Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

# Report on
# Remediation Action Plan

## Proposed Open Play Space
## 4 Vernon Street, Strathfield

Prepared for
Meriden School

Project 86568.02
June 2019

**Douglas Partners**
*Geotechnics / Environment / Groundwater*

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## 1. Introduction

Douglas Partners Pty Ltd (DP) was commissioned by Meriden School to prepare a Remediation Action Plan (RAP) for the proposed open play space at 'Site 2', located at 4 Vernon Street, Strathfield (the "site", as shown by the green outline on Drawing 1, Appendix A). Preparation of the RAP was commissioned by Richard Arkell of Meriden School.

The development involves the demolition of the existing house and construction of an open play space with a shaded structure, a stand for seating and a new carport.

In the preparation of this RAP, reference has been made to the following guidelines:

- National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended in 2013), (NEPC, 2013);
- NSW EPA, *Sampling Design Guidelines* (EPA, 1995);
- NSW OEH, *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011);
- NSW DEC (2006) *Contaminated Sites Guidelines for the NSW Site Auditor Scheme* 2nd Edition (DEC, 2006)
- NSW EPA *Waste Classification Guidelines, Part 1: Classifying Waste* (EPA, 2014a);
- NSW EPA *Waste Classification Guidelines Part 2: Immobilisation of Waste* (EPA, 2014b); and
- State Environmental Planning Policy 55 (SEPP55) - Remediation of Land.

The overall goal of the remediation programme outlined in the RAP is to render the site suitable, from a contamination perspective, for the proposed development. The objectives are listed in Section 2.

## 2. Objectives of this RAP

The objectives of this RAP are to:

- establish an appropriate remedial strategy so as to render the site suitable, from a site contamination perspective, for the proposed development;
- establish the remediation acceptance criteria to be adopted for the remediation of the site and the validation requirements to verify the successful implementation of the remediation strategy;
- establish appropriate environmental safeguards required to complete the remediation works in an environmentally acceptable manner;

- establish appropriate occupational, health and safety (OH&S) procedures required to complete the remediation works in a manner that would not pose a threat to the health of site workers or users; and
- Establish a framework to minimise environmental risk on the site and the surrounding environment.

## 3. Site Description

The site covers a rectangular area of approximately 460 $m^2$ within the local government area of Strathfield Council. At the time the preliminary contamination investigation was undertaken (February 2019), the site was used as a clothing store for Meriden School and was occupied by a single storey, free standing brick building with a tiled roof and a detached single brick garage to the east. The site locality and a location plan showing the site boundary is shown on Drawing 1, Appendix A. The site identification details are provided in Table 1 below.

**Table 1: Site Identification Details**

| Item | Details |
|---|---|
| Site Owner | Meiden School |
| Site Address | 4 Vernon Street, Strathfield |
| Current land use | School Facilities |
| Lot and Deposited Plan | Lot 1 D.P 1244199 (formerly identified as Lot B D.P438392) |
| LEP Planning Zone | R3: Medium Density Residential |
| Approximate Site Area | 460 $m^2$ |
| Proposed future land-use | School Facilities |

## 4. Site Geology, Hydrogeology and Topography

The site is at approximately 16 m AHD. Gentle slopes at the site and nearby land are to the north-west.

According to the Sydney 1:100,000 Geology Sheet, the site is underlain by Ashfield Shale which comprises black to dark grey shale and laminite.

According to the Sydney 1:100,000 Soils Landscape Sheet, the site is located within the Blacktown soil landscape which has residual (natural) soils.

According to NSW Acid Sulfate Soils Risk mapping data from NSW Department of Environment and Climate Change (1994-1998), the site is not located at or near an area associated with a risk of acid sulfate soils.

The nearest surface water body is Powells Creek which is located approximately 600 m to the north of the site. Powells Creek flows into Homebush Bay, approximately 4 km to the north of the site. Based on topography, it anticipated that groundwater at the site would flow to the north or north-west and migrate towards Powells Creek.

A search of the Water NSW website did not reveal any registered groundwater bores within 500 m of the site.

## 5. Review of previous reports

Previous reports reviewed as part of this RAP include:

- Douglas Partners *Report on Preliminary Site Investigation for Contamination, Site 2 - Proposed Open Play Space, 4 Vernon Street, Strathfield,* prepared for Meriden School, Project 86568.02 dated 25 February 2019 (DP, 2019a);
- Douglas Partners *Report on Hazardous Building Materials (HBM) Register*, prepared for Meriden School and Allen Jack+ Cottier Architects Pty Ltd, Project 86568.02 dated 2 February 2019 (DP, 2019b); and
- Douglas Partners *Report on Geotechnical Investigation, Site 2 - Proposed Open Play Space, 4 Vernon Street, Strathfield,* prepared for Meriden School, Project 86568.02 dated 20 February 2019 (DP, 2019c);

### 5.1 DP, 2018a

DP undertook a preliminary site investigation (PSI) with limited sampling for contamination, which included a review of site history information, a site walkover, intrusive investigation, laboratory analysis and reporting. This was undertaken in conjunction with the geotechnical investigation reported in DP 2018c.

Aerial photographs from 1930 to 2018 were reviewed to provide an indication of past land uses and identify possible sources of contamination. The existing house was evident in the 1930 aerial photograph. Apart from some possible changes to the arrangement of the back yard, the site has remained essentially the same since 1930. The existing neighbouring house to the north has also been present since (before) 1930.

The neighbouring land to the south, which is currently occupied by a school building (Blackman Auditorium), was occupied by a residence from (before) 1930 to (after) 1999.

The neighbouring land to the east appears to have been part of school grounds since 1930. A school building had been constructed on this land by 1999.

Properties on the opposite side of Vernon Street appear to have been used for residential purposes since (before) 1930. It appears that one of these properties had been redeveloped between 1978 and 1999.

A conceptual site model (CSM) was developed on the basis of the history reported above and the site features noted. The current CSM is outlined in Section 6.

A series of boreholes were positioned in the investigation area as shown on Drawing 1, Appendix A. The investigation found the following typical substrata profile across the locations:

> FILLING: Dark grey sandy silt filling with inclusion of rootlets and gravels, to a depth of 0.2 m bgl at each borehole, possible ash was observed in filling at BH4;
>
> RESIDUAL CLAY: High plasticity, firm to stiff, red brown and brown residual clays, to depths ranging between 0.6 m and 0.8m bgl. This natural material was underlain by grey and brown clay with a trace of ironstone bands to depths ranging between 1.0 and 1.4m bgl, becoming very stiff and hard with depth;
>
> SHALE: Inferred to be extremely low to very low strength shale.

Test bore logs are provided in Appendix C and should be referenced for detailed descriptions of the soil profile at each test location. No free groundwater was observed during drilling of the boreholes.

No obvious signs of contamination (e.g. odours, staining etc.) were observed in the sampled soil. Potential asbestos containing material (ACM) was not observed in the soil whilst sampling.

A fill sample from each test bore was submitted for analysis for a suite of potential contaminants (metals, TRH, BTEX, PAH, OCP, OPP, total phenols and asbestos) as fill was considered more likely to contain contaminants than underlying natural soils, particularly given that materials such as ash was observed in fill, which may be indicative of PAH contamination. The test results are summarised in Table B1, Appendix B.

The site assessment criteria (SAC) for the investigation comprised predominantly health investigation and screening levels (HIL and HSL) and ecological investigation and screening levels (EIL and ESL). The generic 'HIL A' were considered to be appropriate given that the site is within primary school grounds. 'HSL C' has been adopted as the SAC given that the proposed development is predominantly open space.

As indicated on Table B1, the bulk of the analyte concentrations in the tested soil samples were less than the adopted SAC, with the exception of the following:

- Concentrations of lead exceeding the HIL A in all fill samples and exceeding the EIL (1100 mg/kg) in the fill sample from BH4, depth 0.1-0.2m;
- Concentrations of zinc exceeding the EIL in sample from BH4/0.1-0.2m;
- Concentrations of TRH (C16-C34) exceeding the ESL in fill in BH3 and BH4;
- Concentrations of benzo(a)pyrene TEQ exceeding the HIL A in all the fill samples; and
- Concentrations of benzo(a)pyrene exceeding the ESL in all fill samples which is a low reliability screening level.

The tested fill has concentrations of lead and PAH above the health-based SAC, and, on this basis, it was considered that remediation will be required to make the site suitable for the proposed open play space development. A site-specific risk assessment (i.e. further investigation and assessment) could

be undertaken to determine if remediation is required, however, the outcome of a site-specific risk assessment may not change the requirement for remediation.

A preliminary waste classification was also undertaken and presented in the report. The results are presented in Table B2, Appendix B. Based on the observations at the time of sampling and the reported analytical results, the fill across the investigation area was preliminarily classifiable as General Solid Waste (non-putrescible), as defined in EPA (2014a) and the natural material has a preliminary classification as virgin excavated natural material (VENM), however, given the potential impacts from overlying filling (containing metals, PAH, TRH and PCB), the VENM classification should be confirmed (or otherwise) through inspection and sample analysis following the excavation and removal / segregation of filling from the natural soil.

Based on the results of the PSI report, it was concluded that:

- Remediation will likely require excavation and removal of the fill (which is approximately 0.2 m thick according to borehole logs) for disposal at a licensed landfill. This would also address fill which has concentrations of lead, TRH and zinc above the ecological-based criteria;

- Remediation may, as an alternative to the above approach, involve keeping the contaminated filling at the site beneath a physical barrier which is managed through implementation of a long-term Environmental Management Plan (EMP). It is noted, however, that the placement of this filling would be limited by geotechnical requirements. Also, potential impacts on groundwater quality from soil contamination would need to be further assessed before this approach is deemed appropriate. The TCLP results for PAH and lead for filling samples indicates a very low potential for PAH and lead in filling to impact groundwater quality. The retention of contaminated soil at the site under a long-term, EMP would require notification under Section 10.7 of the *Environmental Planning and Assessment Act 1979* or a covenant registered on the title to land under Section 88B of the *Conveyancing Act 1919*.

- The remediation approach to be adopted should be documented in a Remediation Action Plan (RAP). The RAP should include the requirements for addressing data gaps (such as within the current building footprint, following its demolition).

## 5.2 DP, 2018b

DP has conducted a hazardous building materials (HBM) survey of a number of buildings for Meriden at Strathfield. The survey included investigation and identification of hazardous material inclusive of asbestos-containing materials (ACM). Other hazardous materials included lead-based paint systems (LBP), lead-containing dust (LCD), ozone depleting substances (ODS), polychlorinated biphenyls in light capacitors (PCB) and synthetic mineral fibre (SMF) in accessible areas.

From the survey and laboratory analysis results, a register of hazardous materials was produced in accordance with the requirements of the relevant Codes of Practice and Guidance Notes. LBP and SMF containing materials were identified or suspected to be present in the buildings at the time of survey. No ODS, LBP or ODS were identified on site. Asbestos containing fibre cement debris and fragments are highly likely to be present onsite. Removal material prior to any significant disturbance (e.g. renovation, demolition or maintenance work) is recommended in the DP (2018b) report.

### 5.3 DP, 2018c

A geotechnical investigation was undertaken by DP in February 2019 and included the drilling of four boreholes across the site. Dynamic cone penetrometer tests at each borehole and laboratory testing of selected soil samples was also carried out. The geotechnical investigation was conducted in conjunction with the fieldwork for DP (2018a).

## 6. Conceptual Site Model

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

### 6.1 Potential Contamination Sources

Based on current and previous site uses, DP's site observations and previous testing results, the potential sources of contamination and associated contaminants are summarised as follows:

- S1 – Fill and surficial soil. Imported contaminated fill used to form/level the site. Deterioration of hazardous building materials may have impacted surficial soils. Various potential contaminants are possible, such as metals, total petroleum hydrocarbons, BTEX, PAH, OCP, OPP, PCB, phenols and asbestos. Contaminants with respect to the proposed development, that have been identified to date, include lead, PAH, TRH and zinc;
- S2 – Hazardous building materials in structures at the site. The potential contaminants are lead (from lead-based paint), asbestos (from asbestos-containing materials) and PCB (from capacitors in light fixtures and paint). It is noted that lead paint was identified in the hazardous building material survey (Reference 86568.02.01.R.01). Asbestos and PCB were not identified in the survey, however, it is possible that these substances were previously present in the building but were then removed for internal renovations.

### 6.2 Potential Receptors

Potential receptors of contamination for the proposed development have been identified to include:

- R1 – Future site users (students, school staff and visitors);
- R2 – Construction workers for the proposed development;
- R3 – Future maintenance workers;
- R4 – Adjacent land users (students, school staff, visitors and residents);
- R5 – Groundwater;
- R6 – Surface water;
- R7 – Terrestrial ecology; and

- R8 – In ground building structures.

## 6.3 Potential Pathways

Potential pathways for contamination to impact receptors include the following:

- P1 – Ingestion and dermal contact;
- P2 – Inhalation of dust;
- P3 – Inhalation of vapours;
- P4 – Surface water runoff;
- P5 – Leaching of contaminants and vertical migration into groundwater;
- P6 – Lateral migration of groundwater;
- P7 – Direct contact with terrestrial ecology; and
- P8 – Direct contact of contaminated ground with in ground structures.

## 6.4 Summary of Potential Complete Pathways

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

**Table 2: Summary of Potential Complete Pathways**

| Potential Source of Contamination | Transport Pathway | Receptor | Notes |
|---|---|---|---|
| S1 –Fill and surficial soil | P1 - Ingestion and dermal contact<br>P2 – Inhalation of dust<br>P3 – Inhalation of vapours | R1 – Future site users<br>R2 – Construction workers<br>R3 – Future maintenance workers | Health-based assessment of soil contamination has been undertaken in this investigation. Remediation of identified impacts has been recommended. |
| | P2 – Inhalation of dust<br>P3 – Inhalation of vapours | R4 – Adjacent land users | |
| | P5 – Leaching of contaminants and vertical migration into groundwater | R5 – Groundwater | Assessment of potential surface water and groundwater contamination has been limited to potential impacts from soils at the site. |
| | P4 – Surface water runoff<br>P6 – Lateral migration of groundwater | R6 – Surface water body | |
| | P7 - Direct contact with terrestrial ecology | R7 – Terrestrial ecology | Ecological assessment of soil contamination has been undertaken in this investigation. Remediation of identified impacts has been recommended. |
| | P8 – Direct contact of contaminated ground with in ground structures | R8 – In ground building structures | Assessment of petroleum hydrocarbons in soil against management limits has been undertaken in this investigation. |
| S2 - Hazardous building materials in structures at the site | P1 - Ingestion and dermal contact<br>P2 – Inhalation of dust | R1 – Future site users<br>R2 – Construction workers<br>R3 – Future maintenance workers | A hazardous building materials survey has been undertaken concurrently with this investigation. |
| | P2 – Inhalation of dust | R4 – Adjacent land users | |

# 7. Data Quality Objectives and Indicators

In order to attain the remediation goals as set out in Section 2 the following seven step data quality objective (DQO) process, as defined in Australian Standard *Guide to the investigation and sampling of sites with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1 – 2005) has been adopted. The DQO process is outlined as follows:

**(a) State the Problem**

The 'problem' under consideration is the implementation of an appropriate remediation action plan to ensure any previously identified contamination and unexpected finds and waste classification/disposal procedures are managed appropriately to ensure that the remediated site will be suitable for the proposed development and that the remedial works pose no unacceptable risks to human health or to the environment.

The various parties involved in this decision process, include:

- The site owner (Meriden School);
- The principal's representative (Contractors to be confirmed);
- The planning authority (Strathfield Council); and
- The environmental consultant (DP) for the investigation and remediation planning works.

**(b) Identify the Decision**

Based on the findings of the previous assessments, site observations and the proposed development details, the principal decision is to adopt an appropriate remediation strategy to achieve the objectives stated in Section 2. Assessment and classification requirements for imported soil are also outlined in the RAP.

**(c) Identify Inputs to the Decision**

Inputs to the decision include:

- Previous reports cited in Section 5;
- NSW Environment Protection Authority, *Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme* (3rd edition);
- Australian Water Quality Guidelines 2000 (AWQG);
- Australian Drinking Water Guidelines 2017 (ADWG, for reference only as the groundwater at the site is not considered a drinking water source);
- National water quality management strategy. Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC and ARMCANZ);
- NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure (as amended 2013).

The primary inputs in adopting a remediation strategy are as follows:

- The areas of potential contamination derived from known historical site activities identified from the site history review outlined in previous DP reports;
- The investigation findings reported previously, as outlined in Section 5;
- Published guidelines appropriate to the proposed future land use;
- Published soil guidelines appropriate to the proposed future land use (hospital and educational facilities) and published guidelines for protection of the environment;
- Field investigation techniques to assess contamination as per DP's standard field procedures;
- Field observations and analytical results; and
- Proposed land use and design of the proposed development.

**(d) Define the Boundary of the Assessment**

The site boundary is shown in Drawing 1 in Appendix A.

**(e) Develop a Decision Rule**

The successful implementation of the RAP is assessed on the basis of the remediation acceptance criteria (RAC) provided in Section 8. The decision rule is the comparison of the analytical results against the relevant guidelines and background concentrations where relevant.

**(f) Specify Acceptable Limits on Decision Errors**

Specific limits for this project will generally be in accordance with NEPC (2013). In order that the results are accurate and reproducible, appropriate and adequate quality assurance and quality control (QA/QC) measures and evaluations will be incorporated into the validation sampling and testing regime.

**(g) Optimize the Design for Obtaining Data**

In order to ensure the collection of representative data, the sampling regime is based on the areas and their extent of environmental concern. In addition, in order to attain an acceptable level of data quality, QA/QC procedures will be adopted as part of the RAP requirements.

If the DQOs are not met, then the reasons as to why they were not achieved will be critically examined. If the situation cannot be easily rectified or is unique to the site assessment of future actions required will be discussed and implemented where applicable.

## 7.1 Data Quality Indicators

DP's quality assurance (QA) and quality control (QC) procedures will be adopted throughout the field sampling programme to ensure sampling precision and accuracy and prevent cross contamination.

The quality controls of documentation completeness, data completeness, data comparability, data representativeness, precision and accuracy for sampling and analysis, if required, are described in Table 3.

**Table 3: Data Quality Indicators**

| Quality Control | Achievement Evaluation Procedure |
|---|---|
| Documentation completeness | Completion of field and laboratory chain of custody documentation, completion of validation sample plans. |
| Data completeness | Sampling density according to provisions in the approved RAP, and analysis of appropriate determinants based on site history and on-site observation. |
| Data comparability and representativeness | Use of NATA accredited laboratories, use of consistent sampling technique. |
| Precision and accuracy for sampling and analysis | Achievement of 30-50% RPD for heavy metals and organics respectively for replicate analysis, acceptable levels for laboratory QC criteria. |

## 8. Remediation Acceptance Criteria

The remediation works will be validated as meeting an acceptable standard for the proposed land use. The validation will be undertaken by the environmental consultant by means of visual inspection, field screening, recovery and analysis of samples (where required) and review of any available plans, as discussed below.

This section provides remediation acceptance criteria (RAC), which will be used to judge the success or otherwise of the remediation by the consultant.

### 8.1 Health Investigation and Screening Levels

Analytical results from laboratory testing will be assessed against the (Tier 1) investigation and screening levels sourced from Schedule B1 of NEPC (2013). This guideline has been endorsed by the NSW EPA under the *Contaminated Land Management* (CLM) *Act* 1997. Schedule B of NEPC (2013) provides investigation and screening levels for commonly encountered contaminants which are applicable to generic land uses and include consideration of, where relevant, the soil type and the depth of contamination. The investigation and screening levels are not intended to be used as clean up levels. They establish concentrations above which further appropriate investigation (e.g. Tier 2 or Tier 3) should be undertaken.

