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Report on
Detailed Site Investigation for Contaminated Land

Proposed Long Stay Car Park
Illawarra Regional Airport, Albion Park Rail

Prepared for
Shellharbour City Council

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

	Signature		Date
Author			3 May 2019
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Report on Detailed Site Investigation for Contaminated Land
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1. Introduction

This report presents the results of a detailed site investigation for contaminated land (DSI) undertaken for a proposed long stay car park at Illawarra Regional Airport, Albion Park Rail (hereinafter referred to as the 'site'). The investigation was commissioned in an email dated 9 April 2019 by Mr Nathan McColl of Shellharbour City Council (Council) and was undertaken in general accordance with Douglas Partners (DP)' proposal WOL190199 dated 16 April 2019. This report should be read with the *Notes About this Report* provided in Appendix A and other explanatory information, and should be kept in its entirety without separation of individual pages or sections.

It is understood that the proposed upgrade to the long stay car park will consist of the construction of an on-ground pavement area to the north of the existing long stay car park. The subject site is shown on Drawing 1, Appendix B.

This DSI is required to support a development application and based on the recommendations of a preliminary site investigation for contaminated land previously completed by DP. This was reported in DP's *Report on Preliminary Site Investigation for Contaminated Land, Proposed Long Stay Car Park, Illawarra Regional Airport, Albion Park Rail*, DP Project 78505.03, dated March 2019 (DP 2019a).

2. Scope of Works

The scope of work for the DSI consisted of:

- A review of a previous DP investigation;
- A review of anecdotal information and previous reports provided by council;
- Excavation of seven test pits in a grid-based pattern across the northern portion of the proposed long stay car park and one borehole into the former ambulance station car park located in the south western portion of the proposed long stay car park. The test pits were excavated, using an excavator, to depths of between 1.1 m below ground level (bgl) and 1.4 m bgl;
- Collection of soil samples from each test pit at regular intervals, change in strata or at points of environmental concern. Each sampling point included the collection of one soil jar and one 500 ml plastic bag for asbestos analysis;
- Collected replicate samples were tested using a photo-ionisation detector (PID) for volatile contaminants to assist with laboratory scheduling;

- Laboratory analysis of nine samples for a range of the following common contaminants:
  - Metals/metalloids (arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel and zinc);
  - Polycyclic aromatic hydrocarbons (PAH)
  - Total recoverable hydrocarbons (TRH)
  - Benzene, toluene ethylbenzene and xylene (BTEX);
  - Phenols;
  - Organochlorine pesticides (OCP) and organophosphorus pesticides (OPP);
  - Polychlorinated biphenyls (PCB); and
  - Asbestos (sieving, Identification, friable asbestos (FA) and asbestos fines (AF)).
- Field sampling and laboratory analysis conducted in compliance with standard environmental protocols, including a Quality Assurance/Quality Control (QA/QC) plan consisting of approximately 10% replicate sampling, and appropriate Chain of Custody procedures and in-house laboratory QA/QC testing; and
- Provision of this report detailing the methodology and results of the DSI.

3. Site Description, Geology and Hydrogeology

The site is identified as part of Lot 10, Deposited Plan 1157377, located to the north of the existing long stay car park, and is proposed to be developed into further airport long stay car parking. The site locality and features are shown on Drawing 1, Appendix B. The site consists of an irregular shaped area covering approximately 4,500 m^2. It is bounded to the north by a vacant lightly grassed area occupied by radio antenna, to the west by Airport Road, to the east by a vacant lightly grassed area and a heavily vegetated bush reserve and to the south by the existing long stay car park with a NSW Rural Fire Service control centre, Fire and Rescue NSW station house and Fire and Rescue NSW training facility further to the south.

At the time of the DSI, the site was predominantly vacant and cleared of trees and shrubs, with only the existing long stay car park and a perimeter fence occupying the site. Refer to Site Photographs, Appendix C for further detail on the condition of the site at the time of the DSI.

The site lies on the coastal plain adjacent to the Illawarra Escarpment and based on online mapping, surface levels of the site are indicated to have a slight fall to the north east with a difference in level of approximately 0.5 m between 5 m to 4.5 m relative to Australian Height Datum (AHD).

Reference to the 1:50 000 Kiama Geology Sheet indicates that the site is underlain by Quaternary Sediments of the Quaternary Age. This formation typically comprises alluvium, gravel, beach and dune sand.

Reference to the *Acid Sulfate Risk Map*, published by the Department of Land and Water Conservation indicates that the site is in an area of "*low probability of occurrence"* at depths of greater than 3 m. This mapped area is described as generally not expecting to contain acid sulfate soil (ASS), although highly localised occurrences may occur, especially near boundaries with environments with a high probability of ASS occurrence.

A search of the NSW Department of Primary Industries Office of Water (DPI Water) registered groundwater works (http://allwaterdata.water.nsw.gov.au/water.stm - Department of Primary Industries Office of Water – All Groundwater Map), was undertaken on 20 March 2019. Four groundwater bores, GW114888, GW114890, GW114889 and GW114891 were located approximately 170 m, 175 m, 180 m and 185 m south east respectively of the site. A brief summary of the groundwater bores is shown in Table 1, with further detail provided in the Work Summary Reports, Appendix D

Table 1: Summary of Groundwater Bores

Identification	Installation Date	Borehole Depth (m) bgl*	Water level (m) bgl	Distance and Direction from Site	Authorised Purpose
GW114888	11/11/2013	7.5	5.5	170 m South East	Monitoring Bore
GW114890		7.5	4.0	175 m South East	
GW114889		7.5	5.2	180 m South East	
GW114891		5.6	4.8	185 m South East	

*Below ground level

The nearest surface water receptor to the site is an unnamed dam located 100 m south of the site. Lake Illawarra is located approximately 700 m east of the site. To the west of the site another dam is located 600 m from the site and beyond Frazors Creek approximately 800 m from the site. Localised groundwater is anticipated to follow the sites topography towards Lake Illawarra in a general north easterly direction.

