[NT]	[NT]	LCS-2	94%
Indeno(1,2,3-c,d)pyrene	mg/kg	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%	[NT]	[NT]	LCS-2	118%

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	LCS-2	17/01/2017
Date analysed	-	[NT]	[NT]	LCS-2	17/01/2017
HCB	mg/kg	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	[NT]	[NT]	LCS-2	94%
gamma-BHC	mg/kg	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	[NT]	[NT]	LCS-2	102%
Heptachlor	mg/kg	[NT]	[NT]	LCS-2	99%
delta-BHC	mg/kg	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	[NT]	[NT]	LCS-2	94%
Heptachlor Epoxide	mg/kg	[NT]	[NT]	LCS-2	98%
gamma-Chlordane	mg/kg	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	[NT]	[NT]	LCS-2	101%
Dieldrin	mg/kg	[NT]	[NT]	LCS-2	104%
Endrin	mg/kg	[NT]	[NT]	LCS-2	125%
pp-DDD	mg/kg	[NT]	[NT]	LCS-2	94%
Endosulfan II	mg/kg	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	[NT]	[NT]	LCS-2	97%
Methoxychlor	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%	[NT]	[NT]	LCS-2	88%

QUALITYCONTROL Organophosphorus Pesticides	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	LCS-2	17/01/2017
Date analysed	-	[NT]	[NT]	LCS-2	17/01/2017
Azinphos-methyl (Guthion)	mg/kg	[NT]	[NT]	[NR]	[NR]
Bromophos-ethyl	mg/kg	[NT]	[NT]	[NR]	[NR]
Chlorpyrifos	mg/kg	[NT]	[NT]	LCS-2	90%
Chlorpyrifos-methyl	mg/kg	[NT]	[NT]	[NR]	[NR]
Diazinon	mg/kg	[NT]	[NT]	[NR]	[NR]
Dichlorvos	mg/kg	[NT]	[NT]	LCS-2	116%
Dimethoate	mg/kg	[NT]	[NT]	[NR]	[NR]
Ethion	mg/kg	[NT]	[NT]	LCS-2	99%
Fenitrothion	mg/kg	[NT]	[NT]	LCS-2	99%
Malathion	mg/kg	[NT]	[NT]	LCS-2	87%
Parathion	mg/kg	[NT]	[NT]	LCS-2	125%
Ronnel	mg/kg	[NT]	[NT]	LCS-2	110%
Surrogate TCMX	%	[NT]	[NT]	LCS-2	88%
QUALITYCONTROL PCBs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	LCS-2	17/01/2017
Date analysed	-	[NT]	[NT]	LCS-2	17/01/2017
Aroclor 1016	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1221	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1232	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1242	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1248	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1254	mg/kg	[NT]	[NT]	LCS-2	90%
Aroclor 1260	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%	[NT]	[NT]	LCS-2	88%
QUALITYCONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	160278-5	17/01/2017 17/01/2017	LCS-2	17/01/2017
Date analysed	-	160278-5	19/01/2017 19/01/2017	LCS-2	17/01/2017
Arsenic	mg/kg	160278-5	32 20 RPD: 46	LCS-2	115%
Cadmium	mg/kg	160278-5	2 2 RPD: 0	LCS-2	105%
Chromium	mg/kg	160278-5	18 14 RPD: 25	LCS-2	112%
Copper	mg/kg	160278-5	49 58 RPD: 17	LCS-2	108%
Lead	mg/kg	160278-5	120 110 RPD: 9	LCS-2	102%
Mercury	mg/kg	160278-5	<0.1 <0.1	LCS-2	86%
Nickel	mg/kg	160278-5	25 27 RPD: 8	LCS-2	102%
Zinc	mg/kg	160278-5	240 240 RPD: 0	LCS-2	105%