It is understood that the redevelopment of the site includes the demolition of the existing house and construction of an open play space with a shaded structure, a stand for seating and a new carport. The generic 'HIL A' is considered to be appropriate as SAC given that the site is within primary school grounds. Health Screening levels for direct contact with contaminants are adopted from the *Cooperative Research Centre for Contamination Assessment and Remediation of the Environment*

(CRC CARE) *Technical Report no.10 Health screening levels for petroleum hydrocarbons in soil and groundwater* (2011), in accordance with NEPC (2013). Given that the proposed use is for an open play space with shade structure and carport and an absence of enclosed structures, HSL C thresholds are adopted for the assessment of potential vapour intrusion.

The adopted HIL and HSL are shown in Table 4.

**Table 4: HIL and HSL for Soil Contaminants**

| Contaminant | HIL A (mg/kg) | HSL C for vapour intrusion (mg/kg) |
|---|---|---|
| **Metals and Inorganics** | | |
| Arsenic | 100 | - |
| Cadmium | 20 | - |
| Chromium (VI) | 100 | - |
| Copper | 6000 | - |
| Lead | 300 | - |
| Mercury (inorganic) | 40 | - |
| Nickel | 400 | - |
| Zinc | 7400 | - |
| **Total Petrolum Hydrocabons** | | |
| C6 – C10 (less BTEX) | - | NL |
| >C10-C16 (less Naphthalene) | - | NL |
| **BTEX** | | |
| Benzene | - | NL |
| Toluene | - | NL |
| Ethylbenzene | - | NL |
| Xylenes | - | NL |
| **PAH** | | |
| Benzo(a)pyrene TEQ | 3 | - |
| Naphthalene | - | NL |
| Total PAHs | 300 | - |
| **Phenols** | | |
| Phenol | 3000 | - |
| Pentochlorophenol | 100 | - |
| Cresols | 400 | - |
| **OCP** | | |
| DDT+DDE+DDD | 240 | - |
| Aldrin + Dieldrin | 6 | - |
| Chlordane | 50 | - |
| Endosulfan (total) | 270 | - |
| Endrin | 10 | - |
| Heptachlor | 6 | - |
| HCB | 10 | - |
| Methoxychlor | 300 | - |
| **OPP** | | |
| Chlorpyrifos | 160 | - |

| Contaminant | HIL A (mg/kg) | HSL C for vapour intrusion (mg/kg) |
|---|---|---|
| **Other Organics** | | |
| PCBs (non dioxin- like PCB only) | 1 | - |

Notes: TEQ is Toxic Equivalency Quotient.
The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.

## 8.2 Ecological Investigation and Screening Levels

Ecological Investigation Levels (EIL) have been derived for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems (NEPC, 2013). EIL depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant based on the sum of the ambient background concentration (ABC) and an added contaminant limit (ACL). The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g. motor vehicle emissions). The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required.

The EIL is calculated using the following formula:

EIL = ABC + ACL

The ABC is determined through direct measurement at an appropriate reference site (preferred) or through the use of methods defined by Olszowy et al *Trace element concentrations in soils from rural and urban areas of Australia*, Contaminated Sites monograph no. 4, South Australian Health Commission, Adelaide, Australia 1995 (Olszowy, 1995) or Hamon et al, *Geochemical indices allow estimation of heavy metal background concentrations in soils*, Global Biogeochemical Cycles, vol. 18, GB1014, (Hamon, 2004). ACL is based on the soil characteristics of pH, CEC and clay content.

EIL (and ACLs where appropriate) have been derived in NEPC (2013) for only a short list of contaminants comprising As, Cu, Cr (III), DDT, naphthalene, Ni, Pb and Zn. An *Interactive (Excel) Calculation Spreadsheet* may be used for calculating site-specific EIL for these contaminants, and has been provided in the ASC NEPM Toolbox available on the SCEW (Standing Council on Environment and Water) website (http://www.scew.gov.au/node/941).

The adopted EIL, derived from the *Interactive (Excel) Calculation Spreadsheet* are shown in Table 5. The following inputs and assumptions have been used to determine the EIL:

- The EIL are for urban residential and public open space land uses;
- Given the likely source of soil contaminants (i.e. previous filling) the contamination is considered as "aged" (>2 years);
- NSW is the state and the traffic volume is low;

- A pH of 6.75. (This is the average of the two pH values obtained by laboratory analysis during the PSI);
- A CEC of 10.5 meq/100g. (This is the average of the two CEC values obtained by laboratory analysis during the PSI);
- A clay content of 5% has been assumed (as a conservative value); and
- An organic carbon content of 1% has been assumed.

**Table 5: Ecological Investigation Levels (EIL)**

| Analyte | | EIL – Urban Residential and Open Space (mg/kg) |
|---|---|---|
| **Metals** | Arsenic | 100 |
| | Copper | 210 |
| | Nickel | 180 |
| | Chromium III | 320 |
| | Lead | 1100 |
| | Zinc | 490 |
| **PAH** | Naphthalene | 170 |
| **OCP** | DDT | 180 |

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. ESL generally apply to the top 2 m of the soil profile as for EIL. The adopted ESL, from Table 1B(6), Schedule B1 of NEPC (2013) are shown in Table 6 and are for urban residential and public open space land use scenarios. Given that various soil types are present at the site (i.e. sandy silt and clay), ESL for the most conservative soil type have been adopted as SAC.

**Table 6: Ecological Screening Levels (ESL)**

| Analyte | | ESL – Urban Residential and Open Space (mg/kg) |
|---|---|---|
| | | Coarse Soil Texture |
| **TPH** | C6 – C10 (less BTEX) | 180* |
| | >C10-C16 | 120* |
| | >C16-C34 | 300 |
| | >C34-C40 | 2800 |
| **BTEX** | Benzene | 50 |
| | Toluene | 85 |
| | Ethylbenzene | 70 |
| | Xylenes | 45 |
| **PAH** | Benzo(a)pyrene | 0.7 |

Note: All ESLs are low reliability apart from those marked with * which are moderate reliability

## 8.3 Management Limits for Petroleum Hydrocarbons

In addition to appropriate consideration and application of the HSL and ESL, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

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

Management Limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. The adopted Management Limits for a residential, parkland or public open space land use scenario from Table 1B(7), Schedule B1 of NEPC (2013) have been adopted and are shown in Table 7. Given that various soil types are present at the site (i.e. sandy silt and clay), Management Limits for the most conservative soil type (coarse) have been adopted as SAC. The Management Limits generally apply to any depth within the soil profile.

**Table 7: Management Limits**

| Analyte | Management Limit – residential, parkland or public open space (mg/kg) |
|---|---|
| | Coarse Soil Texture |
| TPH $C_6$ – $C_{10}$ | 700 |
| TPH >$C_{10}$-$C_{16}$ | 1000 |
| TPH >$C_{16}$-$C_{34}$ | 2500 |
| TPH >$C_{34}$-$C_{40}$ | 10 000 |

## 8.4 Asbestos in Soil

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

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

A detailed asbestos assessment was not undertaken as part of the PSI. The presence or absence of asbestos at a limit of reporting of 0.1 g/kg as well as a visual assessment for the presence or absence of ACM has been adopted for remediation purposes as an initial screen.

### 8.5 Classification Assessment for Off-Site Disposal

All wastes will be assessed in accordance with the POEO Act (1997).

For disposal to landfill, this will comprise assessment in accordance with the NSW Environment Protection Authority (EPA) *Waste Classification Guidelines* (2014).

For re-use off-site, should this option be considered viable, soil will be assessed in accordance with other EPA guidance or licences under the POEO Act, and may include:

- Resource recovery orders issued by EPA under the *Protection of the Environment Operations (Waste) Regulation* 2014; and
- Guidance on assessment of virgin excavated natural material (VENM).

## 9. Remedial Action Plan

### 9.1 Extent of Remediation Required

In keeping with the outcomes and recommendations outlined in DP (2018a), the extent of remediation at the site is defined as follows:

- As indicated on Table B1 in Appendix B, elevated levels of lead and PAH exceeded health based investigation and/or screening levels in all the fill samples tested. The fill extends to depths of up to 0.2 m in the bores.

There were also some exceedances of the environmental screening levels for TRH. These exceedances are not considered to be significant.

On this basis, all fill at the site is subject to the requirements and strategies of this RAP.

The whole of site area is subject to the unexpected finds protocol outlined in Section 10. And the management of surplus soils as outlined in Section 9.1.

### 9.2 Typical Remedial Options Available

A number of remedial options were reviewed based on the soil contaminants identified to date. The suitability of the remedial options was examined in accordance with a number of relevant documents, including, *inter alia*, the following:

- NSW Environment Protection Authority (2017), *Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme (3rd edition)*; and
- NEPC (2013).

Possible remedial options to achieve the remediation objectives are identified as follows:

- No action;
- On-site treatment of contaminated material;

- Removal of contaminated material to landfill; and
- Capping/on-site containment of contaminated materials.

### 9.2.1 No Action

The “No Action” option involves no remedial response to the contamination identified on the subject site. This option was not considered appropriate for the following reasons:

- It does not provide any means to improve the current condition of the site; and
- There will remain potential human health and ecological risks should no action be taken.

### 9.2.2 On-site Treatment of Contaminated Material

On-site treatment of the contaminated material would typically involve the excavation, stockpiling, treatment and replacement of the treated contaminated material. Considering the nature of the identified contamination (i.e. generally low level lead and PAH contamination), this option is not considered to be viable for the site.

### 9.2.3 Removal of Contaminated Material to Landfill

Off-site disposal of contaminated material is considered a suitable option for managing human health and environmental impacts from the contaminated materials. Removal to landfill involves physically excavating and moving impacted soil to an off-site location for storage, treatment or disposal. Disposal to landfill may require prior treatment of the impacted soil if the chemical levels exceed landfill criteria as defined in the *Waste Classification Guidelines* (NSW EPA, 2014).

This type of treatment may cause potential impacts on the local community from waste transport, as well as imposing an unnecessary burden on the capacity of the receiving landfill. Essentially this option is more suitable under circumstances where construction of basements was proposed and which would in any case require removal of the waste soils as part of the site formation process.

To undertake such removal when it is not necessary would contravene the principles of the *Waste Avoidance and Resource Recovery Act 2001*

### 9.2.4 Capping/On-site containment of contaminated materials

Physical barrier (or encapsulation) systems involve the placement/installation of a layer of suitable capping material such as verified clean soil, or permanent pavement over the contaminated fill that would limit the exposure of site users to contaminants.

This option is considered to be viable for the site given the following:

- The contamination identified has low leachability, as demonstrated by TCLP testing as part of DP (2018a);and
- The contamination levels (primarily lead and PAH) are relatively low level;

### 9.3 Selected Remediation Option

The proposed excavations on site are anticipated to extend to depths of no more than about 1 m below existing surface levels to allow for levelling works and construction of new footings, service trenches, etc. The impacted soils are currently identified up to 0.2 m below existing surface levels. In light of the discussions presented herein, the selected (preferred) remediation strategy is as follows:

- Excavation of fill from the site and off-site disposal; and
- Validation of the removal of all fill.

### 9.4 Preliminary Waste Classification

A preliminary waste classification was also undertaken and presented in DP (2018a). The results are presented in Table B2, Appendix B. Based on the observations at the time of sampling and the reported analytical results, the fill across the investigation area was preliminarily classified as General Solid Waste (non-putrescible), as defined in EPA (2014a)

Specific waste classifications will be required for surplus soils, once identified. This is likely to involve further sampling and testing to supplement the results presented in DP (2018a).

## 10. Remediation Procedures and Sequence

The detailed procedures and sequence for the remediation work will rest with the Contractor and will depend upon the equipment to be used and the overall sequence of the development. It is the Contractor's responsibility to devise a safe work method statement and to implement proper controls that enable the personnel undertaking the remediation to work in a safe environment. This RAP does not relieve the contractor(s) of their ultimate responsibility for work health and safety of their workforce and to prevent contamination of areas outside the immediate workspace. This RAP sets out the minimum standards and guidelines for remediation that will need to be used in preparing a method statement.

The Principal and/ or Contractor must obtain all required approvals, licences and permissions prior to commencement of remediation works, and implement relevant conditions.

### 10.1 Excavation, Waste Classification and Disposal

It is understood that all surplus soil resulting from the works will be removed from the site. Furthermore, under this RAP, all fill will be removed from the site.

All materials to be removed from the site will therefore need to be disposed of in accordance with the *Protection of the Environmental Operations Act* 1997 (POEO Act) and its associated Regulations. In

order to inform disposal options soils must be classified in accordance with the following, as applicable:

- The NSW EPA (2014) *Waste Classification Guidelines*; or
- A general or specific resource recovery order (RRO) as made under the *Protection of the Environment Operations (Waste) Regulation* 2014, or
- The definition of virgin excavated natural material (VENM) as provided in the POEO Act.

The classification process requires sampling and testing of soils to the specifications outlined in the above references.

Materials classified under the EPA (2014) guidelines must be disposed to a landfill facility licensed to accept waste under the assigned classification. Materials classified under a RRO or VENM can be beneficially re-used on another development site, with some conditions applying to soils classified under a RRO.

There currently also exists recycling facilities licensed to receive soils with low levels of contamination. Built into their environment protection license (EPL), each individual facility has specific conditions on the types of material (appearance, chemical composition etc) they can accept.

The process of waste classification will generally be as follows:

- The excavation contractor will plan the works so as to minimise the potential for cross contamination of materials. The plan will include consideration of, as a minimum, the order of works, soil tracking via plant movements and stockpiling areas (if needed). The plan may be in the form of an annotated drawing or similar of the proposed site layout and vehicle movement routes;
- The excavation contractor will have nominated a facility for the disposal of the soil, using the preliminary classification of general solid waste (non-putrescible), with contingencies for restricted solid waste, or special waste (asbestos). The facility will be licensed by the NSW EPA to accept the soils under the waste classification designated by the Environmental Consultant;
- The soils will be excavated under the recommendations of the Environmental Consultant and stockpiled nearby for waste classification. Alternatively, the waste classification can be confirmed through *in situ* sampling following the demolition of all site structures, however this process will require thorough supervision of the excavation of materials by the Environmental Consultant to observe circumstances that may change the waste classification;
- If stockpiles are formed, the excavation contractor will have tracking records to document the source of each stockpile. Stockpiles of different materials will be kept separate;
- The Environmental Consultant will undertake sampling and testing of each stockpile (or *in situ*) and will produce a waste classification report. Where the Environmental Consultant considers there to be a beneficial re-use option, the Environmental Consultant, with permission from the client, will conduct appropriate sampling, testing and reporting to verify compliance with a RRO and/or the VENM/ENM definition; and
- At the completion of the excavation and removal of fill from the site, to the satisfaction of the Environmental Consultant, validation sampling and testing of the exposed natural soils will be undertaken in accordance with Section 12. The validation sampling and testing, combined with a

visual assessment of the exposed natural soil, will also be used to provide a VENM classification (if found suitable) for any natural soils to be excavated from that point.

All tracking of the soils from source to destination will be the responsibility of the excavation contractor. Disposal dockets will be retained and provided to the Environmental Consultant for inclusion in the validation report.

## 11. Unexpected Finds Protocol

An "Unexpected Finds Protocol" (UFP) has been established to deal with unexpected findings and/or unplanned situations that may be uncovered during civil, excavation or construction works associated with the proposed development.

This UFP is also applicable to any unexpected finds relating to potentially contaminated soils with a historical uncertainty that may be encountered during excavation works with the site. The protocol is as follows:

1. The contractor(s) undertaking any remediation, civil or construction works will be provided with a copy of the RAP (plus any amendment or addendum), including this UFP. The contractor(s) will nominate their site (project) manager who will be responsible for implementing the UFP;
2. Upon discovery of suspected (unexpected) contaminated material, the site (project) manager is to be notified and the affected area closed off by the use of barrier tape and warning signs (if appropriate) and sediment controls. Warning signs shall be specific to the findings and potential hazards and shall comply with the Australian Standard 1319-1994 – Safety Signs for the Occupational Environment;
3. A qualified environmental consultant is to be notified by the site manager to inspect the area and confirm the presence or otherwise of hazards or contamination, and to determine the method and extent of investigation or remediation works to be undertaken. A report detailing this information will be compiled by the environmental consultant and provided to the site manager, who will disseminate to the Principal (or their representative);
4. All work associated with the contaminated soil will be undertaken by an appropriately licensed contractor, as stipulated by the environmental consultant;
5. All works must comply with the provisions of the relevant legislation and guidelines;
6. Documentary evidence (weighbridge dockets) of appropriate disposal of the material is to be provided to the Principal (or their representative) if disposal occurs;
7. Details of all relevant activities are to be recorded in the site record system;
8. Details of the remediation and validation works undertaken with respect to the unexpected find must be incorporated into the final validation report as prepared by the environmental consultant.

# 12. Validation

## 12.1 Site Inspections

The Environmental Consultant is to conduct periodic site inspections during fill excavation and removal, when any issue of concern is identified under the UFP, and to assess the progress of remediation. If considered warranted, full time engagement of the Environmental Consultant to oversee the works may be undertaken, particularly to confirm the separation of fill and natural soils. A record of the inspections and observations, including a photographic record, will be provided as part of the validation assessment report.

## 12.2 Remedial Excavation Testing Requirements

Where contaminated fill (as identified by the Environmental Consultant) is removed from the site and disposed off-site, systematic validation samples are to be collected from the exposed surface of remedial excavations and analysed at the frequencies shown below:

- Base of excavation – One sample should be collected from the floor of the excavation for small excavations, or at a minimum of 1 sample per 20 m for large excavations;
- Side walls of excavation – samples must be collected from the excavation walls at a minimum rate of one location per side wall or one sample per 20 m, whichever is the greater. Note that the actual number of samples may vary depending on the size of the it excavation and the degree of contamination, the soil profile encountered and the presence of groundwater;
- Every sample will be analysed for the contaminants of concern, being lead, PAH, TRH and zinc, plus any other contaminants that may identified as an unexpected find or during the waste classification process; and
- QA / QC analysis as per industry standards.

## 12.3 Waste Classification Sample Collection and Analysis

Where waste classification is required *ex situ* (i.e. in stockpile) generally one sample will be taken per 25 $m^3$ – 250 $m^3$ depending on the homogeneity of the material, with a minimum of three samples per stockpile. The sampling frequency will be determined by the Environmental Consultant. For the purpose of the waste classification process the following sampling rate is to be adopted:

- ≤ 50 $m^3$ : minimum of three samples;
- 50 $m^3$ – 250 $m^3$ : One sample per 50 $m^3$, minimum of three samples;
- > 250 $m^3$: One sample per 250 $m^3$, minimum of three samples.

If the soils are to be assessed against options for re-use (i.e. in compliance with a RRO or VENM definition) then the Environmental Consultant will determine the sampling frequency and analytical suite with reference to the applicable RRO. It is noted that the fill at the site is not considered to be suitable for classification under a RRO.

If asbestos is encountered in stockpiled material, it is recommended that the footprint of the stockpile, (if located on unsealed ground) be validated by an occupational hygienist following the removal of stockpiles containing asbestos-based materials.

No soils will leave the site without a formal waste classification.

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the POEO Act. All licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the site. Note: asbestos wastes should be subject to Waste/Locate tracking.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification and the corresponding requirements outlined in the NSW EPA (2014), and with the appropriate approvals obtained from the EPA, if required.

Details of all soils removed from the site (including any VENM) shall be documented by the Contractor with copies of the receiving site environmental management plan (EPL), weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and the PR. A site log shall be maintained by the Contractor to track disposed loads against on-site origin.

Transport of spoil shall be via a clearly delineated, pre-defined haul route. The proposed waste transport route will be notified to the local Council and truck dispatch shall be logged and recorded by the Contractor for each load leaving the Site. A record of the truck dispatch will be provided to the PR.

## 12.4 Importation of Soil

Prior to importation appropriate documentation confirming the soil can be legally imported onto the site under the POEO Act and meets the RAC (as outlined in Section 7) is to be provided to the Environmental Consultant for review.