4. Background

4.1 DP's Preliminary Site Investigation for Contaminated Land (DP 2019a)

A preliminary site investigation for contaminated land (PSI) was conducted by DP, as reported in DP (2019a), which was undertaken to provide preliminary information on the potential for contamination at the site and consisted of a review of readily available site and site history information, a site walkover and preparation of the PSI report.

As part of DP (2019a), a review was conducted of a contaminated land investigation previously prepared by DP for a formerly proposed aeromedical facility at the location of the former terminal building at the Illawarra Regional Airport (located approximately 120 m south west of the current site).

The contaminated land investigation was reported in DP's *Report on Preliminary Site Investigation, Proposed Aeromedical Facility, Illawarra Regional Airport, Albion Park Rail*, DP Project 78505.01, Document R.001.Rev0 dated 6 November 2013 (DP 2013).

DP (2013) concluded that from a contamination perspective the proposed aeromedical facility site was considered suitable for the proposed development. From a contamination perspective no issues were identified from DP (2013) that would affect the current site.

A review of a geotechnical report previously prepared by Terra Insight for the subject site, entitled *"Geotechnical Report on Pavement Investigation" for "Illawarra Regional Airport – long term parking site"* (Terra 2017) was also conducted as part of DP (2019a).

Six test pits were excavated as part of Terra (2017). The encountered subsurface conditions generally comprised; topsoil to depths of 0.1 m to 0.2 m, which was underlain by fill to depths of 0.6 m to 0.7 m and natural residual soils to a final depth of 1.0 m. The fill found in the test pits generally comprised clay of high plasticity and orange-brown mottling, with the exception of one test pit (TP01), located in the northern portion of the site, where the encountered fill comprised clay of high plasticity, orange-brown mottling, intermixed with coal wash rejects.

Based on an aerial photograph review conducted as part of DP (2019a) it is understood that the site was densely vegetated until 1963, when the site began to be cleared, but remained vacant until around 2005 when stockpiles and disturbed terrain were observed in the southern portion of the site. It is further understood that an ambulance station and associated car park were subsequently constructed and demolished within the south western portion of the site. Anecdotal information verbally provided by airport staff at the time of the DP (2019a) site walkover, indicated a potential for the site and adjacent sites to the south (including a Fire and Rescue NSW training facility) to be contaminated with per- and poly-fluoroakyl substances (PFAS) as a result of previous firefighting activities and training (DP 2019a).

Based on the findings of DP (2019a), the following potential sources of contamination were identified:

- The use of PFAS as a result of previous fire fighting training that may have taken place at the site and adjacent sites; and
- Uncontrolled fill of unknown origin associated with progressive development of the site including vegetation clearance, construction and subsequent demolition of the NSW Ambulance Station building, historic stockpiling of fill and construction of the existing car park.

DP (2019a) concluded that there was a low to moderate risk for the potential of contamination at the site. As such DP (2019a) recommended that further intrusive investigation work be undertaken across the site to assess its contamination status and compatibility with the proposed development.

4.2 DP's Geotechnical Site Investigation (DP 2019b)

DP conducted a geotechnical investigation for the site concurrently with DP (2019a). This was reported in DP's *Report on Geotechnical Investigation, Proposed Long Stay Car Park Upgrade, Illawarra Regional Airport, Albion Park Rail* DP project 78505.02 dated April 2019 (DP 2019b).

The investigation comprised the excavation of three test pits (201, 202 and 205) and the drilling of two boreholes (203 and 204).

The field investigation encountered relatively uniform conditions underlying the site, with the succession of strata broadly summarised as follows:

TOPSOIL (FILL):	Brown silty clay topsoil fill with some rootlets encountered to depths of 0.2 m in Pits 201, 202 and 205;
FILL (PAVEMENT):	Dark grey, medium to coarse gravel (road base) fill to a depth of 0.1 m in Bores 203 and 204 with a spray coat seal.
FILL (CLAY):	Brown silty clay fill with some rootlets and gravel encountered to a depth of 0.4 m in Pit 201. Possible fill (likely re-worked natural clay material) was also encountered in Pits 202 and 205 to depths of 0.7 and 0.4 m, respectively;
CLAY:	Variably stiff to very stiff silty clay and/or silty sandy clay in all boreholes and test pits underlying the fill and continuing to the limit of investigation depths of 2.0 – 4.0 m.

No obvious asbestos or other signs of potential contamination such as malodorous or discoloured soil were observed during DP (2019b).

4.3 Anecdotal Information

The anecdotal information reviewed as part of this DSI included an email received by DP from Mr Nathan McColl of Shellharbour City Council dated 10 April 2019, which included a response from Mr Michael Gray of NSW Rural Fire Service (NSWRFS) which stated that to the best of their knowledge NSWRFS had not utilised any PFAS products which are outside the current Australian Standards and guidelines across the site.

A further email received by DP from Mr Nathan McColl of Shellharbour City Council dated 12 April 2019, identified that the southern portion of the site was cleared of all materials to a depth of approximately 400 mm, which appeared to be a natural material. This included all stockpiles within the area and piers of the former ambulance station. The limit of clearing was confined to the extent of the existing spray seal car park which did not include the asphalt car park belonging to the former ambulance station, which is still in place. The pavement of the existing spray seal car park was built up from the cleared level with quarry material and bitumen spray sealed.

4.4 Previous Environmental Site Assessment for Fire and Rescue NSW (GHD 2017)

A previous environmental site assessment report prepared by GHD for the Fire and Rescue NSW training facility to the south of the site was provided to DP by Mr Nathan McColl of Shellharbour City Council on 10 April 2019. As part of this DSI the GHD report, entitled *Report* for *Fire and Rescue NSW - Albion Park Training Facility, Environmental Site Assessment – PFAS,* dated April 2017 (GHD 2017), was reviewed.