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160278-3	17/01/2017
Date analysed	-	[NT]	[NT]	160278-3	18/01/2017
TRHC ₆ - C ₉	mg/kg	[NT]	[NT]	160278-3	92%
TRHC ₆ - C ₁₀	mg/kg	[NT]	[NT]	160278-3	92%
Benzene	mg/kg	[NT]	[NT]	160278-3	99%
Toluene	mg/kg	[NT]	[NT]	160278-3	99%
Ethylbenzene	mg/kg	[NT]	[NT]	160278-3	84%
m+p-xylene	mg/kg	[NT]	[NT]	160278-3	89%
o-Xylene	mg/kg	[NT]	[NT]	160278-3	86%
naphthalene	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate aaa- Trifluorotoluene	%	[NT]	[NT]	160278-3	107%
QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160278-3	17/01/2017
Date analysed	-	[NT]	[NT]	160278-3	17/01/2017
TRHC ₁₀ - C ₁₄	mg/kg	[NT]	[NT]	160278-3	90%
TRHC ₁₅ - C ₂₈	mg/kg	[NT]	[NT]	160278-3	96%
TRHC ₂₉ - C ₃₆	mg/kg	[NT]	[NT]	160278-3	95%
TRH>C ₁₀ -C ₁₆	mg/kg	[NT]	[NT]	160278-3	90%
TRH>C ₁₆ -C ₃₄	mg/kg	[NT]	[NT]	160278-3	96%
TRH>C ₃₄ -C ₄₀	mg/kg	[NT]	[NT]	160278-3	95%
Surrogate o-Terphenyl	%	[NT]	[NT]	160278-3	92%
QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160278-3	17/01/2017
Date analysed	-	[NT]	[NT]	160278-3	17/01/2017
Naphthalene	mg/kg	[NT]	[NT]	160278-3	67%
Acenaphthylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	[NT]	[NT]	160278-3	94%
Phenanthrene	mg/kg	[NT]	[NT]	160278-3	85%
Anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	[NT]	[NT]	160278-3	91%
Pyrene	mg/kg	[NT]	[NT]	160278-3	95%
Benzo(a)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	[NT]	[NT]	160278-3	86%
Benzo(b,j,k)fluoranthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	[NT]	[NT]	160278-3	105%
Indeno(1,2,3-c,d)pyrene	mg/kg	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Benzo(g,h,i)perylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%	[NT]	[NT]	160278-3	112%
QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160278-3	17/01/2017
Date analysed	-	[NT]	[NT]	160278-3	17/01/2017
HCB	mg/kg	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	[NT]	[NT]	160278-3	118%
gamma-BHC	mg/kg	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	[NT]	[NT]	160278-3	119%
Heptachlor	mg/kg	[NT]	[NT]	160278-3	127%
delta-BHC	mg/kg	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	[NT]	[NT]	160278-3	118%
Heptachlor Epoxide	mg/kg	[NT]	[NT]	160278-3	122%
gamma-Chlordane	mg/kg	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	[NT]	[NT]	160278-3	119%
Dieldrin	mg/kg	[NT]	[NT]	160278-3	132%
Endrin	mg/kg	[NT]	[NT]	160278-3	123%
pp-DDD	mg/kg	[NT]	[NT]	160278-3	118%
Endosulfan II	mg/kg	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	[NT]	[NT]	160278-3	115%
Methoxychlor	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%	[NT]	[NT]	160278-3	124%

QUALITYCONTROL Organophosphorus Pesticides	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160278-3	17/01/2017
Date analysed	-	[NT]	[NT]	160278-3	17/01/2017
Azinphos-methyl (Guthion)	mg/kg	[NT]	[NT]	[NR]	[NR]
Bromophos-ethyl	mg/kg	[NT]	[NT]	[NR]	[NR]
Chlorpyrifos	mg/kg	[NT]	[NT]	160278-3	105%
Chlorpyrifos-methyl	mg/kg	[NT]	[NT]	[NR]	[NR]
Diazinon	mg/kg	[NT]	[NT]	[NR]	[NR]
Dichlorvos	mg/kg	[NT]	[NT]	160278-3	101%
Dimethoate	mg/kg	[NT]	[NT]	[NR]	[NR]
Ethion	mg/kg	[NT]	[NT]	160278-3	103%
Fenitrothion	mg/kg	[NT]	[NT]	160278-3	112%
Malathion	mg/kg	[NT]	[NT]	160278-3	104%
Parathion	mg/kg	[NT]	[NT]	160278-3	119%
Ronnel	mg/kg	[NT]	[NT]	160278-3	110%
Surrogate TCMX	%	[NT]	[NT]	160278-3	84%
QUALITYCONTROL PCBs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160278-3	17/01/2017
Date analysed	-	[NT]	[NT]	160278-3	17/01/2017
Aroclor 1016	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1221	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1232	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1242	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1248	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1254	mg/kg	[NT]	[NT]	160278-3	89%
Aroclor 1260	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%	[NT]	[NT]	[NR]	[NR]
QUALITYCONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	160278-9	17/01/2017 17/01/2017	160278-3	17/01/2017
Date analysed	-	160278-9	19/01/2017 19/01/2017	160278-3	17/01/2017
Arsenic	mg/kg	160278-9	15 18 RPD: 18	160278-3	86%
Cadmium	mg/kg	160278-9	2 2 RPD: 0	160278-3	83%
Chromium	mg/kg	160278-9	12 15 RPD: 22	160278-3	80%
Copper	mg/kg	160278-9	44 45 RPD: 2	160278-3	106%
Lead	mg/kg	160278-9	110 110 RPD: 0	160278-3	76%
Mercury	mg/kg	160278-9	<0.1 <0.1	160278-3	88%
Nickel	mg/kg	160278-9	22 21 RPD: 5	160278-3	73%
Zinc	mg/kg	160278-9	220 220 RPD: 0	160278-3	76%

Report Comments:

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 160278-1 for Cu and Zn. Therefore a triplicate result has been issued as laboratory sample number 160278-13.