By preference, material imported onto the site will comprise virgin excavated natural material (VENM). Alternatively, the material must meet a general or site specific RRO as issued by the NSW EPA, as well as the site RAC. This includes, but is not limited to:

- Imported soils for backfilling (temporary or permanent);
- Imported topsoil for landscaping;
- Imported aggregate such as DGB (temporary or permanent); and
- Imported mulch.

It should be noted that recycled materials often risk being impacted / contaminated with contaminants including PCB, TRH or asbestos. The preference is to utilise suppliers of natural materials, rather than recycled, to avoid any issues associated with unsuitable materials. Where recycled materials are preferred they MUST comply with a relevant RRO as well as the site RAC. Compliance with the RAC includes testing for analytes not necessarily required under the RRO, such as asbestos and PCB.

PRIOR TO importing any materials to the site the Environmental Consultant is to review any supporting documentation confirming compliance with the above. The Environmental Consultant may require additional information (including additional sampling and analysis) to provide a final determination on the suitability of the soil to be accepted to the site.

The material must be inspected during importation by the Contractor and any materials not meeting the description given in the provided documentation or displaying signs of contamination will be rejected. The Environmental Consultant will also conduct inspections during and/ or following importation to check the same.

Imported material also needs to be suitable for its proposed purpose from a geotechnical/ horticultural perspective as relevant.

## 12.5 Quality Assurance Plan

### 12.5.1 Field QA

Quality assurance (QA) and quality control (QC) procedures will be adopted throughout the field sampling programme to ensure sampling precision and accuracy and prevent cross contamination.

DP will address sampling accuracy and precision through the analysis of 10% field duplicate/replicate samples (with 5% inter-laboratory duplicate/replicate and 5% intra-laboratory duplicate/replicates) as well as the collection of field rinsate samples of sampling equipment at a rate of one per 20 samples, or one per day of sampling operations.

Appropriate sampling procedures will be undertaken to ensure that cross contamination does not occur and will follow DP's Standard Operating Procedures Manual. This specifies that:-

- Standard operating procedures are followed;
- Site safety plans are developed prior to commencement of works;
- Duplicate or replicate field samples are collected and analysed;
- Equipment rinsate samples are analysed as part of the QA/QC programme;
- Samples are stored under secure, temperature controlled conditions;
- Chain of custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory; and that
- Proper disposal of contaminated soil, fill or groundwater originating from the site area is completed.

### 12.5.2 Laboratory Quality Assurance and Quality Control

DP's preferred laboratories will undertake in-house QA/QC procedures involving the routine testing of:-

- Reagent blanks;
- Spike recovery analysis;
- Laboratory duplicate analysis;

- Analysis of control standards;
- Calibration standards and blanks; and
- Statistical analysis of QC data including control standards and recovery plots.

### 12.6 Validation Reporting

A validation assessment report will be prepared by a qualified environmental consultant in accordance with NSW DEC Contaminated Sites *Guidelines for Consultants Reporting on Contaminated Sites* (2011) and other appropriate guidance documentation. The report will be submitted to the appropriate certifying authority at the completion of the remediation works program.

The validation report will confirm that the site has been remediated to a suitable standard for the proposed land-use and that no related adverse human health and environmental effects have occurred as a result of the temporary works. The validation report will also include a summary of the information from previous investigations, particularly the materials that remain on-site.

The validation report will include details of the total volume of contaminated materials removed from site, present detailed analytical results where applicable, confirm that placed fill is clean and indicate the final disposal destination of the materials removed from site.

## 13. General Environmental Management Plan

### 13.1 General

The Contractor will undertake the work with due regard to the minimisation of environmental effects and to meet regulatory and statutory requirements.

The Contractor should have in place an over-arching construction environmental management plan that incorporates this RAP so that work on the site complies with, but not limited to, the following:

- Protection of the Environment Operations Act 1997;
- Contaminated Land Management Act 1997;
- Work Health and Safety Act 2011; and
- Work Health and Safety Regulation 2011.

The following general measures outlined below should be implemented during the remediation phase. All personnel should be made familiar with the following section prior to the commencement of site works as required.

## 13.2 Vibration Control

The use of any plant and/or machinery should not cause unacceptable vibrations to nearby properties and should meet Council requirements.

## 13.3 Dust Control

Dust emissions should be confined within the site boundary. The following dust control procedures will be employed to comply with this requirement as necessary:

- Erection of dust screens around the perimeter of the site;
- Securely covering all loads entering or exiting the site;
- Use of water sprays across the site to suppress dust;
- Covering of all stockpiles of contaminated soil remaining onsite more than 48 hours;
- Dust monitoring as may be required by the Council DA consent; and
- Keeping excavation and stockpile surfaces moist.

## 13.4 Odour Control

No odours should be detected at any boundary of the site during remediation works by an authorised Council Officer relying solely on sense of smell. The following procedures should be employed to comply with this requirement as required:

- Use of appropriate covering techniques such as plastic sheeting, polythene or geotextile membranes to cover excavation faces or stockpiles;
- Fine spray of water and/or hydrocarbon mitigating agent on the impacted areas/materials, as required;
- The use of water spray, as and when appropriate, to eliminate wind-blown dust;
- Use of sprays or sprinklers on stockpiles or loads to lightly condition the material;
- Restriction of stockpile heights to 5 m above surrounding site level. If required, restrict uncovered stockpiles to appropriate sizes to minimise odour generation;
- Ceasing works during periods of inclement weather such as high winds or heavy rain;
- Regular checking of the fugitive dust and odour issues to ensure compliance. Undertake immediate remediation measures to rectify any cases of excessive dust or odour (e.g. use of misting sprays or odour masking agent); and
- Adequate maintenance of equipment and machinery to minimise exhaust emissions.

## 13.5 Stormwater Management and Control

As necessary, the remediation contractor shall take appropriate measures to ensure that potentially contaminated water does not leave the site. In particular, stormwater management for the duration of

the remediation works shall be utilised and monitored to minimise stormwater flow into adjacent waterways.

### 13.6 Occupational Health and Safety

The Contractors shall develop a site emergency response plan (ERP) and occupational health and safety plan (OHSP). This will ensure the safety of the personnel working on site, given any likely emergency situation which may occur. The OHSP and ERP should include emergency phone numbers and details of local emergency facilities.

Appropriate fencing and signage should be installed around and within the site to prevent unauthorised access to the site, restricted access remediation areas and/or deep excavations.

All personnel on site should be required to wear the following personnel protective equipment (PPE) at all times:

- Steel-capped boots;
- High visibility clothing; and
- Hard hat meeting AS1801-1981 requirements.

The following additional PPE will be worn, as required:

- Hearing protection meeting AS1270-1988 requirements when working around machinery or plant equipment if noise levels exceed exposure standards;
- Safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary, particularly during any demolition);
- Disposable coveralls (if necessary) to prevent contact with splashed contaminated soil, materials or water;
- Nitrile work gloves meeting AS2161-1978 requirements or heavy duty gauntlet gloves; and
- Any additional protection identified by the Environmental Consultant.

In the event that personnel are required to work in areas of potential contact with asbestos, the following PPE in addition to standard construction PPE, should be worn during works involving the handling and/or removal of soils impacted by asbestos:

- Disposable coveralls (rated type 5, cat 3 or equivalent);
- Half-face P1/P2 respirator or equivalent;
- Gloves; and
- Safety footwear which should be laceless.

Excavation, handling, stockpiling, transport etc. of materials containing asbestos should be undertaken by a licensed contractor in accordance with relevant regulatory requirements.

## 13.7 Hours of Operation

All remediation work should be conducted within the hours specified by the City of Strathfield.

## 13.8 Contingency Plans to Respond to Site Incidents

The key to effective management of incidents is the timely action taken before any situation reaches a reportable or critical level. Therefore, surveillance activities are extremely important, and should be conducted for the measures prescribed herein and any other measures as seen appropriate by the Principal's representative. During work activities on the site, the following inspection or preventative actions must be performed by the main Contractor and carefully documented:

- Regular inspection of works;
- Completion of routine environmental checklists and follow-up of non-compliance situations;
- Maintenance of supervision on-site; and
- An induction process for site personnel involved in the remediation works that includes relevant information on environmental requirements, and ensures that all site personnel are familiar with the site emergency procedures.

The Contractor's site foreman should be responsible for initiating an immediate emergency response using the resources available on the site. Where external assistance is required, the relevant emergency services should be contacted. A list containing contact details for key personnel who may be involved in an environmental emergency response should be completed and be readily available to personnel at all times.

## 13.9 Identify Regulatory Compliance

The work should be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements, including, inter alia, provisions specified in:

- *Protection of the Environment Operations Act* 1997;
- *Contaminated Land Management Act* 1997;
- *Dangerous Goods Act* 2008;
- *Work Health and Safety Act* 2011;
- *Work Health and Safety Regulation* 2011;
- DUAP NSW EPA (1998) *State Environmental Planning Policy No. 55* (SEPP 55).

## 13.10 Community Engagement

The Contractor must affix a sign to the main entrance of the site displaying contact details of the Contractor, Environmental Consultant and Principal Contractor. Each party must keep a log of any communications received by the public. A summary of any communications received will be included in the validation report.

### 13.11 Contact Details

The following table provides a list of personnel and contact details relevant to the remediation. The list should be filled in as relevant personnel are appointed to the remediation project.

**Table 8: Contact Details**

| Role | Personnel / Contact | Contact Details (phone) |
|---|---|---|
| Principal | Meriden School | |
| Principal's Representative | | |
| Site Manager | | |
| Environmental Consultant | | |
| Regulator | NSW EPA (pollution line) | 131 555 |
| Regulator | NSW EPA (general enquiries) | 131 555 |
| Consent Authority | City of Strathfield | (02) 9952 8222 |
| Utility Provider | Sydney Water | 13 20 92 |
| Utility Provider | Power | |
| Utility Provider | Gas | |

Notes to table:
Table to be completed when the contact details are known.

## 14. Documentation

The following documents will need to be reviewed as part of the validation assessment by the Environmental Consultant at the completion of all remediation works. These are to include and be provided to the Environmental Consultant by the relevant parties.

- Any Licences and Approvals required for the remediation works;
- Transportation Record: this will comprise a record of all truckloads of soil entering or leaving the site, including truck identification (e.g. registration number), date, time, load characteristics (i.e. classification, on-site source, destination);
- Disposal dockets: for any soil materials disposed off-site, the contractor will supply records of: transportation records, spoil source, spoil disposal location, receipt provided by the receiving waste facility (where available), a record of receipt from the receiving site will be supplied (i.e. the receiving sites transportation records, including EPL for the disposal site and written confirmation that they can take the waste consignment);
- Imported materials records: records for any soil imported onto the site, including source site, classification reports, inspection records of soil upon receipt at site and transportation records;
- Records relating to any unexpected finds and contingency plans implemented;

- Incident Reports: any WHS Environmental Incidents which occur during the works will be documented and the PR and appropriate regulatory authority will be informed in accordance with regulatory requirements;
- Laboratory certificates and chain-of-custody documentation; and
- Letters/ memos as required to provide instruction or information to the Principal and Contractor.

The purpose of the documentation is to ensure the works are conducted in accordance with all applicable regulations and that appropriate records of the works are kept for future reference. Documentation should be provided by the relevant parties in a timely manner to allow the works to be conducted efficiently.

A validation assessment report will be prepared for the site by the Environmental Consultant in accordance with NSW Office of Environment and Heritage (OEH) *Contaminated Sites Guidelines for Consultants Reporting on Contaminated Sites* (reprinted 2011) and other appropriate guidance documentation. The validation report shall detail the methodology, results and conclusion of the assessment and make a clear statement regarding the suitability of the site for the proposed land use.

## 15. Conclusion

It is considered that the site can be rendered suitable for the proposed development subject to proper implementation of the remediation procedures, unexpected finds protocols and completion of the validation assessment detailed in this RAP.

Based on the contamination assessment findings, short term exposure during remediation and construction works is not expected to pose an unacceptable risk to workers. It is anticipated that the civil contractor will work to a construction environmental management plan that will minimise exposure of the workers to direct contact with the soils.

## 16. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at Meriden School, 4 Vernon Street, Strathfield in accordance with DP's proposal SYD181254.P.002.Rev0 dated 9 May 2019 and acceptance received from Richard Arkell of Meriden School dated 9 May 2019. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Meriden School for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological

processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

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

Asbestos has not been detected by observation or by laboratory analysis, either on the surface of the site, or in filling materials at the test locations sampled and analysed. Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints, or to parts of the site being inaccessible and not available for inspection/sampling or to vegetation preventing visual inspection and reasonable access. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

This report must be read in conjunction with all of the attached and should be kept in its entirety withou1t separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

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

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

**Douglas Partners Pty Ltd**

# Appendix A

About This Report

Drawing

# About this Report

Douglas Partners

## Introduction

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

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

## Copyright



## Borehole and Test Pit Logs

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

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

## Groundwater

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

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

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

## Reports

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

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

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

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

# *About this Report*

## Site Anomalies

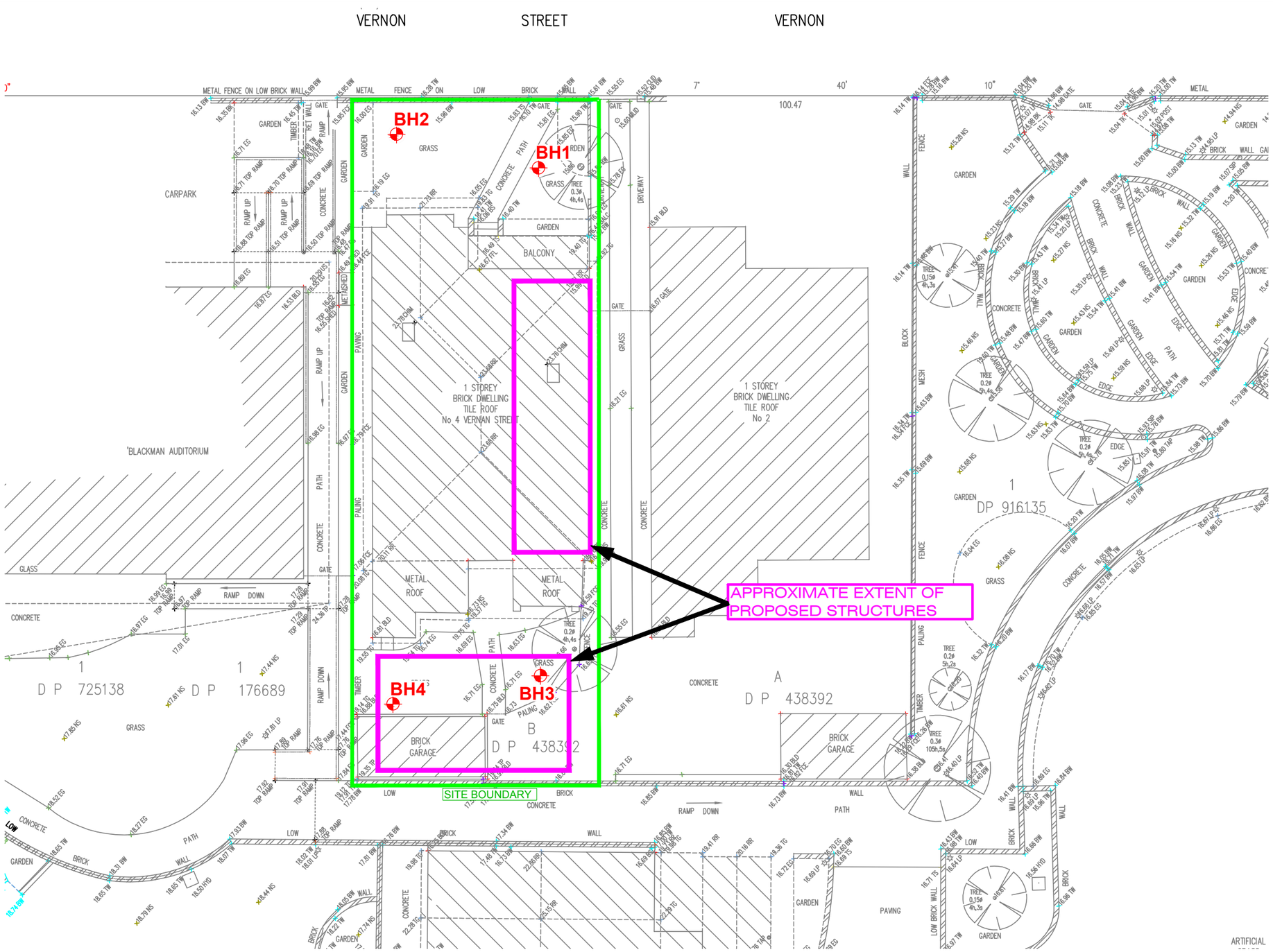
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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

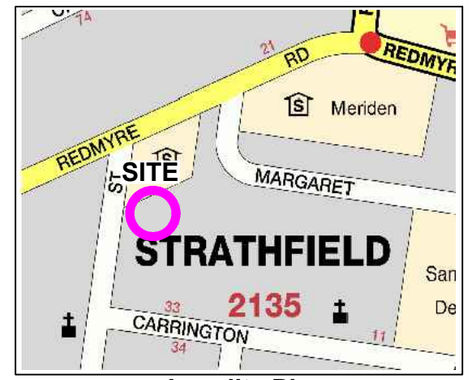
## Information for Contractual Purposes

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

## Site Inspection

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




**Locality Plan**

NOTE:
1: Base drawing from Linker Surveying (Ref 161014, dated 1.11.2016)
2: Test locations are approximate only and are shown with reference to existing features.