The investigation area of conducted for GHD (2017) consisted the Fire and Rescue NSW's training facility (located approximately 120 m south of the subject site). The assessment was limited to PFAS contamination in soils, sediment and groundwater at the training facility and areas surrounding the training facility.

Two soil boreholes and one groundwater borehole were located in the southern portion of the current site. All the soil samples tested from these boreholes returned results that were less than the adopted screening criteria. Leachability testing on the soil samples was also conducted. All of the leachability results for the identified boreholes on the current site exceeded the adopted ecological marine waters assessment criteria. The sample tested from the identified groundwater bore on the site also exceeded the adopted drinking water criteria. However, the exceedances were only marginally above marine and drinking water guidelines.

GHD (2017) concluded that any off-site PFAS exceedences in soil were likely to occur from surface water migration from the training facility.

5. Summary of Conceptual Site Model

Based on the proposed long stay car park development comprising an impermeable hardstand area and following review of the anecdotal information and previous investigations provided by Shellharbour City Council, it is considered that firefighting training activities undertaken by Fire and Rescue NSW to the south of the site and training activities undertaken by the Rural Fire Service within the current site boundary do not present a potential source of PFAS contamination at the site.

A conceptual site model (CSM) has been developed based on the reviewed historical information and observations made during the site inspection. The CSM identifies potential sources of contaminants of concern, sensitive receptors, and potential transport mechanisms that could expose sensitive receptors to unacceptable ecological and/or health risks. The objective of the CSM is to highlight actual or potential exposure pathways that may exist, and identify any data gaps that may need to be addressed during this investigation.

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 (potential complete pathways).

For potential ecological and/or health risks to be present, all of the following elements of an exposure pathway are required:

1. Contaminant source (such as a fuel tank or fill);
2. Receptor (eg site worker, visitor, aquatic and terrestrial ecosystems); and
3. Transport mechanism/exposure route between the source and receptor (eg ingestion, inhalation or dermal contact).

If all three elements are present, it is considered that a complete exposure pathway exists. Partial or incomplete exposure pathways may also be present.

For this site uncontrolled fill of unknown origin associated with progressive development of the site is considered to present a potential contamination source.

The possible pathways between the source (S1) and receptors (R1 to R7) are provided in Table 2 below.

Table 2: Conceptual Site Model

Source	Transport Pathway	Receptor	Action Recommended
S1 – Uncontrolled Fill in northern portion of the site and localised fill in former ambulance car park	P1 - Ingestion and dermal contact P2 - Inhalation of dust / vapours	R1 - Current Users R2 – Construction and Maintenance Workers R3 - End users	An intrusive investigation is required to assess possible contamination including chemical testing of the soils. Testing of soils will be used as a screen for the assessment of potential surface water and groundwater contamination.
	P2 - Inhalation of dust / vapours	R4 – Adjacent site users	
	P5 - Leaching of contaminants	R5 – Groundwater	
	P3 - Surface water run-off P4 - Lateral migration of groundwater	R6 - Surface water	
	P6 - Contact with terrestrial ecology	R7 - Terrestrial ecology	

6. Sampling and Analysis Plan

6.1 Sample Location, Density and Pattern

In order to address the objectives of this DSI, a sampling plan for the site was established with reference to *Schedule B2, Guideline on Site Characterisation* of the National Environment Protection Council's *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended 2013 (NEPC, 2013) and the NSW EPA *Contaminated Sites Sampling Design Guidelines* 1995 (NSW EPA 1995).

Based on the findings of the previous PSI report (DP 2019a) the sampling density was established based on the minimum number of sampling points required for site characterisation as detailed in NSW EPA 1995. The sampling pattern was established using systematic grid-based sampling as detailed in *Schedule B2* of NEPC (2013).

Based on an area of 0.2 ha (northern portion of site), 7 grid based sampling locations were required in order to meet the minimum number of sampling points required for site characterisation as recommended in NSW EPA 1995.

An additional sampling location within the area of the former ambulance station car park was utilised in order to assess the underlying material.
Field work was carried out on 17 April. Seven test pits (401 – 407) and one borehole (408) were excavated and drilled to depths of between 1.1 m and 1.4 m bgl using a Bobcat excavator. All investigation locations were logged on site by a qualified environmental engineer who collected samples for contamination assessment purposes.

The levels shown on the test pit and borehole logs are relative to Australian Height Datum (AHD) and were determined using a differential GPS to obtain accurate ground surface levels for the test pits and borehole.

The sampling locations for this DSI are shown on Drawing 1, Appendix B.

6.2 Sample Depths

Soil samples were collected for soil logging and laboratory analysis from near surface, at signs of potential contamination (including fill) and the shallowest natural stratum encountered. From the seven test pits and one borehole a total of 32 soil samples were collected. Replicate samples were taken at a rate of 10% of the total number of primary samples, for QC purposes. Sample depths ranged from ground surface to 1.2 m bgl.

The test pit logs and borehole log detailing all of the samples collected are provided in Appendix D.

6.3 Sampling Methodology

Environmental sampling was conducted with reference to standard operating procedures described in the DP *Field Procedures Manual* which includes:

- The use of disposable gloves for the collection of soil samples by hand directly from the centre of the excavator bucket. The gloves were replaced between each sample;
- Labelling of the sample containers with individual and unique identification details including Project No., Sample Location. and depth;
- Collection of at least 10% intra-laboratory replicate samples;
- Placement of the containers into chilled, enclosed and secure container for transport to the laboratory;
- Use of chain-of-custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.
- All replicate samples were tested in the field for potential volatile contaminants using photo-ionisation detector (PID)

6.4 Analytical Rationale

Nine primary soil samples and one intra-laboratory replicate samples obtained from fill and natural soils were submitted to a National Association of Testing Authorities (NATA) accredited laboratory (Envirolab Services Pty Ltd) for analysis of contaminants of potential concern, which were selected based on the potential for contamination identified in the preliminary CSM for the site (as discussed in Section 5). The fill samples were selected based on the type and depth of the ground conditions encountered.