Asbestos ID was analysed by Approved Identifier: Lucy Zhu
Asbestos ID was authorised by Approved Signatory: Paul Ching

INS: Insufficient sample for this test
NR: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

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.

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.

[illegible]

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 (eg. BH1), sampling depth interval and date. If more than one sample container is used, this should also be indicated (eg. 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 AS1726-1993²⁰.
- 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.

²⁰ 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 adherence 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 be 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* (1994²¹) methods and those described in *Environmental Sampling and Analysis, A Practical Guide*, (H. Keith 1991²²).

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 handling and analysis protocols and use of proper chain-of-custody and documentation procedures.

²¹ US EPA, (1994), *SW-846: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. (US EPA SW-846)

²² 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 (eg. 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:

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

Appendix D: Field Work Documents



Groundwater Grab Sampling

Client:	Caltex Narwee	Job No.:	E25086KG		
Project:	Preliminary Stage 2 ESA	Well No.:	MW...1		
Location:	41 Broadarrow Road, Narwee	Depth (m):	—		
MONITORING WELL SAMPLING DETAILS					
Method:	Bailer	SWL (m):	...0.825...		
Date:	16 Dec 2016	Time:	...11 am...		
Undertaken By:	PB	PID (ppm):	...		
FIELD MEASUREMENTS					
Volume Removed (L)	Temp (°C)	pH	EC (S/m)	DO (mg/L)	Eh (mV)
—	21.1	5.84	3204	5.4	200
Comments: Rain					
Tested By:	PB	Remarks:			
Date Tested:	16 Dec 2016	- SWL is an abbreviation for standing water level			
Checked By:	<i>[Signature]</i>	- EC is electrical conductivity			
Date:	1/2/17	- DO is dissolved oxygen			
		- Eh is redox potential			

Groundwater Grab Sampling

Client:	Caltex Narwee	Job No.:	E25086KG		
Project:	Preliminary Stage 2 ESA	Well No.:	MW..2		
Location:	41 Broadarrow Road, Narwee	Depth (m):	—		
MONITORING WELL SAMPLING DETAILS					
Method:	Bailer	SWL (m):	...1.341...		
Date:	16 Dec 2016	Time:	...11 am...		
Undertaken By:	PB		...		
FIELD MEASUREMENTS					
Volume Removed (L)	Temp (°C)	pH	EC (mS/m)	DO (mg/L)	Eh (mV)
—	20.9	5.74	12027	7.2	134
Comments: Rain					
Tested By:	PB	Remarks:			
Date Tested:	16 Dec 2016	- SWL is an abbreviation for standing water level			
Checked By:	<i>[Signature]</i>	- EC is electrical conductivity			
Date:	1/2/17	- DO is dissolved oxygen			
		- Eh is redox potential			



Groundwater Grab Sampling

Client:	Caltex Narwee	Job No.:	E25086KG		
Project:	Preliminary Stage 2 ESA	Well No.:	MW..3		
Location:	41 Broadarrow Road, Narwee	Depth (m):	—		
MONITORING WELL SAMPLING DETAILS					
Method:	Bailer	SWL (m):	...1.983...		
Date:	16 Dec 2016	Time:	...11 am...		
Undertaken By:	PB	PID (ppm):		
FIELD MEASUREMENTS					
Volume Removed (L)	Temp (°C)	pH	EC (S/m)	DO (mg/L)	Eh (mV)
—	22.4	5.21	438.5	4.3	160
Comments: Rain					
Tested By:	PB	Remarks:			
Date Tested:	16 Dec 2016	- SWL is an abbreviation for standing water level			
Checked By:	PB	- EC is electrical conductivity			
Date:	12/17	- DO is dissolved oxygen			
		- Eh is redox potential			

Groundwater Grab Sampling

Client:	Caltex Narwee	Job No.:	E25086KG		
Project:	Preliminary Stage 2 ESA	Well No.:	MW....		
Location:	41 Broadarrow Road, Narwee	Depth (m):			
MONITORING WELL SAMPLING DETAILS					
Method:	Bailer	SWL (m):		
Date:	16 Dec 2016	Time:		
Undertaken By:	PB			
FIELD MEASUREMENTS					
Volume Removed (L)	Temp (°C)	pH	EC (mS/m)	DO (mg/L)	Eh (mV)
Comments:					
Tested By:	PB	Remarks:			
Date Tested:	16 Dec 2016	- SWL is an abbreviation for standing water level			
Checked By:		- EC is electrical conductivity			
Date:		- DO is dissolved oxygen			
		- Eh is redox potential			