**LEGEND**
- Borehole location

| | | | |
|---|---|---|---|
| Douglas Partners Geotechnics / Environment / Groundwater | CLIENT: Meriden School | TITLE: **Site Plan** Site 2 - Proposed Open Play Space 4 Vernon Street, STRATHFIELD | PROJECT No: 86568.02 |
| | OFFICE: Sydney / DRAWN BY: PSCH | | DRAWING No: 1 |
| | SCALE: 1:200 @ A3 / DATE: 17.1.2019 | | REVISION: 0 |

# Appendix B

Summary of Results Tables

**Table B1: Summary of Results of Soil Analysis (All results in mg/kg unless otherwise stated)**

| Sample Location (Borehole) or Sample ID | Sample Depth (m) | Soil Type | Metals | | | | | | | | Polycyclic Aromatic Hydrocarbons | | | | Total Recoverable Hydrocabons and BTEX | | | | | | | | | Organochlorine Pesticides | | | | | | | | | | | | | | Organophorus Pesticides | | PCBs (total) | Phenols (total) | Asbestos (fibres) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Cadmium | Chromium (III + VI) | Copper | Lead | Mercury | Nickel | Zinc | Benzo(a)pyrene | Benzo(a)pyrene TEQ | Naphthalene | Total PAHs | TRH C6-C10 less BTEX | TRH >C10-C16 less Naphthalene | TRH C6-C10 | TRH >C10-C16 | TRH >C16-C34 | TRH >C34-C40 | Benzene | Toluene | Ethylbenzene | Total Xylene | DDT | DDT+DDE+DDD | Aldrin | Dieldrin | Chlordane | Endosulfan I | Endosulfan II | Endosulfan Sulphate | Endrin | Heptachlor | HCB | Methoxychlor | Other OCP | Chlorpyriphos | Other OPP | | | |
| BH1 | 0.1 - 0.2 | Filling | 15 | <0.4 | 30 | 49 | **570** | 0.4 | 8 | 210 | **5.6** | **8.2** | 0.4 | 62 | <25 | <50 | <25 | <50 | 260 | <100 | <0.2 | <0.5 | <1 | <1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.2 | <PQL | <0.1 | <PQL | <0.1 | <5 | NAD |
| BH1 - [TRIPLICATE] | 0.1 - 0.2 | Filling | - | - | - | - | - | - | - | - | **5.8** | **8.2** | 0.2 | 57 | - | <50 | - | <50 | 170 | <100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| BH1 | 0.4 - 0.5 | Natural | 8 | <0.4 | 21 | 17 | 19 | <0.1 | 5 | 26 | <0.05 | <0.5 | <0.1 | <0.05 | <25 | <50 | <25 | <50 | <100 | <100 | <0.2 | <0.5 | <1 | <1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <PQL | <0.1 | <PQL | <0.1 | <5 | - |
| BH2 | 0.1 - 0.2 | Filling | 10 | <0.4 | 22 | 32 | **420** | 0.2 | 6 | 140 | **5.3** | **7.8** | 0.2 | 67 | <25 | <50 | <25 | <50 | 270 | <100 | <0.2 | <0.5 | <1 | <1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <PQL | <0.1 | <PQL | <0.1 | - | NAD |
| BH2 | 0.4 - 0.5 | Natural | 7 | <0.4 | 19 | 14 | 20 | <0.1 | 4 | 20 | <0.05 | <0.5 | <0.1 | <0.05 | <25 | <50 | <25 | <50 | <100 | <100 | <0.2 | <0.5 | <1 | <1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <PQL | <0.1 | <PQL | <0.1 | - | - |
| BH3 | 0.1 - 0.2 | Filling | 14 | 0.6 | 24 | 110 | **440** | 0.2 | 10 | 250 | **4.5** | **6.6** | 0.2 | 53 | <25 | <50 | <25 | <50 | **320** | <100 | <0.2 | <0.5 | <1 | <1 | <0.4 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <PQL | <0.1 | <PQL | <0.1 | - | NAD |
| BD2/170119 | 0.1 - 0.2 | Filling | 12 | <0.4 | 20 | 64 | **330** | 0.2 | 10 | 220 | - | - | <1 | - | <25 | <50 | <25 | <50 | 130 | <100 | <0.2 | <0.5 | <1 | <1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| BH3 | 0.4 - 0.5 | Natural | 8 | <0.4 | 22 | 22 | 16 | <0.1 | 4 | 30 | <0.05 | <0.5 | <0.1 | <0.05 | <25 | <50 | <25 | <50 | <100 | <100 | <0.2 | <0.5 | <1 | <1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <PQL | <0.1 | <PQL | <0.1 | - | - |
| BH4 | 0.1 - 0.2 | Filling | 11 | 1 | 30 | 130 | **1200** | 0.5 | 14 | **690** | **8.8** | **13** | 0.3 | 110 | <25 | <50 | <25 | <50 | **440** | <100 | <0.2 | <0.5 | <1 | <1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <PQL | <0.1 | <PQL | 0.2 | <5 | NAD |
| BH4 | 0.4 - 0.5 | Natural | 9 | <0.4 | 19 | 18 | 19 | <0.1 | 3 | 22 | <0.05 | <0.5 | <0.1 | 0.1 | <25 | <50 | <25 | <50 | <100 | <100 | <0.2 | <0.5 | <1 | <1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <PQL | <0.1 | <PQL | <0.1 | <5 | - |
| **Site Assessment Criteria** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **HIL A** | | | 100 | 20 | 100 for Cr(VI) | 6000 | 300 | 40 | 400 | 7400 | - | 3 | - | 300 | - | - | - | - | - | - | - | - | - | - | 240 | 6 | | 50 | 270 | | | 10 | 6 | 10 | 300 | - | 160 | - | 1 | 100* | - |
| **HSL C for vapour intrusion** | | | - | - | - | - | - | - | - | - | - | - | NL | - | NL | NL | - | - | - | - | NL | NL | NL | NL | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **EIL** | | | 100 | - | 320 for Cr(III) | 210 | 1100 | - | 180 | 490 | - | - | 170 | - | - | - | - | - | - | - | - | - | - | - | 180 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **ESL** | | | - | - | - | - | - | - | - | - | 0.7 | - | - | - | 180 | - | - | 120 | 300 | 2800 | 65 | 105 | 125 | 45 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Management Limit** | | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 700 | 1000 | 2500 | 10000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Notes

| | |
|---|---|
| BH1 - [TRIPLICATE] | Laboratory triplicate of the sample from BH1, depth 0.1 - 0.2m |
| BD2/170119 | Blind replicate of sample from BH3, depth 0.1-0.2 m |
| **BOLD** | Exceedance of health criterion |
| **BOLD** | Exceedance of health criterion and ecological criterion |
| **BOLD** | Exceedance of ecological criterion |
| NAD | No asbestos detected at limit of reporting (0.1g/kg) |
| PQL | Practical Quantitation Limit |
| * | Value for pentachlorophenol |
| - | Not tested / Not applicable |
| TEQ | Toxicity Equivalent Quotient |

**Table B2: Summary of Results for Waste Classification**

| Sample Location (Borehole) or Sample ID | Sample Depth (m) | Soil Type | Metals | | | | | | | Polycyclic Aromatic Hydrocarbons | | | Total Recoverable Hydrocarbons | | BTEX | | | | Total PCB | Organochlorine Pesticides | | Organophosphorus Pesticides | Asbestos |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Cadmium | Chromium (III + VI) | Lead | Lead in TCLP | Mercury | Nickel | Benzo(a)pyrene | TCLP in Benzo(a)pyrene | Total PAH | C6-C9 | C10-C36 | Benzene | Toluene | Ethylbenzene | Total Xylene | | Endosulfan | All other OCP | All OPP | |
| | | | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/L) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/L) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | (mg/kg) | |
| BH1 | 0.1 - 0.2 | Filling | 15 | <0.4 | 30 | 570 | 0.2 | 0.4 | 8 | 5.6 | <0.001 | 62 | <25 | 300 | <0.2 | <0.5 | <1 | <1 | <0.1 | <PQL | <PQL | <PQL | NAD |
| BH1 - [TRIPLICATE] | 0.1 - 0.2 | Filling | - | - | - | - | - | - | - | 5.8 | - | 57 | - | 100 | - | - | - | - | - | - | - | - | - |
| BH1 | 0.4 - 0.5 | Natural | 8 | <0.4 | 21 | 19 | - | <0.1 | 5 | <0.05 | - | <0.05 | <25 | <PQL | <0.2 | <0.5 | <1 | <1 | <0.1 | <PQL | <PQL | <PQL | - |
| BH2 | 0.1 - 0.2 | Filling | 10 | <0.4 | 22 | 420 | 0.2 | 0.2 | 6 | 5.3 | <0.001 | 67 | <25 | 310 | <0.2 | <0.5 | <1 | <1 | <0.1 | <PQL | <PQL | <PQL | NAD |
| BH2 | 0.4 - 0.5 | Natural | 7 | <0.4 | 19 | 20 | - | <0.1 | 4 | <0.05 | - | <0.05 | <25 | <PQL | <0.2 | <0.5 | <1 | <1 | <0.1 | <PQL | <PQL | <PQL | - |
| BH3 | 0.1 - 0.2 | Filling | 14 | 0.6 | 24 | 440 | 0.1 | 0.2 | 10 | 4.5 | <0.001 | 53 | <25 | 360 | <0.2 | <0.5 | <1 | <1 | <0.1 | <PQL | <PQL | <PQL | NAD |
| BD2/170119 | 0.1 - 0.2 | Filling | 12 | <0.4 | 20 | 330 | - | 0.2 | 10 | - | - | - | <25 | <PQL | <0.2 | <0.5 | <1 | <1 | - | - | - | - | - |
| BH3 | 0.4 - 0.5 | Natural | 8 | <0.4 | 22 | 16 | - | <0.1 | 4 | <0.05 | - | <0.05 | <25 | <PQL | <0.2 | <0.5 | <1 | <1 | <0.1 | <PQL | <PQL | <PQL | - |
| BH4 | 0.1 - 0.2 | Filling | 11 | 1 | 30 | 1200 | 0.2 | 0.5 | 14 | 8.8 | <0.001 | 110 | <25 | 480 | <0.2 | <0.5 | <1 | <1 | 0.2 | <PQL | <PQL | <PQL | NAD |
| BH4 | 0.4 - 0.5 | Natural | 9 | <0.4 | 19 | 19 | - | <0.1 | 3 | <0.05 | - | 0.1 | <25 | <PQL | <0.2 | <0.5 | <1 | <1 | <0.1 | <PQL | <PQL | <PQL | - |
| **General Solid Waste Criteria (without TCLP)** | | | | | | | | | | | | | | | | | | | | | | | |
| **CT1** | | | 100 | 20 | 100 for Cr(IV) | 100 | - | 4 | 40 | 0.8 | - | 200 | 100000 | 400000 | 10 | 288 | 600 | 1000 | <50 | 60 | <50* | 250** | - |
| **General Solid Waste Criteria (with TCLP)** | | | | | | | | | | | | | | | | | | | | | | | |
| **SCC1** | | | - | - | - | 1500 | - | - | - | 10 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **TCLP1** | | | - | - | - | - | 5 | - | - | - | 0.04 | - | - | - | - | - | - | - | - | - | - | - | - |

Notes

| | |
|---|---|
| BH1 - [TRIPLICATE] | Laboratory triplicate of the sample from BH1, depth 0.1 - 0.2 m |
| BD2/170119 | Blind replicate of sample from BH3, depth 0.1-0.2 m |
| CT1 | Contaminant Threshold |
| SCC | Specific Contaminant Concentration |
| TCLP | Toxicity Characteristics Leaching Procedure |
| NAD | No asbestos detected at reporting limit of 0.1g/kg |
| PQL | Practical Quantification Limit |
| * | Value for scheduled chemicals |
| ** | Value for moderately harmful pesticides |
| - | Not Applicable / Not Defined / Not analysed |

# Appendix C

Descriptive Notes

Borehole Log Results

# Sampling Methods

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## Sampling

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

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

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

## Test Pits

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

## Large Diameter Augers

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

## Continuous Spiral Flight Augers

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

## Non-core Rotary Drilling

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

## Continuous Core Drilling

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

## Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

### Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

## Description and Classification Methods

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

## Soil Types

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

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

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

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

Definitions of grading terms used are:

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

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

In fine grained soils (>35% fines)

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

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

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

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

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

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

# Soil Descriptions

## Cohesive Soils

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

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

## Cohesionless Soils

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

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

## Soil Origin

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

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

## Moisture Condition – Coarse Grained Soils

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

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

## Moisture Condition – Fine Grained Soils

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

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

## Rock Strength

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

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

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

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

## Degree of Weathering

The degree of weathering of rock is classified as follows:

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

# *Rock Descriptions*

## Degree of Fracturing

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

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

## Rock Quality Designation

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

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

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

## Stratification Spacing

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

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

# Symbols & Abbreviations



## Introduction

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

## Drilling or Excavation Methods

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

## Water

| | |
|---|---|
| ▷ | Water seep |
| ▽ | Water level |

## Sampling and Testing

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

## Description of Defects in Rock

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

### Defect Type

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

### Orientation

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

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

### Coating or Infilling Term

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

### Coating Descriptor

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

### Shape

| | |
|---|---|
| cu | curved |
| ir | irregular |
| pl | planar |
| st | stepped |
| un | undulating |

### Roughness

| | |
|---|---|
| po | polished |
| ro | rough |
| sl | slickensided |
| sm | smooth |
| vr | very rough |

### Other

| | |
|---|---|
| fg | fragmented |
| bnd | band |
| qtz | quartz |

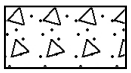
# *Symbols & Abbreviations*

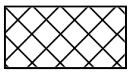
## Graphic Symbols for Soil and Rock

### General

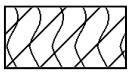

Asphalt

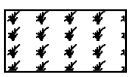

Road base

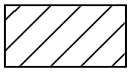

Concrete

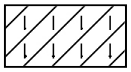

Filling

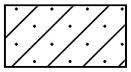
### Soils


Topsoil

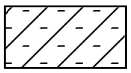

Peat

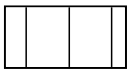

Clay

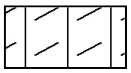

Silty clay

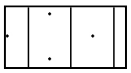

Sandy clay

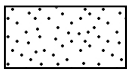

Gravelly clay

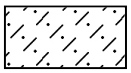

Shaly clay

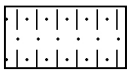

Silt


Clayey silt


Sandy silt

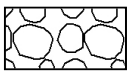

Sand

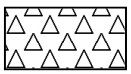

Clayey sand


Silty sand


Gravel

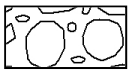

Sandy gravel


Cobbles, boulders

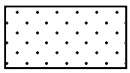

Talus

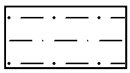
### Sedimentary Rocks

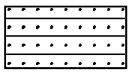

Boulder conglomerate

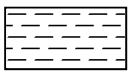

Conglomerate


Conglomeratic sandstone

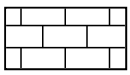

Sandstone


Siltstone

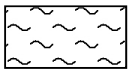

Laminite

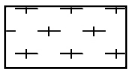

Mudstone, claystone, shale

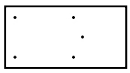

Coal


Limestone

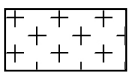
### Metamorphic Rocks

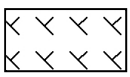

Slate, phyllite, schist

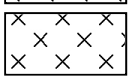

Gneiss

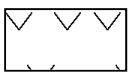

Quartzite

### Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

# BOREHOLE LOG

**CLIENT:** Meriden School
**PROJECT:** Site 2 - Proposed Open Play Space
**LOCATION:** 4 Vernon Street, Strathfield

**SURFACE LEVEL:** 15.8 AHD
**EASTING:** 323302
**NORTHING:** 6250096
**DIP/AZIMUTH:** 90°/--

**BORE No:** BH1
**PROJECT No:** 86568.02
**DATE:** 17-1-2019
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Dynamic Penetrometer Test (blows per 150mm) |
|---|---|---|---|---|---|---|---|---|---|
| | | FILLING (Topsoil): dark grey, sandy silt topsoil with trace of rootlets and gravels | | A/E | 0.1 | | | | |
| | 0.2 | CLAY: firm, red brown to brown clay with trace of silt, damp | | A/E | 0.2 | | | | |
| | | | | A/E | 0.4 | | | | |
| 15 | 0.8 | CLAY: stiff, pale grey and pale brown clay with trace of ironstone bands, moist | | A/E | 0.5 | | | | |
| | 1 | | | A/E | 0.9 | | | | 1 |
| | | below 1.35 m: becoming hard | | | 1.0 | | | | |
| 14 | 1.4 | Bore discontinued at 1.4m<br>Hand auger refusal on ironstone bands | | | | | | | >> |

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

**RIG:** Hand Tools **DRILLER:** AT **LOGGED:** AT **CASING:** Uncased

**TYPE OF BORING:** Hand auger to 1.5m

**WATER OBSERVATIONS:** No free groundwater observed whilst augering

**REMARKS:** Borehole backfilled with drilling spoil

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Meriden School
**PROJECT:** Site 2 - Proposed Open Play Space
**LOCATION:** 4 Vernon Street, Strathfield

**SURFACE LEVEL:** 15.9 AHD
**EASTING:** 323300
**NORTHING:** 6250089
**DIP/AZIMUTH:** 90°/--

**BORE No:** BH2
**PROJECT No:** 86568.02
**DATE:** 17-1-2019
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Dynamic Penetrometer Test (blows per 150mm) |
|---|---|---|---|---|---|---|---|---|---|
| | | FILLING (Topsoil): dark grey, sandy silt topsoil with trace of rootlets and gravels | | A/E | 0.1 | | | | |
| | 0.2 | CLAY: stiff, red brown to brown clay with trace of silt, damp | | | 0.2 | | | | |
| | | | | A/E* | 0.4 | | | | |
| | | below 0.6 m: becoming very stiff | | | 0.5 | | | | |
| | 0.7 | CLAY: stiff to very stiff, pale grey and pale brown clay with trace of ironstone bands, moist | | A/E | 0.9 | | | | |
| 15 | 1 | | | | 1.0 | | | | 1 |
| | 1.2 | Bore discontinued at 1.2m<br>Hand auger refusal on ironstone bands | | | | | | | |
| 14 | | | | | | | | | |

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

**RIG:** Hand Tools **DRILLER:** AT **LOGGED:** AT **CASING:** Uncased

**TYPE OF BORING:** Hand auger to 1.2m

**WATER OBSERVATIONS:** No free groundwater observed whilst augering

**REMARKS:** *BD1/170119, Borehole backfilled with drilling spoil

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Meriden School
**PROJECT:** Site 2 - Proposed Open Play Space
**LOCATION:** 4 Vernon Street, Strathfield

**SURFACE LEVEL:** 16.7 AHD
**EASTING:** 323326
**NORTHING:** 6250091
**DIP/AZIMUTH:** 90°/--

**BORE No:** BH3
**PROJECT No:** 86568.02
**DATE:** 17-1-2019
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Dynamic Penetrometer Test (blows per 150mm) |
|---|---|---|---|---|---|---|---|---|---|
| 16 | 0.2 | FILLING (Topsoil): dark grey, sandy silt topsoil with trace of rootlets and gravels | | A/E | 0.1 | | | | 5 10 15 20 |
| | 0.6 | CLAY: firm, red brown to brown clay with trace of silt, damp<br>below 0.45 m: becoming soft | | A/E* | 0.2<br>0.4<br>0.5 | | | | |
| | 1 | CLAY: stiff, pale grey and pale brown clay with trace of ironstone bands, moist<br>below: 1.05 m: becoming hard | | A/E | 0.9<br>1.0 | | | | 1 |
| 15 | 1.1 | Bore discontinued at 1.1m<br>Hand auger refusal on ironstone bands | | | | | | | >> |

**RIG:** Hand Tools **DRILLER:** AT **LOGGED:** AT **CASING:** Uncased

**TYPE OF BORING:** Hand auger to 1.1m

**WATER OBSERVATIONS:** No free groundwater observed whilst augering

**REMARKS:** *BD2/170119, Borehole backfilled with drilling spoil

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Meriden School
**PROJECT:** Site 2 - Proposed Open Play Space
**LOCATION:** 4 Vernon Street, Strathfield

**SURFACE LEVEL:** 16.8 AHD
**EASTING:** 323326
**NORTHING:** 6250085
**DIP/AZIMUTH:** 90°/--

**BORE No:** BH4
**PROJECT No:** 86568.02
**DATE:** 17-1-2019
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Dynamic Penetrometer Test (blows per 150mm) |
|---|---|---|---|---|---|---|---|---|---|
| | 0.2 | FILLING (Topsoil): dark grey, sandy silt topsoil with trace of rootlets, gravels and possible ash | | A/E | 0.1 | | | | |
| | | CLAY: firm to stiff, red brown to brown clay with trace of silt, damp | | A/E | 0.2<br>0.4<br>0.5 | | | | |
| 16 | 0.7 | CLAY: stiff to very stiff, pale grey and pale brown clay with trace of ironstone bands, moist | | A/E | 0.9 | | | | |
| | 1.0 | Bore discontinued at 1.0m<br>Hand auger refusal on ironstone bands | | | 1.0 | | | | |
| 15 | | | | | | | | | |

**RIG:** Hand Tools **DRILLER:** AT **LOGGED:** AT **CASING:** Uncased

**TYPE OF BORING:** Hand auger to 1.0m

**WATER OBSERVATIONS:** No free groundwater observed whilst augering

**REMARKS:** Borehole backfilled with drilling spoil

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# Appendix D

Laboratory Results

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

# CERTIFICATE OF ANALYSIS 209851

## Client Details

| | |
|---|---|
| **Client** | Douglas Partners Pty Ltd |
| **Attention** | David Walker |
| **Address** | 96 Hermitage Rd, West Ryde, NSW, 2114 |

## Sample Details

| | |
|---|---|
| **Your Reference** | **86568.02, Strathfield** |
| **Number of Samples** | 9 Soil |
| **Date samples received** | 21/01/2019 |
| **Date completed instructions received** | 21/01/2019 |

## 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** | 29/01/2019 |
| **Date of Issue** | 29/01/2019 |

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**Asbestos Approved By**
Analysed by Asbestos Approved Identifier: Aida Marner
Authorised by Asbestos Approved Signatory: Lucy Zhu