7. Site Assessment Criteria

Based on the proposed development at the site being a long stay car park, criteria pertaining to a commercial land use have been adopted.

The Site Assessment Criteria (SAC) applied in the current investigation are informed by the CSM which identified human and ecological receptors of potential contamination on the site (refer to Section 5). Analytical results were assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of NEPC (2013). NEPC (2013) is endorsed by the NSW EPA under the CLM Act 1997. Petroleum based health screening levels for direct contact have been 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) as referenced by NEPC (2013).

7.1 Health Investigation and Screening Levels

The generic Health Investigation Levels (HIL) and Health Screening Levels (HSL) for a commercial land use are considered to be appropriate for the assessment of contamination at the site given the proposed development as a long stay car park. The adopted soil HIL and HSL for the potential contaminants of concern are presented in Table 3.

Table 3: Commercial HIL and HSL in mg/kg unless otherwise indicated

Contaminants		HIL – D / HSL - D Direct Contact	HSL - D Vapour Intrusion[3]
Metals	Arsenic	3000	-
	Cadmium	900	-
	Chromium (VI)	3600	-
	Copper	240000	-
	Lead	1500	-
	Mercury (inorganic)	730	-
	Nickel	6000	-
	Zinc	400000	-
PAH	Benzo(a)pyrene TEQ[1]	40	-
	Naphthalene	11000	NL[4]
	Total PAH	4000	-
TRH	F1	26000	260
	F2	20000	NL[2]
	>C_{16}-C_{34} [F3]	27000	-
	>C_{34}-C_{40} [F4]	38000	-
BTEX	Benzene	430	3
	Toluene	99000	NL[4]
	Ethylbenzene	27000	NL[4]
	Xylenes	81000	230
Phenol	Pentachlorophenol	660	-
OCP	Aldrin + Dieldrin	45	-
	Chlordane	530	-
	DDT+DDE+DDD	3600	-
	Endosulfan	2000	-
	Endrin	100	-
	Heptachlor	50	-
	HCB	80	-
	Methoxychlor	2500	-
OPP	Chlorpyrifos	2000	-
PCB [2]		7	-

1. Sum of carcinogenic PAH
2. non dioxin-like PCBs only.
3. The vapour intrusion HSL have been calculated for a sand soil as a conservative approach given the presence of heterogeneous fill at the site and an assumed depth to contamination 0 m to <1 m.
4. 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 results 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'.

7.2 Ecological Investigation Levels

Ecological Investigation Levels (EIL) and Added Contaminant Limits (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.

The adopted EIL, were derived using the *Interactive (Excel) Calculation Spreadsheet* (NEPC website http://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox#hils) and are presented in Table 4.

Table 4: EIL in mg/kg

Analyte		EIL Commercial	Comments
Metals	Arsenic	160	Adopted parameters: pH = 5.2 (range 5.1 to 5.3); CEC = 6.8 $cmol_c/kg$ (range 6.4 to 7.1 $cmol_c/kg$); assumed clay content = 10%; "Aged" (>2 years) source of contamination low for traffic volumes in NSW
	Copper	170	
	Nickel	120	
	Chromium III	670	
	Lead	1800	
	Zinc	370	
PAH	Naphthalene	370	
OCP	DDT	640	

7.3 Ecological Screening Levels

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The ESL adopted are shown in the following Table 5.

Table 5: ESL in mg/kg

Analyte		ESL Commercial	Comments
TRH	C6 – C10 (less BTEX) [F1]	215*	All ESLs are low reliability apart from those marked with * which are moderate reliability
	>C10-C16 (less Naphthalene) [F2]	170*	
	>C16-C34 [F3]	2500	
	>C34-C40 [F4]	6600	
BTEX	Benzene	95	
	Toluene	135	
	Ethylbenzene	185	
	Xylenes	95	
PAH	Benzo(a)pyrene	0.7	

1. The ESL have been calculated for a fine soil based on the heterogeneous fill encountered and commercial land use

7.4 Management Limits

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;
- Effects on buried infrastructure eg penetration of, or damage to, in-ground services.

The management limits adopted from Schedule B1 of NEPC (2013) are shown in the following Table 6.

Table 6: Management Limits in mg/kg

Analyte		Management Limit Commercial	
TRH	C6 – C10	800	The management limits have been calculated for a fine soil as a conservative approach based on the heterogeneous fill encountered.
	>C10-C16	1000	
	>C16-C34 (F3)	5000	
	>C34-C40 (F4)	10000	

7.5 Asbestos in Soil

NEPC (2013) defines the various asbestos types referred to above as follows:

Bonded ACM: Asbestos-containing material which is in sound condition, bound in a matrix of cement or resin, and cannot pass through a 7mm x 7mm sieve.

FA: Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically unbonded or was previously bonded and is now significantly degraded and crumbling.

AF: Asbestos fines including free fibres, small fibre bundles and also small fragments of bonded ACM that pass through a 7mm x 7mm sieve.

Health Screening Levels (HSLs) for asbestos in soil, which are based on likely exposure levels for different scenarios, have been adopted in NEPC (2013) based on DoH (2009). The HSLs have been developed for various land use scenarios including Residential A (gardens and accessible soil), Residential B (minimal opportunities for soil access), Recreational C (parks and public open space) and Commercial / Industrial D.

On the basis of the potential sensitive land use and in accordance with Table 7, Schedule B1, NEPC (2013) the following HSLs have been adopted:

- 0.05% w/w of bonded ACM in soil (Commercial D)
- 0.001% w/w friable asbestos (FA) and asbestos fines (AF), where quantifiable; and
- No visible asbestos on the ground surface.

8. Results

8.1 Field Work Observations

Details of the subsurface conditions encountered are given on the test pit and borehole logs included in Appendix D. These should be read in conjunction with the accompanying notes defining clarification methods and descriptive terms.