**Results Approved By**
Giovanni Agosti, Group Technical Manager
Jeremy Faircloth, Organics Supervisor
Lucy Zhu, Asbestos Analyst
Nick Sarlamis, Inorganics Supervisor
Priya Samarawickrama, Senior Chemist
Steven Luong, Senior Chemist

**Authorised By**

Jacinta Hurst, Laboratory Manager

| Asbestos ID - soils | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-3 | 209851-5 | 209851-7 |
| Your Reference | UNITS | BH1 | BH2 | BH3 | BH4 |
| Depth | | 0.1-0.2 | 0.1-0.2 | 0.1-0.2 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date analysed | - | 23/01/2019 | 23/01/2019 | 23/01/2019 | 23/01/2019 |
| Sample mass tested | g | Approx. 35g | Approx. 30g | Approx. 30g | Approx. 30g |
| Sample Description | - | Brown fine-grained soil & rocks | Brown fine-grained soil & rocks | Brown fine-grained soil & rocks | Brown fine-grained soil & rocks |
| Asbestos ID in soil | - | No asbestos detected at reporting limit of 0.1g/kg<br><br>Organic fibres detected | No asbestos detected at reporting limit of 0.1g/kg<br><br>Organic fibres detected | No asbestos detected at reporting limit of 0.1g/kg<br><br>Organic fibres detected | No asbestos detected at reporting limit of 0.1g/kg<br><br>Organic fibres detected |
| Asbestos comments | - | NO | NO | NO | NO |
| Trace Analysis | - | No asbestos detected | No asbestos detected | No asbestos detected | No asbestos detected |

| vTRH(C6-C10)/BTEXN in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-3 | 209851-4 | 209851-5 |
| Your Reference | UNITS | BH1 | BH1 | BH2 | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 24/01/2019 | 24/01/2019 | 24/01/2019 | 24/01/2019 | 24/01/2019 |
| TRH $C_6$ - $C_9$ | mg/kg | <25 | <25 | <25 | <25 | <25 |
| TRH $C_6$ - $C_{10}$ | mg/kg | <25 | <25 | <25 | <25 | <25 |
| vTPH $C_6$ - $C_{10}$ less BTEX (F1) | mg/kg | <25 | <25 | <25 | <25 | <25 |
| Benzene | mg/kg | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| Toluene | mg/kg | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Ethylbenzene | mg/kg | <1 | <1 | <1 | <1 | <1 |
| m+p-xylene | mg/kg | <2 | <2 | <2 | <2 | <2 |
| o-Xylene | mg/kg | <1 | <1 | <1 | <1 | <1 |
| naphthalene | mg/kg | <1 | <1 | <1 | <1 | <1 |
| Total +ve Xylenes | mg/kg | <1 | <1 | <1 | <1 | <1 |
| *Surrogate* aaa-Trifluorotoluene | % | 100 | 85 | 86 | 91 | 94 |

| vTRH(C6-C10)/BTEXN in Soil | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 209851-6 | 209851-7 | 209851-8 | 209851-9 |
| Your Reference | UNITS | BH3 | BH4 | BH4 | BD2/170119 |
| Depth | | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | - |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 24/01/2019 | 24/01/2019 | 24/01/2019 | 24/01/2019 |
| TRH $C_6$ - $C_9$ | mg/kg | <25 | <25 | <25 | <25 |
| TRH $C_6$ - $C_{10}$ | mg/kg | <25 | <25 | <25 | <25 |
| vTPH $C_6$ - $C_{10}$ less BTEX (F1) | mg/kg | <25 | <25 | <25 | <25 |
| Benzene | mg/kg | <0.2 | <0.2 | <0.2 | <0.2 |
| Toluene | mg/kg | <0.5 | <0.5 | <0.5 | <0.5 |
| Ethylbenzene | mg/kg | <1 | <1 | <1 | <1 |
| m+p-xylene | mg/kg | <2 | <2 | <2 | <2 |
| o-Xylene | mg/kg | <1 | <1 | <1 | <1 |
| naphthalene | mg/kg | <1 | <1 | <1 | <1 |
| Total +ve Xylenes | mg/kg | <1 | <1 | <1 | <1 |
| *Surrogate* aaa-Trifluorotoluene | % | 85 | 89 | 90 | 88 |

| svTRH (C10-C40) in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-3 | 209851-4 | 209851-5 |
| Your Reference | UNITS | BH1 | BH1 | BH2 | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 24/01/2019 | 24/01/2019 | 24/01/2019 | 24/01/2019 | 24/01/2019 |
| TRH $C_{10}$ - $C_{14}$ | mg/kg | <50 | <50 | <50 | <50 | <50 |
| TRH $C_{15}$ - $C_{28}$ | mg/kg | 160 | <100 | 170 | <100 | 250 |
| TRH $C_{29}$ - $C_{36}$ | mg/kg | 140 | <100 | 140 | <100 | 110 |
| 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 | 260 | <100 | 270 | <100 | 320 |
| TRH >$C_{34}$ -$C_{40}$ | mg/kg | <100 | <100 | <100 | <100 | <100 |
| Total +ve TRH (>C10-C40) | mg/kg | 260 | <50 | 270 | <50 | 320 |
| *Surrogate* o-Terphenyl | % | 134 | 109 | 129 | 124 | 123 |

| svTRH (C10-C40) in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-6 | 209851-7 | 209851-8 | 209851-9 | 209851-10 |
| Your Reference | UNITS | BH3 | BH4 | BH4 | BD2/170119 | BH1 - [TRIPLICATE] |
| Depth | | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | - | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 23/01/2019 |
| Date analysed | - | 24/01/2019 | 24/01/2019 | 24/01/2019 | 24/01/2019 | 24/01/2019 |
| TRH $C_{10}$ - $C_{14}$ | mg/kg | <50 | <50 | <50 | <50 | <50 |
| TRH $C_{15}$ - $C_{28}$ | mg/kg | <100 | 290 | <100 | <100 | 100 |
| TRH $C_{29}$ - $C_{36}$ | mg/kg | <100 | 190 | <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 | 440 | <100 | 130 | 170 |
| TRH >$C_{34}$ -$C_{40}$ | mg/kg | <100 | <100 | <100 | <100 | <100 |
| Total +ve TRH (>C10-C40) | mg/kg | <50 | 440 | <50 | 130 | 170 |
| *Surrogate* o-Terphenyl | % | 124 | 128 | 124 | 120 | 91 |

| PAHs in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-3 | 209851-4 | 209851-5 |
| Your Reference | UNITS | BH1 | BH1 | BH2 | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 23/01/2019 | 23/01/2019 | 23/01/2019 | 23/01/2019 | 23/01/2019 |
| Naphthalene | mg/kg | 0.4 | <0.1 | 0.2 | <0.1 | 0.2 |
| Acenaphthylene | mg/kg | 1.2 | <0.1 | 0.6 | <0.1 | 0.7 |
| Acenaphthene | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Fluorene | mg/kg | 0.6 | <0.1 | 0.3 | <0.1 | 0.3 |
| Phenanthrene | mg/kg | 6.3 | <0.1 | 7.8 | <0.1 | 5.5 |
| Anthracene | mg/kg | 1.4 | <0.1 | 1.5 | <0.1 | 1.2 |
| Fluoranthene | mg/kg | 11 | <0.1 | 13 | <0.1 | 10 |
| Pyrene | mg/kg | 10 | <0.1 | 12 | <0.1 | 9.4 |
| Benzo(a)anthracene | mg/kg | 5.4 | <0.1 | 6.1 | <0.1 | 5.1 |
| Chrysene | mg/kg | 4.4 | <0.1 | 4.8 | <0.1 | 3.7 |
| Benzo(b,j+k)fluoranthene | mg/kg | 8.5 | <0.2 | 8.2 | <0.2 | 6.9 |
| Benzo(a)pyrene | mg/kg | 5.6 | <0.05 | 5.3 | <0.05 | 4.5 |
| Indeno(1,2,3-c,d)pyrene | mg/kg | 2.7 | <0.1 | 2.5 | <0.1 | 2.2 |
| Dibenzo(a,h)anthracene | mg/kg | 0.8 | <0.1 | 0.8 | <0.1 | 0.7 |
| Benzo(g,h,i)perylene | mg/kg | 3.4 | <0.1 | 3.0 | <0.1 | 2.7 |
| Total +ve PAH's | mg/kg | 62 | <0.05 | 67 | <0.05 | 53 |
| Benzo(a)pyrene TEQ calc (zero) | mg/kg | 8.2 | <0.5 | 7.8 | <0.5 | 6.6 |
| Benzo(a)pyrene TEQ calc(half) | mg/kg | 8.2 | <0.5 | 7.8 | <0.5 | 6.6 |
| Benzo(a)pyrene TEQ calc(PQL) | mg/kg | 8.2 | <0.5 | 7.8 | <0.5 | 6.6 |
| *Surrogate p*-Terphenyl-d14 | % | 112 | 117 | 116 | 119 | 112 |

| PAHs in Soil | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 209851-6 | 209851-7 | 209851-8 | 209851-10 |
| Your Reference | UNITS | BH3 | BH4 | BH4 | BH1 - [TRIPLICATE] |
| Depth | | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 23/01/2019 |
| Date analysed | - | 23/01/2019 | 23/01/2019 | 23/01/2019 | 24/01/2019 |
| Naphthalene | mg/kg | <0.1 | 0.3 | <0.1 | 0.2 |
| Acenaphthylene | mg/kg | <0.1 | 1.3 | <0.1 | <0.1 |
| Acenaphthene | mg/kg | <0.1 | 0.2 | <0.1 | <0.1 |
| Fluorene | mg/kg | <0.1 | 0.7 | <0.1 | 0.3 |
| Phenanthrene | mg/kg | <0.1 | 13 | 0.1 | 4.4 |
| Anthracene | mg/kg | <0.1 | 2.9 | <0.1 | 1.2 |
| Fluoranthene | mg/kg | <0.1 | 20 | <0.1 | 9.6 |
| Pyrene | mg/kg | <0.1 | 18 | <0.1 | 9.6 |
| Benzo(a)anthracene | mg/kg | <0.1 | 9.8 | <0.1 | 5.3 |
| Chrysene | mg/kg | <0.1 | 7.3 | <0.1 | 5.0 |
| Benzo(b,j+k)fluoranthene | mg/kg | <0.2 | 13 | <0.2 | 8.9 |
| Benzo(a)pyrene | mg/kg | <0.05 | 8.8 | <0.05 | 5.8 |
| Indeno(1,2,3-c,d)pyrene | mg/kg | <0.1 | 4.1 | <0.1 | 2.7 |
| Dibenzo(a,h)anthracene | mg/kg | <0.1 | 1.2 | <0.1 | 0.7 |
| Benzo(g,h,i)perylene | mg/kg | <0.1 | 4.9 | <0.1 | 3.2 |
| Total +ve PAH's | mg/kg | <0.05 | 110 | 0.1 | 57 |
| Benzo(a)pyrene TEQ calc (zero) | mg/kg | <0.5 | 13 | <0.5 | 8.2 |
| Benzo(a)pyrene TEQ calc(half) | mg/kg | <0.5 | 13 | <0.5 | 8.2 |
| Benzo(a)pyrene TEQ calc(PQL) | mg/kg | <0.5 | 13 | <0.5 | 8.2 |
| *Surrogate p*-Terphenyl-d14 | % | 114 | 116 | 118 | 112 |

| Organochlorine Pesticides in soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-3 | 209851-4 | 209851-5 |
| Your Reference | UNITS | BH1 | BH1 | BH2 | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| HCB | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| alpha-BHC | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| gamma-BHC | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| beta-BHC | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Heptachlor | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| delta-BHC | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Aldrin | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Heptachlor Epoxide | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| gamma-Chlordane | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| alpha-chlordane | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Endosulfan I | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| pp-DDE | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Dieldrin | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Endrin | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| pp-DDD | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Endosulfan II | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| pp-DDT | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.4 |
| Endrin Aldehyde | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Endosulfan Sulphate | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Methoxychlor | mg/kg | <0.2 | <0.1 | <0.1 | <0.1 | <0.1 |
| Total +ve DDT+DDD+DDE | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| *Surrogate* TCMX | % | 130 | 105 | 110 | 105 | 104 |

| Organochlorine Pesticides in soil | | | | |
|---|---|---|---|---|
| Our Reference | | 209851-6 | 209851-7 | 209851-8 |
| Your Reference | UNITS | BH3 | BH4 | BH4 |
| Depth | | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| HCB | mg/kg | <0.1 | <0.1 | <0.1 |
| alpha-BHC | mg/kg | <0.1 | <0.1 | <0.1 |
| gamma-BHC | mg/kg | <0.1 | <0.1 | <0.1 |
| beta-BHC | mg/kg | <0.1 | <0.1 | <0.1 |
| Heptachlor | mg/kg | <0.1 | <0.1 | <0.1 |
| delta-BHC | mg/kg | <0.1 | <0.1 | <0.1 |
| Aldrin | mg/kg | <0.1 | <0.1 | <0.1 |
| Heptachlor Epoxide | mg/kg | <0.1 | <0.1 | <0.1 |
| gamma-Chlordane | mg/kg | <0.1 | <0.1 | <0.1 |
| alpha-chlordane | mg/kg | <0.1 | <0.1 | <0.1 |
| Endosulfan I | mg/kg | <0.1 | <0.1 | <0.1 |
| pp-DDE | mg/kg | <0.1 | <0.1 | <0.1 |
| Dieldrin | mg/kg | <0.1 | <0.1 | <0.1 |
| Endrin | mg/kg | <0.1 | <0.1 | <0.1 |
| pp-DDD | mg/kg | <0.1 | <0.1 | <0.1 |
| Endosulfan II | mg/kg | <0.1 | <0.1 | <0.1 |
| pp-DDT | mg/kg | <0.1 | <0.1 | <0.1 |
| Endrin Aldehyde | mg/kg | <0.1 | <0.1 | <0.1 |
| Endosulfan Sulphate | mg/kg | <0.1 | <0.1 | <0.1 |
| Methoxychlor | mg/kg | <0.1 | <0.1 | <0.1 |
| Total +ve DDT+DDD+DDE | mg/kg | <0.1 | <0.1 | <0.1 |
| *Surrogate* TCMX | % | 108 | 105 | 105 |

| Organophosphorus Pesticides | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-3 | 209851-4 | 209851-5 |
| Your Reference | UNITS | BH1 | BH1 | BH2 | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Azinphos-methyl (Guthion) | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Bromophos-ethyl | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Chlorpyriphos | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Chlorpyriphos-methyl | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Diazinon | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Dichlorvos | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Dimethoate | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Ethion | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Fenitrothion | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Malathion | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Parathion | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Ronnel | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| *Surrogate* TCMX | % | 130 | 105 | 110 | 105 | 104 |

| Organophosphorus Pesticides | | | | |
|---|---|---|---|---|
| Our Reference | | 209851-6 | 209851-7 | 209851-8 |
| Your Reference | UNITS | BH3 | BH4 | BH4 |
| Depth | | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Azinphos-methyl (Guthion) | mg/kg | <0.1 | <0.1 | <0.1 |
| Bromophos-ethyl | mg/kg | <0.1 | <0.1 | <0.1 |
| Chlorpyriphos | mg/kg | <0.1 | <0.1 | <0.1 |
| Chlorpyriphos-methyl | mg/kg | <0.1 | <0.1 | <0.1 |
| Diazinon | mg/kg | <0.1 | <0.1 | <0.1 |
| Dichlorvos | mg/kg | <0.1 | <0.1 | <0.1 |
| Dimethoate | mg/kg | <0.1 | <0.1 | <0.1 |
| Ethion | mg/kg | <0.1 | <0.1 | <0.1 |
| Fenitrothion | mg/kg | <0.1 | <0.1 | <0.1 |
| Malathion | mg/kg | <0.1 | <0.1 | <0.1 |
| Parathion | mg/kg | <0.1 | <0.1 | <0.1 |
| Ronnel | mg/kg | <0.1 | <0.1 | <0.1 |
| *Surrogate* TCMX | % | 108 | 105 | 105 |

| PCBs in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-3 | 209851-4 | 209851-5 |
| Your Reference | UNITS | BH1 | BH1 | BH2 | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Aroclor 1016 | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Aroclor 1221 | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Aroclor 1232 | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Aroclor 1242 | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Aroclor 1248 | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Aroclor 1254 | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Aroclor 1260 | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Total +ve PCBs (1016-1260) | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| *Surrogate* TCLMX | % | 130 | 105 | 110 | 105 | 104 |

| PCBs in Soil | | | | |
|---|---|---|---|---|
| Our Reference | | 209851-6 | 209851-7 | 209851-8 |
| Your Reference | UNITS | BH3 | BH4 | BH4 |
| Depth | | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Aroclor 1016 | mg/kg | <0.1 | <0.1 | <0.1 |
| Aroclor 1221 | mg/kg | <0.1 | <0.1 | <0.1 |
| Aroclor 1232 | mg/kg | <0.1 | <0.1 | <0.1 |
| Aroclor 1242 | mg/kg | <0.1 | <0.1 | <0.1 |
| Aroclor 1248 | mg/kg | <0.1 | <0.1 | <0.1 |
| Aroclor 1254 | mg/kg | <0.1 | 0.2 | <0.1 |
| Aroclor 1260 | mg/kg | <0.1 | <0.1 | <0.1 |
| Total +ve PCBs (1016-1260) | mg/kg | <0.1 | 0.2 | <0.1 |
| *Surrogate* TCLMX | % | 108 | 105 | 105 |

| Acid Extractable metals in soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-3 | 209851-4 | 209851-5 |
| Your Reference | UNITS | BH1 | BH1 | BH2 | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date prepared | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Arsenic | mg/kg | 15 | 8 | 10 | 7 | 14 |
| Cadmium | mg/kg | <0.4 | <0.4 | <0.4 | <0.4 | 0.6 |
| Chromium | mg/kg | 30 | 21 | 22 | 19 | 24 |
| Copper | mg/kg | 49 | 17 | 32 | 14 | 110 |
| Lead | mg/kg | 570 | 19 | 420 | 20 | 440 |
| Mercury | mg/kg | 0.4 | <0.1 | 0.2 | <0.1 | 0.2 |
| Nickel | mg/kg | 8 | 5 | 6 | 4 | 10 |
| Zinc | mg/kg | 210 | 26 | 140 | 20 | 250 |

| Acid Extractable metals in soil | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 209851-6 | 209851-7 | 209851-8 | 209851-9 |
| Your Reference | UNITS | BH3 | BH4 | BH4 | BD2/170119 |
| Depth | | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | - |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date prepared | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Arsenic | mg/kg | 8 | 11 | 9 | 12 |
| Cadmium | mg/kg | <0.4 | 1 | <0.4 | <0.4 |
| Chromium | mg/kg | 22 | 30 | 19 | 20 |
| Copper | mg/kg | 22 | 130 | 18 | 64 |
| Lead | mg/kg | 16 | 1,200 | 19 | 330 |
| Mercury | mg/kg | <0.1 | 0.5 | <0.1 | 0.2 |
| Nickel | mg/kg | 4 | 14 | 3 | 10 |
| Zinc | mg/kg | 30 | 690 | 22 | 220 |

| Misc Soil - Inorg | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-7 | 209851-8 |
| Your Reference | UNITS | BH1 | BH1 | BH4 | BH4 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date prepared | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Total Phenolics (as Phenol) | mg/kg | <5 | <5 | <5 | <5 |

| Moisture | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference | | 209851-1 | 209851-2 | 209851-3 | 209851-4 | 209851-5 |
| Your Reference | UNITS | BH1 | BH1 | BH2 | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date prepared | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 23/01/2019 | 23/01/2019 | 23/01/2019 | 23/01/2019 | 23/01/2019 |
| Moisture | % | 17 | 20 | 22 | 18 | 15 |

| Moisture | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 209851-6 | 209851-7 | 209851-8 | 209851-9 |
| Your Reference | UNITS | BH3 | BH4 | BH4 | BD2/170119 |
| Depth | | 0.4-0.5 | 0.1-0.2 | 0.4-0.5 | - |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date prepared | - | 22/01/2019 | 22/01/2019 | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 23/01/2019 | 23/01/2019 | 23/01/2019 | 23/01/2019 |
| Moisture | % | 27 | 20 | 24 | 14 |

| CEC | | | |
|---|---|---|---|
| Our Reference | | 209851-3 | 209851-5 |
| Your Reference | UNITS | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil |
| Date prepared | - | 22/01/2019 | 22/01/2019 |
| Date analysed | - | 25/01/2019 | 25/01/2019 |
| Exchangeable Ca | meq/100g | 8.9 | 9.6 |
| Exchangeable K | meq/100g | 0.6 | 0.6 |
| Exchangeable Mg | meq/100g | 0.86 | 0.97 |
| Exchangeable Na | meq/100g | <0.1 | <0.1 |
| Cation Exchange Capacity | meq/100g | 10 | 11 |

| Misc Inorg - Soil | | | |
|---|---|---|---|
| Our Reference | | 209851-3 | 209851-5 |
| Your Reference | UNITS | BH2 | BH3 |
| Depth | | 0.1-0.2 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil |
| Date prepared | - | 23/01/2019 | 23/01/2019 |
| Date analysed | - | 23/01/2019 | 23/01/2019 |
| pH 1:5 soil:water | pH Units | 6.7 | 6.8 |

| Method ID | Methodology Summary |
|---|---|
| **ASB-001** | Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004. |
| **Inorg-001** | pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times. |
| **Inorg-008** | Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours. |
| **Inorg-031** | Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish).<br>Solids are extracted in a caustic media prior to analysis. |
| **Metals-009** | Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish. |
| **Metals-020** | Determination of various metals by ICP-AES. |
| **Metals-021** | Determination of Mercury by Cold Vapour AAS. |
| **Org-003** | Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID.<br>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.<br><br>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.<br><br>Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40). |
| **Org-005** | Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. |
| **Org-005** | Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.<br>Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT. |
| **Org-006** | Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. |
| **Org-006** | Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.<br>Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs. |
| **Org-008** | Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. |

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

| QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | 209851-2 |
| Date extracted | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Date analysed | - | | | 24/01/2019 | 1 | 24/01/2019 | 24/01/2019 | | 24/01/2019 | 24/01/2019 |
| TRH $C_6$ - $C_9$ | mg/kg | 25 | Org-016 | <25 | 1 | <25 | <25 | 0 | 96 | 89 |
| TRH $C_6$ - $C_{10}$ | mg/kg | 25 | Org-016 | <25 | 1 | <25 | <25 | 0 | 96 | 89 |
| Benzene | mg/kg | 0.2 | Org-016 | <0.2 | 1 | <0.2 | <0.2 | 0 | 97 | 91 |
| Toluene | mg/kg | 0.5 | Org-016 | <0.5 | 1 | <0.5 | <0.5 | 0 | 95 | 87 |
| Ethylbenzene | mg/kg | 1 | Org-016 | <1 | 1 | <1 | <1 | 0 | 92 | 89 |
| m+p-xylene | mg/kg | 2 | Org-016 | <2 | 1 | <2 | <2 | 0 | 98 | 90 |
| o-Xylene | mg/kg | 1 | Org-016 | <1 | 1 | <1 | <1 | 0 | 95 | 90 |
| naphthalene | mg/kg | 1 | Org-014 | <1 | 1 | <1 | <1 | 0 | [NT] | [NT] |
| *Surrogate* aaa-Trifluorotoluene | % | | Org-016 | 102 | 1 | 100 | 88 | 13 | 103 | 89 |

| QUALITY CONTROL: svTRH (C10-C40) in Soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | 209851-2 |
| Date extracted | - | | | 24/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Date analysed | - | | | 25/01/2019 | 1 | 24/01/2019 | 24/01/2019 | | 24/01/2019 | 24/01/2019 |
| TRH $C_{10}$ - $C_{14}$ | mg/kg | 50 | Org-003 | <50 | 1 | <50 | <50 | 0 | 114 | 107 |
| TRH $C_{15}$ - $C_{28}$ | mg/kg | 100 | Org-003 | <100 | 1 | 160 | 380 | 81 | 111 | 110 |
| TRH $C_{29}$ - $C_{36}$ | mg/kg | 100 | Org-003 | <100 | 1 | 140 | 260 | 60 | 129 | 118 |
| TRH >$C_{10}$ -$C_{16}$ | mg/kg | 50 | Org-003 | <50 | 1 | <50 | <50 | 0 | 114 | 107 |
| TRH >$C_{16}$ -$C_{34}$ | mg/kg | 100 | Org-003 | <100 | 1 | 260 | 570 | 75 | 111 | 110 |
| TRH >$C_{34}$ -$C_{40}$ | mg/kg | 100 | Org-003 | <100 | 1 | <100 | 120 | 18 | 129 | 118 |
| *Surrogate* o-Terphenyl | % | | Org-003 | 99 | 1 | 134 | 109 | 21 | 125 | 109 |

| QUALITY CONTROL: PAHs in Soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | 209851-2 |
| Date extracted | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Date analysed | - | | | 23/01/2019 | 1 | 23/01/2019 | 23/01/2019 | | 23/01/2019 | 23/01/2019 |
| Naphthalene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 0.4 | 1.3 | 106 | 97 | 100 |
| Acenaphthylene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 1.2 | 0.1 | 169 | [NT] | [NT] |
| Acenaphthene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | <0.1 | 0.6 | 143 | [NT] | [NT] |
| Fluorene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 0.6 | 14 | 184 | 99 | 101 |
| Phenanthrene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 6.3 | 3.0 | 71 | 99 | 99 |
| Anthracene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 1.4 | 23 | 177 | [NT] | [NT] |
| Fluoranthene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 11 | 21 | 62 | 106 | 109 |
| Pyrene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 10 | 11 | 10 | 104 | 107 |
| Benzo(a)anthracene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 5.4 | 8.0 | 39 | [NT] | [NT] |
| Chrysene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 4.4 | 14 | 104 | 100 | 101 |
| Benzo(b,j+k)fluoranthene | mg/kg | 0.2 | Org-012 | <0.2 | 1 | 8.5 | 9.4 | 10 | [NT] | [NT] |
| Benzo(a)pyrene | mg/kg | 0.05 | Org-012 | <0.05 | 1 | 5.6 | 4.3 | 26 | 103 | 107 |
| Indeno(1,2,3-c,d)pyrene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 2.7 | 1.3 | 70 | [NT] | [NT] |
| Dibenzo(a,h)anthracene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 0.8 | 5.2 | 147 | [NT] | [NT] |
| Benzo(g,h,i)perylene | mg/kg | 0.1 | Org-012 | <0.1 | 1 | 3.4 | 3.4 | 0 | [NT] | [NT] |
| *Surrogate p*-Terphenyl-d14 | % | | Org-012 | 115 | 1 | 112 | 110 | 2 | 109 | 110 |

| QUALITY CONTROL: Organochlorine Pesticides in soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | 209851-2 |
| Date extracted | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Date analysed | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| HCB | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| alpha-BHC | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 126 | 132 |
| gamma-BHC | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| beta-BHC | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 87 | 92 |
| Heptachlor | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 94 | 101 |
| delta-BHC | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Aldrin | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 81 | 86 |
| Heptachlor Epoxide | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 88 | 93 |
| gamma-Chlordane | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| alpha-chlordane | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Endosulfan I | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| pp-DDE | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 90 | 97 |
| Dieldrin | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 98 | 106 |
| Endrin | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 89 | 92 |
| pp-DDD | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 89 | 89 |
| Endosulfan II | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| pp-DDT | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Endrin Aldehyde | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Endosulfan Sulphate | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.1 | <0.1 | 0 | 90 | 106 |
| Methoxychlor | mg/kg | 0.1 | Org-005 | <0.1 | 1 | <0.2 | <0.2 | 0 | [NT] | [NT] |
| *Surrogate* TCMX | % | | Org-005 | 103 | 1 | 130 | 108 | 18 | 114 | 119 |

| QUALITY CONTROL: Organophosphorus Pesticides | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | 209851-2 |
| Date extracted | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Date analysed | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Azinphos-methyl (Guthion) | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Bromophos-ethyl | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Chlorpyriphos | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | 96 | 97 |
| Chlorpyriphos-methyl | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Diazinon | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Dichlorvos | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | 99 | 98 |
| Dimethoate | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Ethion | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | 87 | 84 |
| Fenitrothion | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | 110 | 109 |
| Malathion | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | 93 | 93 |
| Parathion | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | 111 | 110 |
| Ronnel | mg/kg | 0.1 | Org-008 | <0.1 | 1 | <0.1 | <0.1 | 0 | 100 | 99 |
| *Surrogate* TCMX | % | | Org-008 | 103 | 1 | 130 | 108 | 18 | 102 | 102 |

| QUALITY CONTROL: PCBs in Soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | 209851-2 |
| Date extracted | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Date analysed | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Aroclor 1016 | mg/kg | 0.1 | Org-006 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Aroclor 1221 | mg/kg | 0.1 | Org-006 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Aroclor 1232 | mg/kg | 0.1 | Org-006 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Aroclor 1242 | mg/kg | 0.1 | Org-006 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Aroclor 1248 | mg/kg | 0.1 | Org-006 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| Aroclor 1254 | mg/kg | 0.1 | Org-006 | <0.1 | 1 | <0.1 | <0.1 | 0 | 121 | 120 |
| Aroclor 1260 | mg/kg | 0.1 | Org-006 | <0.1 | 1 | <0.1 | <0.1 | 0 | [NT] | [NT] |
| *Surrogate* TCLMX | % | | Org-006 | 103 | 1 | 130 | 108 | 18 | 102 | 102 |

| QUALITY CONTROL: Acid Extractable metals in soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | 209851-2 |
| Date prepared | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Date analysed | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Arsenic | mg/kg | 4 | Metals-020 | <4 | 1 | 15 | 14 | 7 | 110 | 77 |
| Cadmium | mg/kg | 0.4 | Metals-020 | <0.4 | 1 | <0.4 | <0.4 | 0 | 107 | 88 |
| Chromium | mg/kg | 1 | Metals-020 | <1 | 1 | 30 | 38 | 24 | 113 | 90 |
| Copper | mg/kg | 1 | Metals-020 | <1 | 1 | 49 | 48 | 2 | 110 | 101 |
| Lead | mg/kg | 1 | Metals-020 | <1 | 1 | 570 | 540 | 5 | 107 | 88 |
| Mercury | mg/kg | 0.1 | Metals-021 | <0.1 | 1 | 0.4 | 0.2 | 67 | 93 | 109 |
| Nickel | mg/kg | 1 | Metals-020 | <1 | 1 | 8 | 9 | 12 | 108 | 89 |
| Zinc | mg/kg | 1 | Metals-020 | <1 | 1 | 210 | 210 | 0 | 105 | 85 |

| QUALITY CONTROL: Acid Extractable metals in soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | [NT] | [NT] |
| Date prepared | - | | | [NT] | 7 | 22/01/2019 | 22/01/2019 | | [NT] | [NT] |
| Date analysed | - | | | [NT] | 7 | 22/01/2019 | 22/01/2019 | | [NT] | [NT] |
| Arsenic | mg/kg | 4 | Metals-020 | [NT] | 7 | 11 | 11 | 0 | [NT] | [NT] |
| Cadmium | mg/kg | 0.4 | Metals-020 | [NT] | 7 | 1 | 1 | 0 | [NT] | [NT] |
| Chromium | mg/kg | 1 | Metals-020 | [NT] | 7 | 30 | 22 | 31 | [NT] | [NT] |
| Copper | mg/kg | 1 | Metals-020 | [NT] | 7 | 130 | 150 | 14 | [NT] | [NT] |
| Lead | mg/kg | 1 | Metals-020 | [NT] | 7 | 1200 | 820 | 38 | [NT] | [NT] |
| Mercury | mg/kg | 0.1 | Metals-021 | [NT] | 7 | 0.5 | 0.4 | 22 | [NT] | [NT] |
| Nickel | mg/kg | 1 | Metals-020 | [NT] | 7 | 14 | 11 | 24 | [NT] | [NT] |
| Zinc | mg/kg | 1 | Metals-020 | [NT] | 7 | 690 | 530 | 26 | [NT] | [NT] |

| QUALITY CONTROL: Misc Soil - Inorg | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | 209851-2 |
| Date prepared | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Date analysed | - | | | 22/01/2019 | 1 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | 22/01/2019 |
| Total Phenolics (as Phenol) | mg/kg | 5 | Inorg-031 | <5 | 1 | <5 | <5 | 0 | 109 | 98 |

| QUALITY CONTROL: CEC | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | [NT] |
| Date prepared | - | | | 22/01/2019 | 3 | 22/01/2019 | 22/01/2019 | | 22/01/2019 | [NT] |
| Date analysed | - | | | 25/01/2019 | 3 | 25/01/2019 | 25/01/2019 | | 25/01/2019 | [NT] |
| Exchangeable Ca | meq/100g | 0.1 | Metals-009 | <0.1 | 3 | 8.9 | 8.3 | 7 | 106 | [NT] |
| Exchangeable K | meq/100g | 0.1 | Metals-009 | <0.1 | 3 | 0.6 | 0.5 | 18 | 110 | [NT] |
| Exchangeable Mg | meq/100g | 0.1 | Metals-009 | <0.1 | 3 | 0.86 | 0.83 | 4 | 103 | [NT] |
| Exchangeable Na | meq/100g | 0.1 | Metals-009 | <0.1 | 3 | <0.1 | <0.1 | 0 | 104 | [NT] |

| QUALITY CONTROL: Misc Inorg - Soil | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-2 | [NT] |
| Date prepared | - | | | 23/01/2019 | 3 | 23/01/2019 | 23/01/2019 | | 23/01/2019 | [NT] |
| Date analysed | - | | | 23/01/2019 | 3 | 23/01/2019 | 23/01/2019 | | 23/01/2019 | [NT] |
| pH 1:5 soil:water | pH Units | | Inorg-001 | [NT] | 3 | 6.7 | 6.6 | 2 | 103 | [NT] |

## Result Definitions

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

## Quality Control Definitions

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

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

## Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

## Report Comments

Asbestos: A portion of the supplied samples were sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire sample.
Envirolab recommends supplying 40-50g of sample in its own container.
Note: Samples requested for asbestos testing were sub-sampled from jars provided by the client.

OC's in Soil - PQL has been raised due to interference from analytes(other than those being tested) in samples 1 and 5.

PAHs in Soil - The laboratory RPD acceptance criteria has been exceeded for 209851-1. Therefore a triplicate result has been issued as 209851-10.

TRH Soil C10-C40 NEPM - The laboratory RPD acceptance criteria has been exceeded for 209851-1. Therefore a triplicate result has been issued as 209851-10.

**Douglas Partners**
Geotechnics / Environment / Groundwater

# CHAIN OF CUSTODY DESPATCH SHEET

| | | | |
|---|---|---|---|
| **Project No:** 86568.02 | **Suburb:** Strathfield | **To:** | Envirolab Services |
| **Project Name:** Strathfield | **Order Number** | | 12 Ashley Street, Chatswood NSW 2067 |
| **Project Manager:** Shahin Falahati / David Walker | **Sampler:** Adam | **Attn:** | |
| **Emails:** david.walker@douglaspartners.com.au | | **Phone:** | 02 9910 6200 |
| **Date Required:** Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☑ | | **Email:** | sydney@envirolab.com.au |
| **Prior Storage:** ☐ Esky ☐ Fridge ☐ Shelved | Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID) | | |

| Sample ID | depth (m) | Lab ID | Date Sampled | Sample Type (S - soil, W - water) | Container Type (G - glass, P - plastic) | Analytes: Combo 8a | Combo 8 | Combo 6a | Combo 6 | Combo 1m | CEC | pH | | | Notes/preservation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH1 | 0.1-0.2 | 1 | 17-1-19 | S | G | ✓ | | | | | | | | | |
| BH1 | 0.4-0.5 | 2 | | | | | ✓ | | | | | | | | |
| BH2 | 0.1-0.2 | 3 | | | | | | ✓ | | | ✓ | ✓ | | | |
| BH2 | 0.4-0.5 | 4 | | | | | | | ✓ | | | | | | |
| BH3 | 0.1-0.2 | 5 | | | | | | ✓ | | | ✓ | ✓ | | | |
| BH3 | 0.4-0.5 | 6 | | | | | | | ✓ | | | | | | |
| BH4 | 0.1-0.2 | 7 | | | | ✓ | | | | | | | | | |
| BH4 | 0.4-0.5 | 8 | | | | | ✓ | | | | | | | | |
| BD2/170119 | | 9 | | | | | | | | ✓ | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **PQL (S) mg/kg** | | | | | | | | | | | | | | **ANZECC PQLs req'd for all water analytes** ☐ | |

ENVIROLAB

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

Job No: 209851
Date Received: 21/1/19
Time Received: 11:25
Received By: N
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

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

**Metals to Analyse: 8HM unless specified here:**

**Lab Report/Reference No:**

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

**Send Results to:** Douglas Partners Pty Ltd **Address:** 96 Hermitage Road, West Ryde **Phone:** 98090666 **Fax:** 98094095

**Signed:** **Received by:** T. Nguyen of ELS **Date & Time:** ~~21/1/19~~ 21/1/19 11:25

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

# SAMPLE RECEIPT ADVICE

## Client Details

| | |
|---|---|
| **Client** | Douglas Partners Pty Ltd |
| **Attention** | David Walker |

## Sample Login Details

| | |
|---|---|
| **Your reference** | 86568.02, Strathfield |
| **Envirolab Reference** | 209851 |
| **Date Sample Received** | 21/01/2019 |
| **Date Instructions Received** | 21/01/2019 |
| **Date Results Expected to be Reported** | 29/01/2019 |

## Sample Condition

| | |
|---|---|
| **Samples received in appropriate condition for analysis** | YES |
| **No. of Samples Provided** | 9 Soil |
| **Turnaround Time Requested** | Standard |
| **Temperature on Receipt (°C)** | 19.4 |
| **Cooling Method** | Ice Pack |
| **Sampling Date Provided** | YES |

## Comments

Nil

Please direct any queries to:

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

*Analysis Underway, details on the following page:*

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

| Sample ID | vTRH(C6-C10)/BTEXN in Soil | svTRH (C10-C40) in Soil | PAHs in Soil | Organochlorine Pesticidesin soil | Organophosphorus Pesticides | PCBsin Soil | Acid Extractable metalsin soil | Misc Soil - Inorg | Asbestos ID - soils | CEC | Misc Inorg - Soil |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BH1 -0.1-0.2** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| **BH1-0.4-0.5** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| **BH2-0.1-0.2** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| **BH2-0.4-0.5** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| **BH3-0.1-0.2** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| **BH3-0.4-0.5** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| **BH4-0.1-0.2** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| **BH4-0.4-0.5** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| **BD2/170119** | ✓ | ✓ | | | | | ✓ | | | | |

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

## Additional Info

| |
|---|
| Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt. |
| Requests for longer term sample storage must be received in writing. |

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

# CERTIFICATE OF ANALYSIS 209851-A

## Client Details

| | |
|---|---|
| **Client** | Douglas Partners Pty Ltd |
| **Attention** | David Walker |
| **Address** | 96 Hermitage Rd, West Ryde, NSW, 2114 |

## Sample Details

| | |
|---|---|
| **Your Reference** | **86568.02, Strathfield** |
| **Number of Samples** | 9 Soil |
| **Date samples received** | 21/01/2019 |
| **Date completed instructions received** | 30/01/2019 |

## 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.

## Report Details

| | |
|---|---|
| **Date results requested by** | 06/02/2019 |
| **Date of Issue** | 04/02/2019 |