Slightly variable conditions were encountered underlying the site, with the principal succession of strata broadly summarised as follows:

FILL:	Dark brown, brown and orange silty clay or sandy silty clay of slightly variable consistency and composition each Pit to depths of between 0.3 m bgl and 0.6 m bgl.
SILTY CLAY:	Brown and orange silty clay underlying the filling in each Pit to termination depths of between 1.1 m bgl and 1.4 m bgl.

Paper was encountered in fill in Pit 405 at 0.1 m. No other anthropogenic material or asbestos was observed in any other investigation locations.

No free groundwater was observed in any of the pits for the short time that they were left open. However, the pits were immediately backfilled following the field investigation which precluded long term monitoring of groundwater levels. Furthermore, groundwater levels are dependent on preceding climatic conditions and soil permeability and can, therefore, fluctuate spatially and with time.

8.2 Analytical Results

All reported chemical analytical results for cadmium, mercury, TRH, BTEX, phenols, OCP, OPP, PCB and asbestos were less than the laboratory's practical quantitation limit (PQL) for each of these potential contaminants.

Concentrations of arsenic, chromium, copper, lead, nickel, zinc and manganese were reported above the laboratory's PQL, but below the adopted SAC.

The soil laboratory test results are summarised in Table E1 and Table E2, Appendix E along with the adopted SAC.

The laboratory certificates of analysis, chain-of-custody documentation and sample receipt are included in Appendix F.

In order to confirm the quality of the assessment data, the seven-step data quality objective process has been completed in accordance with Appendix B, Schedule B2 of NEPC (2013). The full DQO are included in the Data Quality Assessment included in Appendix G.

The QA/QC assessment is also included in the Data Quality Assessment provided in Appendix G. The results of the QA/QC assessment indicate that there are no issues precluding the use of the analytical results in the assessment.

9. Discussion

Based on the proposed long stay car park development comprising an impermeable hardstand area and following review of the anecdotal information and previous investigations provided by Shellharbour City Council, it is considered that fire fighting training activities undertaken by Fire and Rescue NSW to the south of the site and training activities undertaken by the Rural Fire Service within the current site boundary do not present a potential source of PFAS contamination at the site. Therefore PFAS contamination was not investigated as part of this DSI.

The field work for this DSI found minor amounts of fill to depths of 0.6 m bgl. A minor amount of anthropogenic material (paper) was observed in one test pit. .

All soil analytical results were either less than the laboratory's practical quantitation limits (PQL) or within the relevant SAC.

10. Conclusions and Recommendations

It is considered that, based on the findings of this DSI, from a contamination viewpoint the site is deemed to be compatible with the proposed long stay car park development.

However, an unexpected finds protocol (UFP) should be included as part of a construction environmental management plan (CEMP) for the proposed development, to manage any unexpected contamination should this be encountered during the development works.

11. References

1. DP (2013) *Report on Preliminary Site Investigation, Proposed Aeromedical Facility, Illawarra Regional Airport, Albion Park Rail,* 78505.01.R.001.Rev0, Douglas Partners Pty Ltd, dated November 2013;
2. DP (2019a) *Report on Preliminary Site Investigation for Contaminated Land, Proposed Long Stay Car Park, Illawarra Regional Airport, Albion Park Rail,* 78505.03.R.001.Rev0 Douglas Partners Pty Ltd, dated March 2019;
3. DP (2019b) *Report on Geotechnical Investigation, Proposed Long Stay Car Park Upgrade, Illawarra Regional Airport, Albion Park Rail,* 78505.02.R.002.Rev0, Douglas Partners Pty Ltd, dated April 2019;
4. GHD (2017) *Report* for *Fire and Rescue NSW - Albion Park Training Facility, Environmental Site Assessment – PFAS*, 21/25583, GHD Pty Ltd, dated April 2017
5. NEPC (2013), *National Environment Protection (Assessment of Site Contamination) Measure 1999 Amended 2013 (NEPM),* National Environment Protection Council.
6. NSW EPA (1997), *Guidelines for Consultants Reporting on Contaminated Sites*, NSW Environment Protection Authority;
7. NSW EPA (1995) *Contaminated Sites Sampling Design Guidelines,* NSW Environment Protection Authority; and
8. Terra (2017), *Illawarra Regional Airport - long term parking site, Geotechnical Report on Pavement Investigation,* TERRA170121.Rep1.Rev0, Terra Insight Pty Ltd, August 2017

12. Limitations

Douglas Partners (DP) has prepared this report for this project at Illawarra Regional Airport, Albion Park Rail in accordance with DP's proposal dated 16 April 2019 and acceptance received from Mr Nathan McColl dated 9 April 2019. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Shellharbour City Council 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.

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

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

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. Building demolition materials, such as concrete, paper and fabric, were, however, located in previous below-ground filling, and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

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

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

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

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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.

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.

Soil Descriptions

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Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. 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	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

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

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

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	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

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;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