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

**Results Approved By**
Giovanni Agosti, Group Technical Manager
Steven Luong, Senior Chemist

**Authorised By**

Jacinta Hurst, Laboratory Manager

| Metals in TCLP USEPA1311 | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 209851-A-1 | 209851-A-3 | 209851-A-5 | 209851-A-7 |
| Your Reference | UNITS | BH1 | BH2 | BH3 | BH4 |
| Depth | | 0.1-0.2 | 0.1-0.2 | 0.1-0.2 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date extracted | - | 31/01/2019 | 31/01/2019 | 31/01/2019 | 31/01/2019 |
| Date analysed | - | 31/01/2019 | 31/01/2019 | 31/01/2019 | 31/01/2019 |
| pH of soil for fluid# determ. | pH units | 6.7 | 6.5 | 6.6 | 7.7 |
| pH of soil TCLP (after HCl) | pH units | 2.1 | 2.3 | 2.1 | 2.1 |
| Extraction fluid used | - | 1 | 1 | 1 | 1 |
| pH of final Leachate | pH units | 5.0 | 5.0 | 5.0 | 5.1 |
| Lead in TCLP | mg/L | 0.2 | 0.2 | 0.1 | 0.2 |

| PAHs in TCLP (USEPA 1311) | | | | | |
|---|---|---|---|---|---|
| Our Reference | | 209851-A-1 | 209851-A-3 | 209851-A-5 | 209851-A-7 |
| Your Reference | UNITS | BH1 | BH2 | BH3 | BH4 |
| Depth | | 0.1-0.2 | 0.1-0.2 | 0.1-0.2 | 0.1-0.2 |
| Date Sampled | | 17/01/2019 | 17/01/2019 | 17/01/2019 | 17/01/2019 |
| Type of sample | | Soil | Soil | Soil | Soil |
| Date extracted | - | 31/01/2019 | 31/01/2019 | 31/01/2019 | 31/01/2019 |
| Date analysed | - | 01/02/2019 | 01/02/2019 | 01/02/2019 | 01/02/2019 |
| Naphthalene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Acenaphthylene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Acenaphthene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Fluorene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Phenanthrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Fluoranthene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Pyrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Benzo(a)anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Chrysene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Benzo(bjk)fluoranthene in TCLP | mg/L | <0.002 | <0.002 | <0.002 | <0.002 |
| Benzo(a)pyrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Indeno(1,2,3-c,d)pyrene - TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Dibenzo(a,h)anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Benzo(g,h,i)perylene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 |
| Total +ve PAH's | mg/L | NIL (+)VE | NIL (+)VE | NIL (+)VE | NIL (+)VE |
| *Surrogate p*-Terphenyl-d14 | % | 109 | 116 | 102 | 98 |

| Method ID | Methodology Summary |
|---|---|
| **EXTRACT.7** | Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311. |
| **Inorg-001** | pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times. |
| **Inorg-004** | Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004.<br>Please note that the mass used may be scaled down from the default based on sample mass available. |
| **Metals-020 ICP-AES** | Determination of various metals by ICP-AES. |
| **Org-012** | Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. |
| **Org-012** | Leachates are extracted with Dichloromethane and analysed by GC-MS. |
| **Org-012** | Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.<br>Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. |

| QUALITY CONTROL: Metals in TCLP USEPA1311 | | | | | | Duplicate | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-1 | [NT] |
| Date extracted | - | | | 31/01/2019 | [NT] | [NT] | [NT] | [NT] | 31/01/2019 | [NT] |
| Date analysed | - | | | 31/01/2019 | [NT] | [NT] | [NT] | [NT] | 31/01/2019 | [NT] |
| Lead in TCLP | mg/L | 0.03 | Metals-020 ICP-AES | <0.03 | [NT] | [NT] | [NT] | [NT] | 93 | [NT] |

| QUALITY CONTROL: PAHs in TCLP (USEPA 1311) | | | | | Duplicate | | | | Spike Recovery % | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test Description | Units | PQL | Method | Blank | # | Base | Dup. | RPD | LCS-W4 | [NT] |
| Date extracted | - | | | 31/01/2019 | [NT] | [NT] | [NT] | [NT] | 31/01/2019 | [NT] |
| Date analysed | - | | | 01/02/2019 | [NT] | [NT] | [NT] | [NT] | 01/02/2019 | [NT] |
| Naphthalene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | 67 | [NT] |
| Acenaphthylene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | [NT] | [NT] |
| Acenaphthene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | [NT] | [NT] |
| Fluorene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | 74 | [NT] |
| Phenanthrene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | 76 | [NT] |
| Anthracene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | [NT] | [NT] |
| Fluoranthene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | 83 | [NT] |
| Pyrene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | 82 | [NT] |
| Benzo(a)anthracene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | [NT] | [NT] |
| Chrysene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | 85 | [NT] |
| Benzo(bjk)fluoranthene in TCLP | mg/L | 0.002 | Org-012 | <0.002 | [NT] | [NT] | [NT] | [NT] | [NT] | [NT] |
| Benzo(a)pyrene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | 84 | [NT] |
| Indeno(1,2,3-c,d)pyrene - TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | [NT] | [NT] |
| Dibenzo(a,h)anthracene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | [NT] | [NT] |
| Benzo(g,h,i)perylene in TCLP | mg/L | 0.001 | Org-012 | <0.001 | [NT] | [NT] | [NT] | [NT] | [NT] | [NT] |
| *Surrogate p*-Terphenyl-d14 | % | | Org-012 | 89 | [NT] | [NT] | [NT] | [NT] | 98 | [NT] |

## Result Definitions

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

## Quality Control Definitions

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

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

## Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 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.

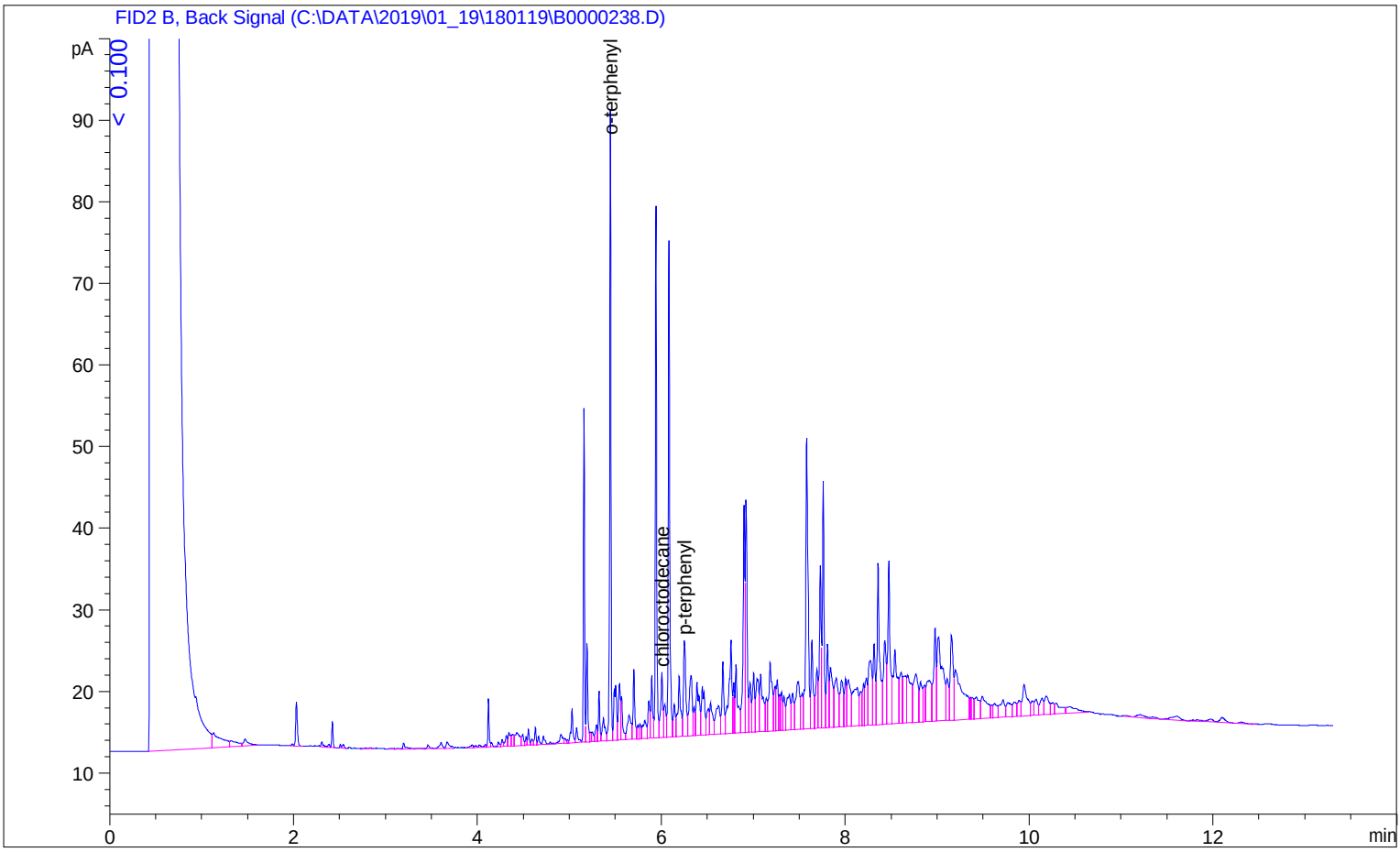
When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

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.

Data File C:\DATA\2019\01_19\180119\B0000238.D
Sample Name: s209851-1

```
==========================================================================
Acq. Operator   :                                  Seq. Line : 238
Acq. Instrument : GC#4                              Location : Vial 88
Injection Date  : 24/01/2019 12:24:33 AM                 Inj :   1
                                                  Inj Volume : 1 µl
Acq. Method     : C:\CHEM32\1\METHODS\NEPM JF.M
Last changed    : 15/08/2018 8:50:23 PM
Analysis Method : C:\METHODS\2019\01_19\180119B-PROCESSING-.M
Last changed    : 21/01/2019 9:01:14 AM
                  (modified after loading) (Current integration events modified)
Method Info     : FAST TPH WITH 15M HP5 COLUMNS
```




```
==========================================================================
                    External Standard Report
==========================================================================

Sorted By             :      Signal
Calib. Data Modified  :      21/01/2019 8:58:40 AM
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B, Back Signal

RetTime  Type     Area     Amt/Area    Amount   Grp   Name
 [min]          [pA*s]                 [mg/L]
-------|------|----------|----------|----------|--|------------------
  5.446 VV    I   76.33942 1.75827e-1   13.42252    o-terphenyl
  6.008 VV        13.12338 2.22440e-1    2.91916    chloroctodecane
  6.253 VV    I   20.16176    4.36818   88.07020    p-terphenyl
```

Data File C:\DATA\2019\01_19\180119\B0000238.D
Sample Name: s209851-1

| RetTime [min] | Type | Area [pA*s] | Amt/Area | Amount [mg/L] | Grp | Name |
|---|---|---|---|---|---|---|
| Totals : | | | | 104.41188 | | |

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

## Summed Peaks Report

Signal 1: FID2 B, Back Signal

| Name | Start Time [min] | End Time [min] | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|---|---|
| TRH C10-C14 | 1.870 | 3.970 | 20.38928 | 3.9439 |
| NEPM >C10-C16 | 2.410 | 4.615 | 41.52022 | 8.0312 |
| TRH C15-C28 | 3.970 | 7.680 | 828.29062 | 161.2682 |
| NEPM >C16-C34 | 4.615 | 8.780 | 1253.65890 | 244.0874 |
| TRH C29-C36 | 7.681 | 9.110 | 569.41306 | 112.1954 |
| NEPM >C34-C40 | 8.781 | 10.010 | 254.88339 | 50.2215 |
| Totals : | | | | 579.7476 |

## Final Summed Peaks Report

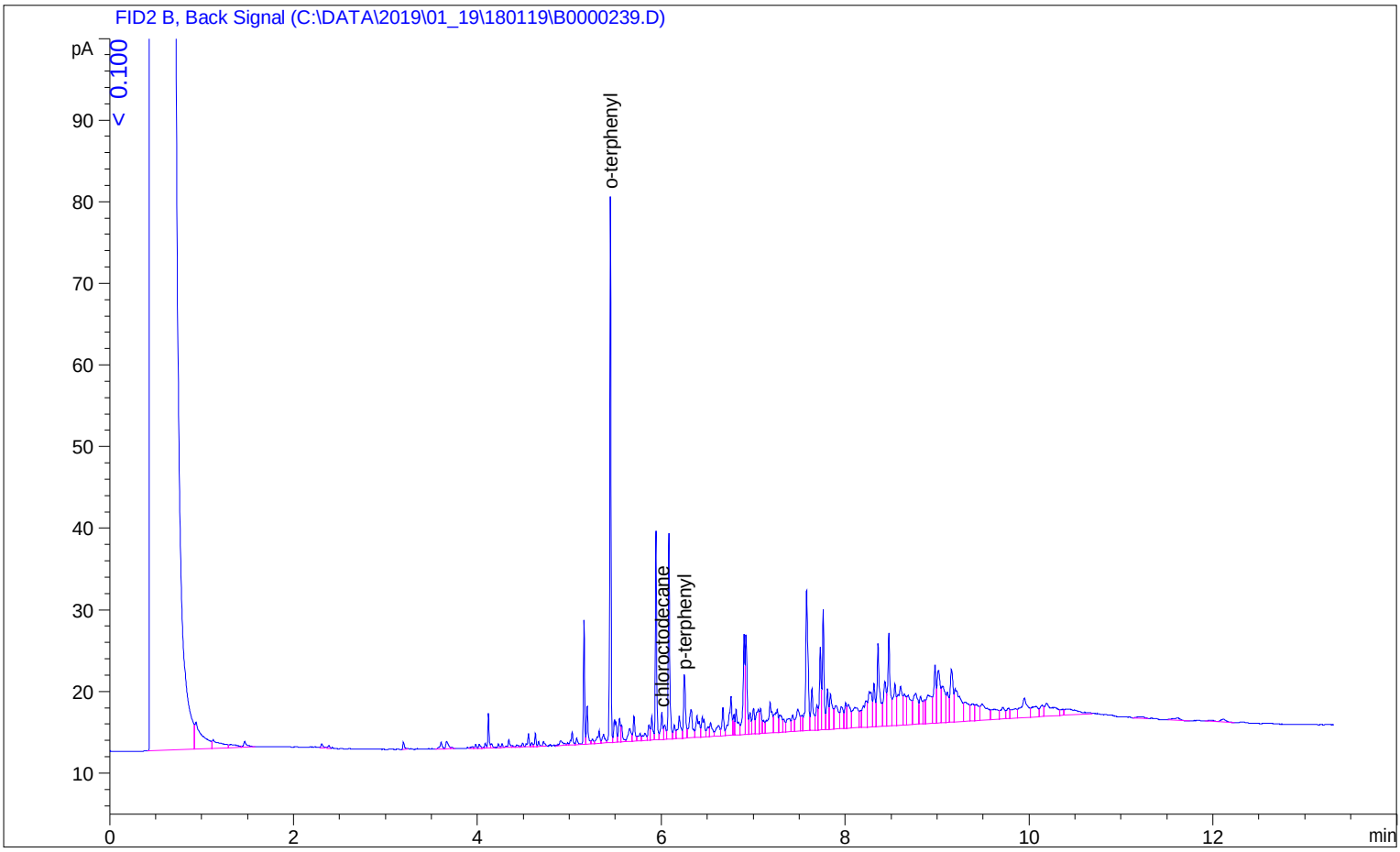
Signal 1: FID2 B, Back Signal

| Name | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|
| TRH C10-C14 | 20.38928 | 3.9439 |
| NEPM >C10-C16 | 41.52022 | 8.0312 |
| TRH C15-C28 | 828.29062 | 161.2682 |
| NEPM >C16-C34 | 1253.65890 | 244.0874 |
| TRH C29-C36 | 569.41306 | 112.1954 |
| NEPM >C34-C40 | 254.88339 | 50.2215 |
| o-terphenyl | 76.33942 | 13.4225 |
| chloroctodecane | 13.12338 | 2.9192 |
| p-terphenyl | 20.16176 | 88.0702 |
| Totals : | | 684.1594 |

*** End of Report ***

Data File C:\DATA\2019\01_19\180119\B0000239.D
Sample Name: s209851-1d

```
==========================================================================
Acq. Operator   :                                  Seq. Line : 239
Acq. Instrument : GC#4                              Location : Vial 89
Injection Date  : 24/01/2019 12:43:03 AM                 Inj :   1
                                                  Inj Volume : 1 µl
Acq. Method     : C:\CHEM32\1\METHODS\NEPM JF.M
Last changed    : 15/08/2018 8:50:23 PM
Analysis Method : C:\METHODS\2019\01_19\180119B-PROCESSING-.M
Last changed    : 24/01/2019 9:50:04 AM
                  (modified after loading)
Method Info     : FAST TPH WITH 15M HP5 COLUMNS
```




```
==========================================================================
                    External Standard Report
==========================================================================

Sorted By             :      Signal
Calib. Data Modified  :      21/01/2019 8:58:40 AM
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B, Back Signal

RetTime  Type     Area     Amt/Area    Amount   Grp   Name
 [min]          [pA*s]                 [mg/L]
-------|------|----------|----------|----------|--|------------------
  5.446 VV    I   61.89534 1.75827e-1   10.88286    o-terphenyl
  6.007 VV        5.09980 2.22440e-1    1.13440    chloroctodecane
  6.253 VV    I   11.05085    4.36818   48.27209    p-terphenyl
```

Data File C:\DATA\2019\01_19\180119\B0000239.D
Sample Name: s209851-1d

| RetTime [min] | Type | Area [pA*s] | Amt/Area | Amount [mg/L] | Grp | Name |
|---|---|---|---|---|---|---|
| Totals : | | | | 60.28935 | | |

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

## Summed Peaks Report

Signal 1: FID2 B, Back Signal

| Name | Start Time [min] | End Time [min] | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|---|---|
| TRH C10-C14 | 1.870 | 3.970 | 6.29678 | 1.2180 |
| NEPM >C10-C16 | 2.410 | 4.615 | 18.26789 | 3.5335 |
| TRH C15-C28 | 3.970 | 7.680 | 345.83601 | 67.3343 |
| NEPM >C16-C34 | 4.615 | 8.780 | 580.14262 | 112.9538 |
| TRH C29-C36 | 7.681 | 9.110 | 317.03263 | 62.4672 |
| NEPM >C34-C40 | 8.781 | 10.010 | 175.78537 | 34.6362 |
| Totals : | | | | 282.1429 |

## Final Summed Peaks Report

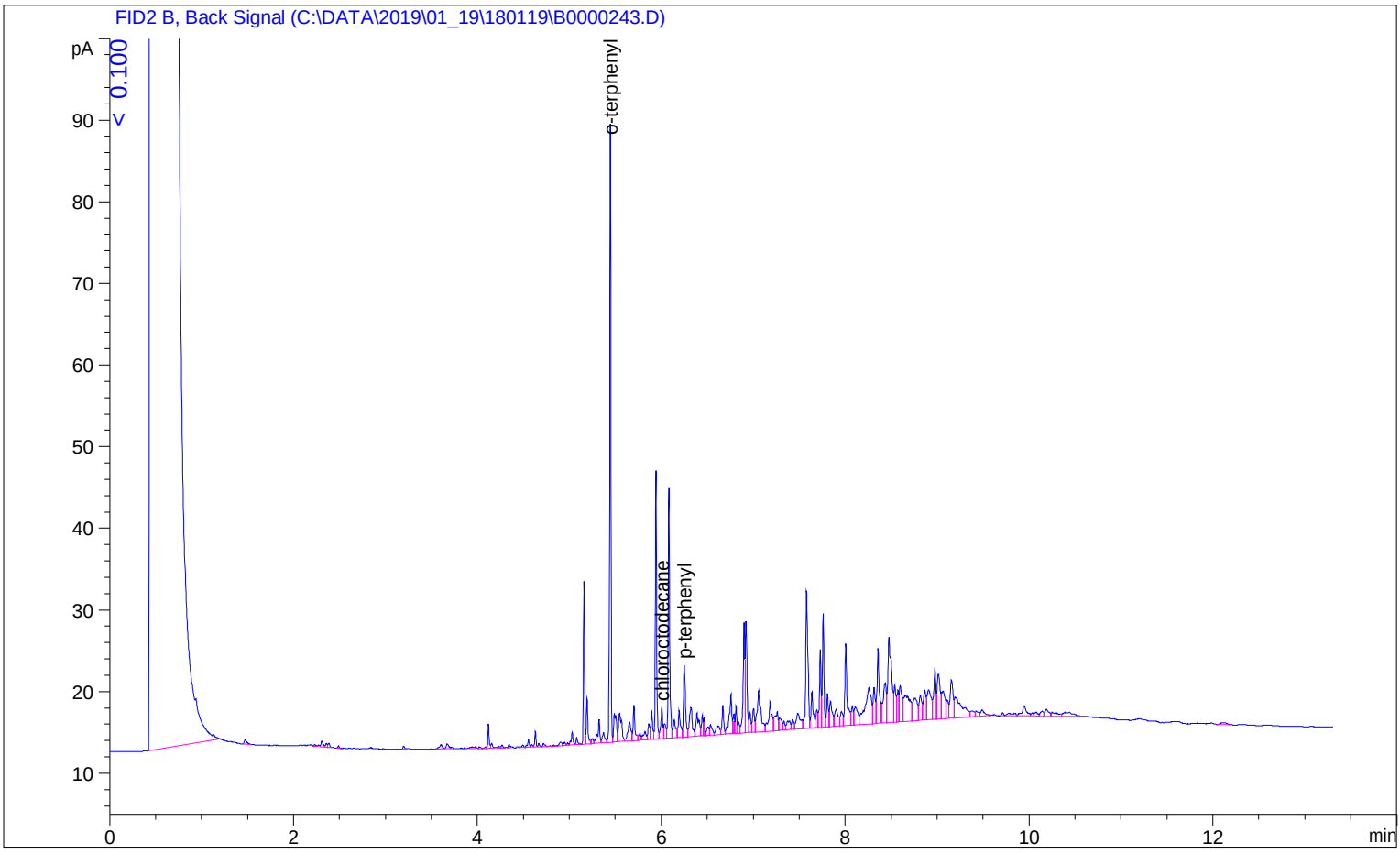
Signal 1: FID2 B, Back Signal

| Name | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|
| TRH C10-C14 | 6.29678 | 1.2180 |
| NEPM >C10-C16 | 18.26789 | 3.5335 |
| TRH C15-C28 | 345.83601 | 67.3343 |
| NEPM >C16-C34 | 580.14262 | 112.9538 |
| TRH C29-C36 | 317.03263 | 62.4672 |
| NEPM >C34-C40 | 175.78537 | 34.6362 |
| o-terphenyl | 61.89534 | 10.8829 |
| chloroctodecane | 5.09980 | 1.1344 |
| p-terphenyl | 11.05085 | 48.2721 |
| Totals : | | 342.4323 |

*** End of Report ***

Data File C:\DATA\2019\01_19\180119\B0000243.D
Sample Name: s209851-3

```
==========================================================================
Acq. Operator   :                                  Seq. Line : 243
Acq. Instrument : GC#4                              Location : Vial 93
Injection Date  : 24/01/2019 1:57:06 AM                  Inj :   1
                                                  Inj Volume : 1 µl
Acq. Method     : C:\CHEM32\1\METHODS\NEPM JF.M
Last changed    : 15/08/2018 8:50:23 PM
Analysis Method : C:\METHODS\2019\01_19\180119B-PROCESSING-.M
Last changed    : 24/01/2019 9:50:37 AM
                  (modified after loading)
Method Info     : FAST TPH WITH 15M HP5 COLUMNS
```




```
==========================================================================
                    External Standard Report
==========================================================================

Sorted By             :      Signal
Calib. Data Modified  :      21/01/2019 8:58:40 AM
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B, Back Signal

RetTime  Type     Area     Amt/Area    Amount   Grp   Name
 [min]          [pA*s]                 [mg/L]
-------|------|----------|----------|----------|--|------------------
  5.445 VV    I   73.09380 1.75827e-1   12.85185    o-terphenyl
  6.007 VV        5.83580 2.22440e-1    1.29811    chloroctodecane
  6.252 VV    I   12.58425    4.36818   54.97026    p-terphenyl
```

Data File C:\DATA\2019\01_19\180119\B0000243.D
Sample Name: s209851-3

| RetTime [min] | Type | Area [pA*s] | Amt/Area | Amount [mg/L] | Grp | Name |
|---|---|---|---|---|---|---|
| Totals : | | | | 69.12023 | | |

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

## Summed Peaks Report

Signal 1: FID2 B, Back Signal

| Name | Start Time [min] | End Time [min] | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|---|---|
| TRH C10-C14 | 1.870 | 3.970 | 6.29933 | 1.2185 |
| NEPM >C10-C16 | 2.410 | 4.615 | 11.40750 | 2.2065 |
| TRH C15-C28 | 3.970 | 7.680 | 342.28795 | 66.6435 |
| NEPM >C16-C34 | 4.615 | 8.780 | 550.85379 | 107.2512 |
| TRH C29-C36 | 7.681 | 9.110 | 279.28975 | 55.0304 |
| NEPM >C34-C40 | 8.781 | 10.010 | 101.26105 | 19.9522 |
| Totals : | | | | 252.3023 |

## Final Summed Peaks Report

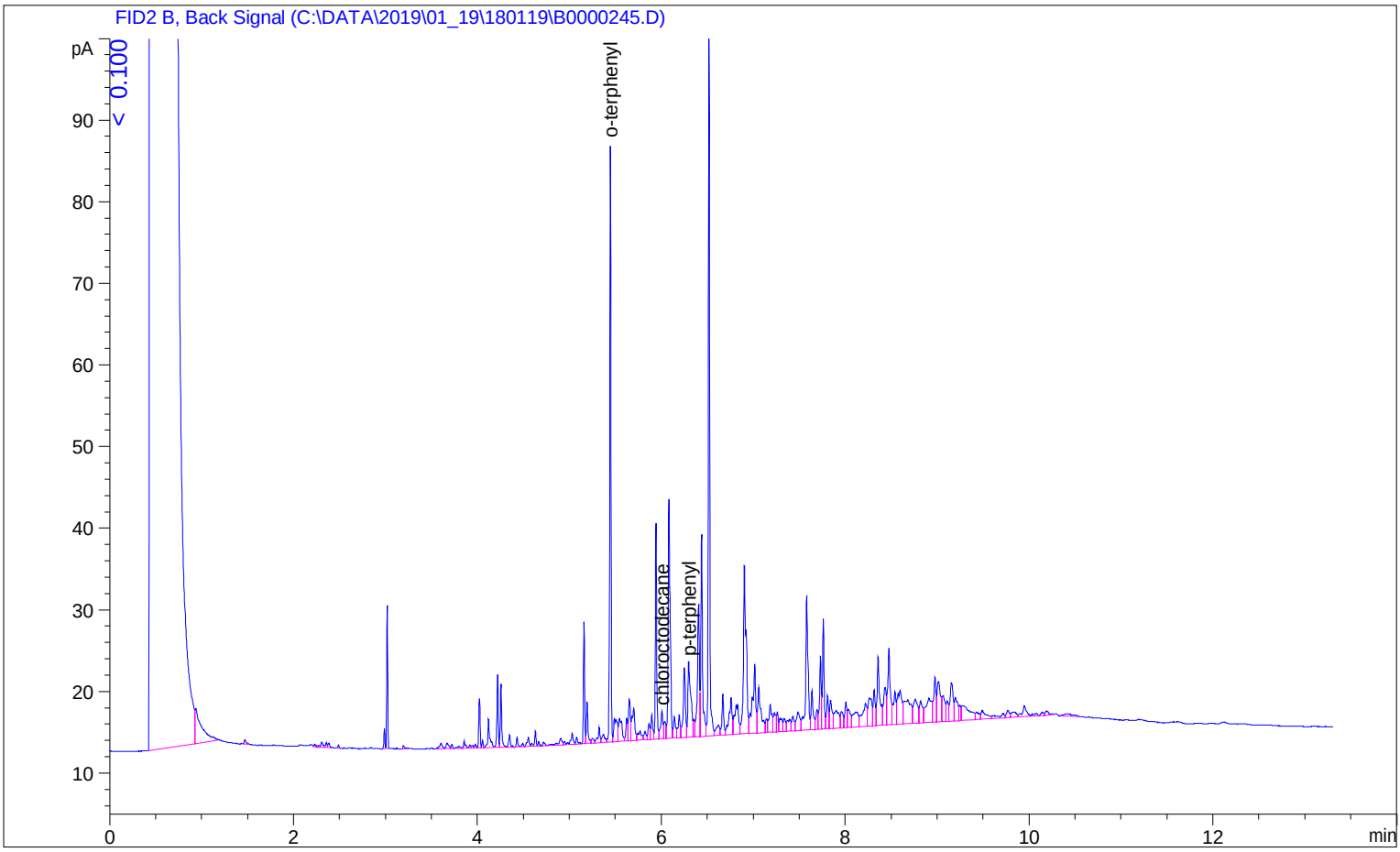
Signal 1: FID2 B, Back Signal

| Name | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|
| TRH C10-C14 | 6.29933 | 1.2185 |
| NEPM >C10-C16 | 11.40750 | 2.2065 |
| TRH C15-C28 | 342.28795 | 66.6435 |
| NEPM >C16-C34 | 550.85379 | 107.2512 |
| TRH C29-C36 | 279.28975 | 55.0304 |
| NEPM >C34-C40 | 101.26105 | 19.9522 |
| o-terphenyl | 73.09380 | 12.8519 |
| chloroctodecane | 5.83580 | 1.2981 |
| p-terphenyl | 12.58425 | 54.9703 |
| Totals : | | 321.4225 |

*** End of Report ***

Data File C:\DATA\2019\01_19\180119\B0000245.D
Sample Name: s209851-5

```
==========================================================================
Acq. Operator   :                                  Seq. Line : 245
Acq. Instrument : GC#4                              Location : Vial 95
Injection Date  : 24/01/2019 2:34:05 AM                  Inj :   1
                                                  Inj Volume : 1 µl
Acq. Method     : C:\CHEM32\1\METHODS\NEPM JF.M
Last changed    : 15/08/2018 8:50:23 PM
Analysis Method : C:\METHODS\2019\01_19\180119B-PROCESSING-.M
Last changed    : 24/01/2019 9:50:37 AM
                  (modified after loading)
Method Info     : FAST TPH WITH 15M HP5 COLUMNS
```




```
==========================================================================
                    External Standard Report
==========================================================================

Sorted By             :      Signal
Calib. Data Modified  :      21/01/2019 8:58:40 AM
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B, Back Signal

RetTime  Type     Area     Amt/Area    Amount   Grp   Name
 [min]          [pA*s]                 [mg/L]
-------|------|----------|----------|----------|--|------------------
  5.446 VV    I   69.97655 1.75827e-1   12.30376    o-terphenyl
  6.008 VV         6.11379 2.22440e-1    1.35995    chloroctodecane
  6.299 VV    I   20.29851    4.36818   88.66751    p-terphenyl
```

Data File C:\DATA\2019\01_19\180119\B0000245.D
Sample Name: s209851-5

| RetTime [min] | Type | Area [pA*s] | Amt/Area | Amount [mg/L] | Grp | Name |
|---|---|---|---|---|---|---|
| Totals : | | | | 102.33122 | | |

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

## Summed Peaks Report

Signal 1: FID2 B, Back Signal

| Name | Start Time [min] | End Time [min] | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|---|---|
| TRH C10-C14 | 1.870 | 3.970 | 25.69009 | 4.9692 |
| NEPM >C10-C16 | 2.410 | 4.615 | 58.33859 | 11.2844 |
| TRH C15-C28 | 3.970 | 7.680 | 550.63705 | 107.2090 |
| NEPM >C16-C34 | 4.615 | 8.780 | 711.60833 | 138.5501 |
| TRH C29-C36 | 7.681 | 9.110 | 248.27725 | 48.9198 |
| NEPM >C34-C40 | 8.781 | 10.010 | 107.10213 | 21.1031 |
| Totals : | | | | 332.0356 |

## Final Summed Peaks Report

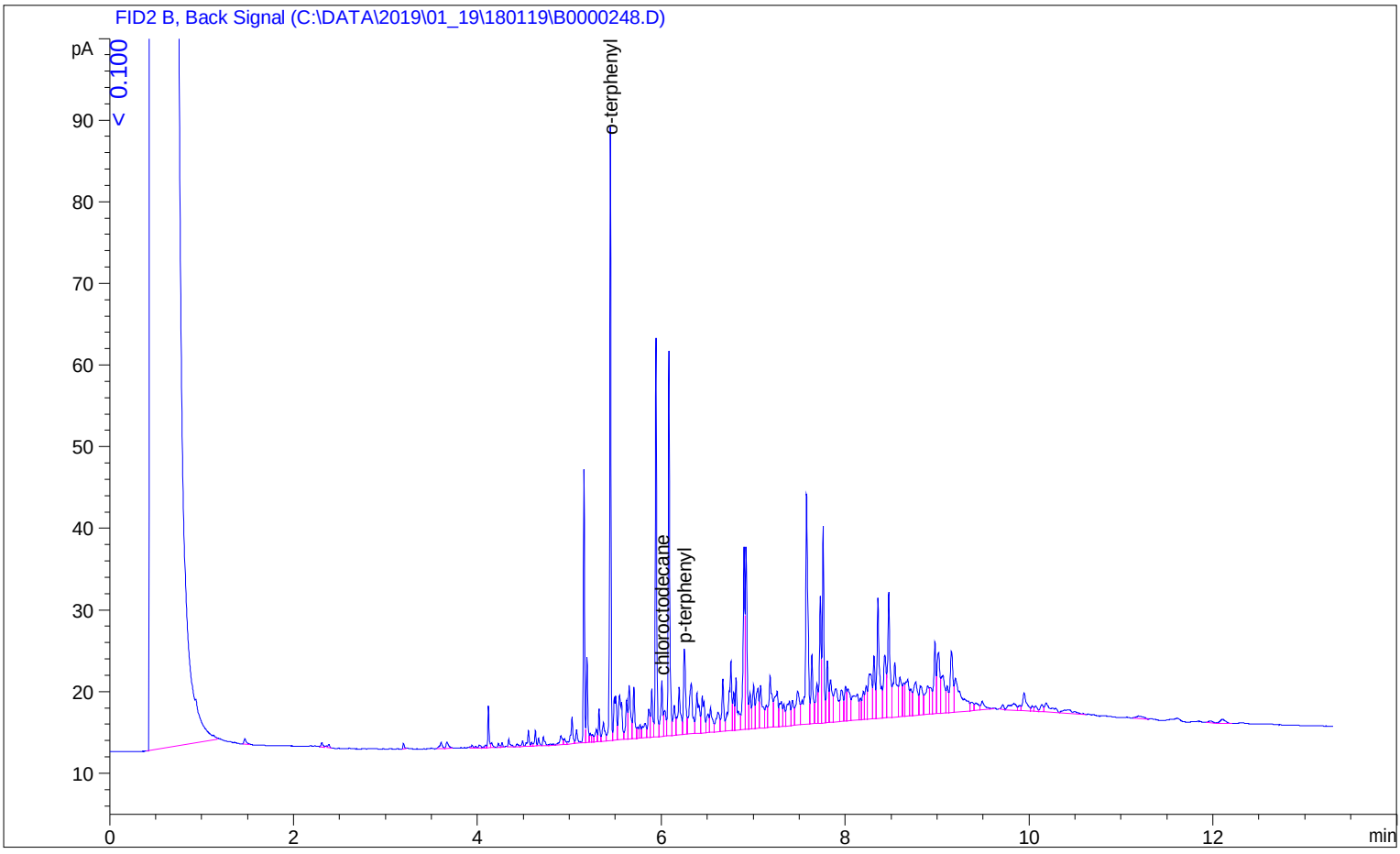
Signal 1: FID2 B, Back Signal

| Name | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|
| TRH C10-C14 | 25.69009 | 4.9692 |
| NEPM >C10-C16 | 58.33859 | 11.2844 |
| TRH C15-C28 | 550.63705 | 107.2090 |
| NEPM >C16-C34 | 711.60833 | 138.5501 |
| TRH C29-C36 | 248.27725 | 48.9198 |
| NEPM >C34-C40 | 107.10213 | 21.1031 |
| o-terphenyl | 69.97655 | 12.3038 |
| chloroctodecane | 6.11379 | 1.3599 |
| p-terphenyl | 20.29851 | 88.6675 |
| Totals : | 434.3669 | |

*** End of Report ***

Data File C:\DATA\2019\01_19\180119\B0000248.D
Sample Name: s209851-7

```
==========================================================================
Acq. Operator   :                                  Seq. Line : 248
Acq. Instrument : GC#4                              Location : Vial 98
Injection Date  : 24/01/2019 3:29:42 AM                  Inj :   1
                                                  Inj Volume : 1 µl
Acq. Method     : C:\CHEM32\1\METHODS\NEPM JF.M
Last changed    : 15/08/2018 8:50:23 PM
Analysis Method : C:\METHODS\2019\01_19\180119B-PROCESSING-.M
Last changed    : 24/01/2019 9:50:37 AM
                  (modified after loading)
Method Info     : FAST TPH WITH 15M HP5 COLUMNS
```




```
==========================================================================
                    External Standard Report
==========================================================================

Sorted By             :      Signal
Calib. Data Modified  :      21/01/2019 8:58:40 AM
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: FID2 B, Back Signal

RetTime  Type     Area     Amt/Area    Amount   Grp   Name
 [min]          [pA*s]                 [mg/L]
-------|------|----------|----------|----------|--|------------------
  5.446 VV    I   72.68448 1.75827e-1   12.77989    o-terphenyl
  6.008 VV        10.53204 2.22440e-1    2.34274    chloroctodecane
  6.253 VV    I   16.79561    4.36818   73.36623    p-terphenyl
```

Data File C:\DATA\2019\01_19\180119\B0000248.D
Sample Name: s209851-7

| RetTime [min] | Type | Area [pA*s] | Amt/Area | Amount [mg/L] | Grp | Name |
|---|---|---|---|---|---|---|
| Totals : | | | | 88.48886 | | |

1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

## Summed Peaks Report

Signal 1: FID2 B, Back Signal

| Name | Start Time [min] | End Time [min] | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|---|---|
| TRH C10-C14 | 1.870 | 3.970 | 5.50987 | 1.0658 |
| NEPM >C10-C16 | 2.410 | 4.615 | 18.12602 | 3.5061 |
| TRH C15-C28 | 3.970 | 7.680 | 624.64118 | 121.6176 |
| NEPM >C16-C34 | 4.615 | 8.780 | 932.87347 | 181.6305 |
| TRH C29-C36 | 7.681 | 9.110 | 399.00827 | 78.6194 |
| NEPM >C34-C40 | 8.781 | 10.010 | 136.24129 | 26.8446 |
| Totals : | | | | 413.2839 |

## Final Summed Peaks Report

Signal 1: FID2 B, Back Signal

| Name | Total Area [pA*s] | Amount [mg/L] |
|---|---|---|
| TRH C10-C14 | 5.50987 | 1.0658 |
| NEPM >C10-C16 | 18.12602 | 3.5061 |
| TRH C15-C28 | 624.64118 | 121.6176 |
| NEPM >C16-C34 | 932.87347 | 181.6305 |
| TRH C29-C36 | 399.00827 | 78.6194 |
| NEPM >C34-C40 | 136.24129 | 26.8446 |
| o-terphenyl | 72.68448 | 12.7799 |
| chloroctodecane | 10.53204 | 2.3427 |
| p-terphenyl | 16.79561 | 73.3662 |
| Totals : | | 501.7728 |

*** End of Report ***