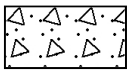
Symbols & Abbreviations

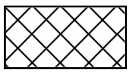
Graphic Symbols for Soil and Rock

General

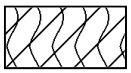

Asphalt

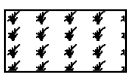

Road base

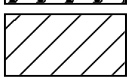

Concrete


Filling

Soils


Topsoil

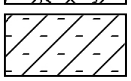

Peat


Clay


Silty clay

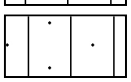

Sandy clay

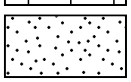

Gravelly clay

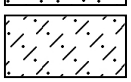

Shaly clay

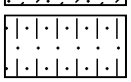

Silt


Clayey silt


Sandy silt

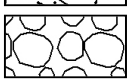

Sand


Clayey sand


Silty sand


Gravel

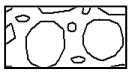

Sandy gravel


Cobbles, boulders

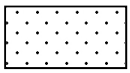

Talus

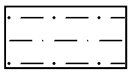
Sedimentary Rocks

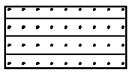

Boulder conglomerate

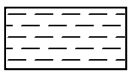

Conglomerate


Conglomeratic sandstone

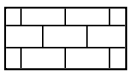

Sandstone


Siltstone

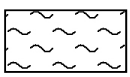

Laminite

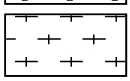

Mudstone, claystone, shale

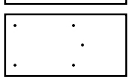

Coal


Limestone

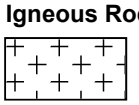
Metamorphic Rocks

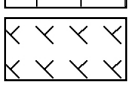

Slate, phyllite, schist

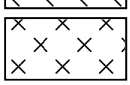

Gneiss

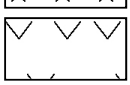

Quartzite

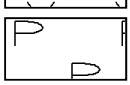
Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Appendix B

Drawing 1

Site Locality Map

Legend

- Previous Geotechnical Borehole Locations (Project 78505.02)
- Previous Geotechnical Test Pit Locations (Project 78505.02)
- Test Pit Locations
- Borehole Locations
- Approximate Extent of Proposed Long Stay Car Park

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Geotechnics | Environment | Groundwater

CLIENT: Shellharbour City Council	
OFFICE: Wollongong	DRAWN BY: KJ
SCALE: As shown	DATE: 23.04.2019

TITLE: **Detailed Site Investigation for Contaminated Land**
Proposed Long Stay Car Park
Illawarra Regional Airport, Albion Park Rail

MGA

PROJECT No: 78505.04
DRAWING No: 1
REVISION: 0

Appendix C

Site Photographs

Photo 1: View of strata in Pit 404

Photo 2: View of spoil from Pit 404

Photo 3: View of borehole 408

Photo 4: View of reinstated pits at the site.

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Shellharbour City Council		**Site Photographs 1 to 4** **Detailed Site Investigation for Contaminated Land** **Proposed Long Stay Car Park, Illawarra Regional Airport**	PROJECT No: 78505.04
	OFFICE: Wollongong	Undertaken By: KJ		PLATE No: 1
	SCALE: NTS	Date: 2 May 2019		REVISION: 0

Appendix D

Test Pit and Borehole Logs

TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Long Stay Car Park
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 4.63 AHD
EASTING: 297274
NORTHING: 6173728

PIT No: 401
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
		FILLING - dark brown silty clay with some root fibres		E	0.0		PID < 1ppm		
					0.1				
				E	0.2		PID < 1ppm		
					0.3				
	0.4	SILTY CLAY - brown silty clay with trace root fibres		E	0.4		PID < 1ppm		
4					0.5				
		- becoming red and grey mottled at 0.7m							
	1			E	1.0		PID < 1ppm		1
	1.1	Pit discontinued at 1.1m Limit of investigation			1.1				
3									

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

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Long Stay Car Park
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 4.66 AHD
EASTING: 297289
NORTHING: 6173721

PIT No: 402
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
									5 10 15 20
		FILLING - dark brown silty clay with some root fibres and trace gravel (basalt, carbonaceous siltstone)		E	0.0		PID < 1ppm		
					0.1				
	0.15	FILLING - brown orange sandy silty clay with trace root fibres					PID < 1ppm		
				E	0.2				
		- large tree root observed at 0.3m			0.3				
	0.6	SILTY CLAY - brown mottled grey and orange silty clay		E	0.6		PID < 1ppm		
					0.7				
		- becoming grey mottled red below 0.8m							
				E	1.1		PID < 1ppm		
					1.2				
	1.4	Pit discontinued at 1.4m Limit of investigation							

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: BR2 taken at 0.01m

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Long Stay Car Park
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 4.74 AHD
EASTING: 297279
NORTHING: 6173708

PIT No: 403
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
		FILLING - dark brown silty clay with some root fibres		E	0.0		PID < 1ppm		
					0.1				
				E	0.2		PID < 1ppm		
	0.3	SILTY CLAY - brown mottled grey silty clay with trace root fibres			0.3				
				E	0.4		PID < 1ppm		
					0.5				
		- becoming mottled grey and red at 0.6m							
	1			E	1.0		PID < 1ppm		1
					1.1				
	1.2	Pit discontinued at 1.2m Limit of investigation							

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

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: BR1 taken at 0-0.1m

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Long Stay Car Park
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 4.71 AHD
EASTING: 297300
NORTHING: 6173709

PIT No: 404
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
		FILLING - dark brown silty clay with some root fibres		E	0.0		PID < 1ppm		
					0.1				
				E	0.2		PID < 1ppm		
	0.3	SILTY CLAY - brown mottled grey silty clay with trace root fibres			0.3				
				E	0.4		PID < 1ppm		
					0.5				
4		- becoming grey mottled red below 0.6m							
				E	0.9		PID < 1ppm		
	1				1.0				1
	1.1	Pit discontinued at 1.1m Limit of investigation							
3									

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Long Stay Car Park
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 4.86 AHD
EASTING: 297282
NORTHING: 6173690

PIT No: 405
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
		FILLING - dark brown silty clay with some root fibres paper observed at 0.1m		E	0.0		PID < 1ppm		
					0.1				
				E	0.2		PID < 1ppm		
	0.3	SILTY CLAY - brown mottled grey silty clay with trace root fibres			0.3				
				E	0.4		PID < 1ppm		
					0.5				
4		- becoming mottled grey and red at 0.7m							
	1			E	0.9		PID < 1ppm		1
					1.0				
	1.1	Pit discontinued at 1.1m Limit of investigation							
3									

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Long Stay Car Park
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 4.91 AHD
EASTING: 297230
NORTHING: 6173693

PIT No: 406
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
		FILLING - dark brown silty clay with some root fibres and trace gravel (carbonaceous siltstone)		E	0.0		PID < 1ppm		
					0.1				
				E	0.2		PID < 1ppm		
	0.3	SILTY CLAY - brown silty clay with some root fibres			0.3				
		- becoming grey mottled red below 0.5m		E	0.5		PID < 1ppm		
					0.6				
4	1			E	1.0		PID < 1ppm		1
					1.1				
	1.2	Pit discontinued at 1.2m Limit of investigation							
3									

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Long Stay Car Park
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 4.83 AHD
EASTING: 297316
NORTHING: 6173696

PIT No: 407
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
		FILLING - dark brown silty clay with some root fibres		E	0.0		PID < 1ppm		
					0.1				
				E	0.2		PID < 1ppm		
	0.3	SILTY CLAY - brown silty clay with trace root fibres			0.3				
				E	0.5		PID < 1ppm		
		- becoming grey mottled red below 0.6m			0.6				
4				E	0.9		PID < 1ppm		
	1				1.0				1
	1.1	Pit discontinued at 1.1m Limit of investigation							
3									

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Long Stay Car Park
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 5.13 AHD
EASTING: 297295
NORTHING: 6173653
DIP/AZIMUTH: 90°/--

BORE No: 408
PROJECT No: 78505.04
DATE: 17/4/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5	0.05	FILLING - Asphaltic Concrete			0.05				
		FILLING - brown grey clayey sandy gravel (basalt)		E	0.1		PID < 1ppm		
					0.2				
				E			PID < 1ppm		
	0.3	FILLING - brown sandy silty clay with some gravel (basalt)			0.3				
					0.4				
				E			PID < 1ppm		
					0.5				
	0.6	SILTY CLAY - brown mottled grey red silty clay			0.6				
				E			PID < 1ppm		
					0.7				
	1				1.0				1
				E			PID < 1ppm		
4	1.1	Bore discontinued at 1.1m Limit of investigation			1.1				

RIG: 5 Ton Bobcat **DRILLER:** VEECH Excavations **LOGGED:** KJ **CASING:**
TYPE OF BORING: 200mm diameter solid flight auger with TC bit
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Appendix E

Table E1 and E2 Summary of Laboratory Results

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Table E1: Summary of Laboratory Results – Metals, TRH, BTEX, PAH

			Metals									TRH						BTEX				PAH			
			Arsenic	Cadmium	Chromium (VI)	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Manganese	TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs
		PQL	4.0	0.4	1.0	1.0	1.0	0.1	1.0	1.0	1.0	25.0	50.0	25.0	50.0	100.0	100.0	0.2	0.5	1.0	1.0	1.0	0.05	0.5	0.05
Sample ID	Depth	Sampled Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
401/0-0.1	0 - 0.1m	17/04/2019	5	<0.4	27	30	21	<0.1	11	29	75	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 170	1500 1800	730 NC	6000 120	400000 370	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
402/0-0.1	0 - 0.1m	17/04/2019	<4	<0.4	10	140	10	<0.1	7	47	410	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 170	1500 1800	730 NC	6000 120	400000 370	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
402/0.2-0.3	0.2 - 0.3m	17/04/2019	4	<0.4	36	18	16	<0.1	13	12	18	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 180	1500 1800	730 NC	6000 120	400000 390	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
403/0-0.1	0 - 0.1m	17/04/2019	4	<0.4	29	19	20	<0.1	12	17	22	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 170	1500 1800	730 NC	6000 120	400000 370	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
BR1	0 - 0.1m	17/04/2019	4	<0.4	26	16	16	<0.1	10	9	12	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
			3000 160	900 NC	3600 670	240000 170	1500 1800	730 NC	6000 120	400000 370	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
404/0.2-0.3	0.2 - 0.3m	17/04/2019	<4	<0.4	28	15	16	<0.1	9	8	14	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 160	1500 1800	730 NC	6000 130	400000 360	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
405/0-0.1	0 - 0.1m	17/04/2019	4	<0.4	26	15	17	<0.1	11	11	14	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 170	1500 1800	730 NC	6000 120	400000 370	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
406/0.2-0.3	0.2 - 0.3m	17/04/2019	<4	<0.4	23	12	16	<0.1	8	7	7	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 170	1500 1800	730 NC	6000 120	400000 370	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
407/0-0.1	0 - 0.1m	17/04/2019	5	<0.4	24	15	18	<0.1	12	12	12	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 180	1500 1800	730 NC	6000 100	400000 370	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC
408/0.2-0.3	0.2 - 0.3m	17/04/2019	<4	<0.4	14	52	20	<0.1	6	120	490	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 170	1500 1800	730 NC	6000 120	400000 370	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC 0.7	40 NC	4000 NC

HIL / HSL exceedance EIL / ESL exceedance ML exceedance HIL/HSL and EIL/ESL exceedance **Bold** = Lab detections Key: Lab result (HIL/HSL value | EIL/ESL value)

ML and HIL/HSL/EIL/ESL exceedance **red** = DC exceedance NT = Not tested NL = Non limiting NC = No criteria NAD = No asbestos detected

Indicates that asbestos has been detected by the lab below the PQL, refer to the lab report

Notes:

a QA/QC replicate of sample listed directly below the primary sample

HIL/HSL HIL D / HSL D - NEPC 2013, Schedule B1
EIL/ESL Commercial and Industrial - NEPC 2013, Schedule B1

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Table E2: Summary of Laboratory Results – Phenol, OCP, OPP, PCB, Asbestos (500 ml)

			Phenol	OCP								OPP	PCB	Asbestos (500 ml)
			Phenol	DDT+DDE+DDD	Aldrin & Dieldrin	Total Chlordane	Total Endosulfan	Endrin	Heptachlor	HCB	Methoxychlor	Chlorpyriphos	Total PCB	Calculated Asbestos (Nepm)
		PQL	5.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Sample ID	Depth	Sampled Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
401/0-0.1	0 - 0.1m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
402/0-0.1	0 - 0.1m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
402/0.2-0.3	0.2 - 0.3m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
403/0-0.1	0 - 0.1m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
BR1	0 - 0.1m	17/04/2019	NT 660 NC	NT 3600 640	NT 45 NC	NT 530 NC	NT 2000 NC	NT 100 NC	NT 50 NC	NT 80 NC	NT 2500 NC	NT 2000 NC	NT 7 NC	NT
404/0.2-0.3	0.2 - 0.3m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
405/0-0.1	0 - 0.1m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
406/0.2-0.3	0.2 - 0.3m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
407/0-0.1	0 - 0.1m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
408/0.2-0.3	0.2 - 0.3m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD

HIL / HSL exceedance EIL / ESL exceedance ML exceedance HIL/HSL and EIL/ESL exceedance **Bold** = Lab detections Key: Lab result (HIL/HSL value / EIL/ESL value)

ML and HIL/HSL/EIL/ESL exceedance **red** = DC exceedance NT = Not tested NL = Non limiting NC = No criteria NAD = No asbestos detected

Indicates that asbestos has been detected by the lab below the PQL, refer to the lab report

Notes:

a QA/QC replicate of sample listed directly below the primary sample

HIL/HSL HIL D / HSL D - NEPC 2013, Schedule B1
EIL/ESL Commercial and Industrial - NEPC 2013, Schedule B1

Appendix F

Laboratory Certificate of Analysis, Sample Receipt Advice and Chain-of –Custody Documentation

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	78505.04	**Suburb:**	Albion Park Rail	**To:**	Envirolab Services Pty Ltd
Project Name:	Proposed Long Stay Carpark	**Order Number**	78505.04		12 Ashley Street, Chatswood
Project Manager:	Michael Gol	**Sampler:**	KJ	**Attn:**	Simon Song
Emails:	michael.gol@douglaspartners.com.au kyle.johannes@douglaspartners.com.au			**Phone:**	02 9910 6200
Date Required:				**Email:**	samplereceipt@envirolabservices.com.au
Prior Storage:	Fridge	Do samples contain 'potential' HBM?	No		

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8A NEPM Asb	Combo 6	PH, CEC		TRH / BTEX					Notes/preservation
401/0-0.1	1	17/04//19		G/P	X									
401/0.2-0.3	2	17/04//19		G/P										
401/0.4-0.5	3	17/04//19		G/P										
401/1.0-1.1	4	17/04//19		G/P										
402/0-0.1	5	17/04//19		G/P	X									
402/0.2-0.3	6	17/04//19		G/P	X		X							
402/0.6-0.7	7	17/04//19		G/P										
402/1.1-1.2	8	17/04//19		G/P										
403/0-0.1	9	17/04//19		G/P	X									
403/0.2-0.3	10	17/04//19		G/P										
403/0.4-0.5	11	17/04//19		G/P										
403/1.0-1.1	12	17/04//19		G/P										
404/0-0.1	13	17/04//19		G/P										
404/0.2-0.3	14	17/04//19		G/P	X		X							
404/0.4-0.5	15	17/04//19		G/P										
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐	

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

Job No: 216109
Date Received: 18/4/19.
Time Received: 16:55
Received by: TN
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: As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Zn

Lab Report/Reference No:

Total number of samples in container: 33 **Relinquished by:** KJ **Transported to laboratory by:** First Choice

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

Signed: **Received by:** T.Nguyen 18/4/19 16:55 **Date & Time:** 18/04/2019

Analysis Read 23/4/19 0745

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	78505.04	**Suburb:**	Albion Park Rail	**To:**	Envirolab Services Pty Ltd
Project Name:	Proposed Long Stay Carpark	**Order Number**	78505.04		12 Ashley Street, Chatswood
Project Manager:	Michael Gol	**Sampler:**	KJ	**Attn:**	Simon Song
Emails:	michael.gol@douglaspartners.com.au	kyle.johannes@douglaspartners.com.au		**Phone:**	02 9910 6200
Date Required:				**Email:**	samplereceipt@envirolabservices.com.au
Prior Storage:	Fridge	Do samples contain 'potential' HBM?	No		

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8A NEPM Asb	Combo 6	PH, CEC		TRH / BTEX					Notes/preservation
404/0.9-1.0	16	17/04//19		G/P										
405/0-0.1	17	17/04//19		G/P	X									
405/0.2-0.3	18	17/04//19		G/P										
405/0.4-0.5	19	17/04//19		G/P										
405/0.9-1.0	20	17/04//19		G/P										
406/0-0.1	21	17/04//19		G/P										
406/0.2-0.3	22	17/04//19		G/P	X									
406/0.5-0.6	23	17/04//19		G/P										
406/1.0-1.1	24	17/04//19		G/P										
407/0-0.1	25	17/04//19		G/P	X		X							
407/0.2-0.3	26	17/04//19		G/P										
407/0.5-0.6	27	17/04//19		G/P										
407/0.9-1.0	28	17/04//19		G/P										
408/0-0.5-0.1	29	17/04//19		G/P										
408/0.2-0.3	30	17/04//19		G/P	X									
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐	

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

Metals to Analyse: 8HM unless specified here: As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Zn

Lab Report/Reference No:

Total number of samples in container: 33 **Relinquished by:** KJ **Transported to laboratory by:** First Choice

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

Signed: **Received by:** T.Nguyen 216109 18/4/19 16:55 **Date & Time:** 18/04/2019

Analysts Recd 230419 0745

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	78505.04	**Suburb:**	Albion Park Rail	**To:**	Envirolab Services Pty Ltd
Project Name:	Proposed Long Stay Carpark	**Order Number**	78505.04		12 Ashley Street, Chatswood
Project Manager:	Michael Gol	**Sampler:**	KJ	**Attn:**	Simon Song
Emails:	michael.gol@douglaspartners.com.au	kyle.johannes@douglaspartners.com.au		**Phone:**	02 9910 6200
Date Required:				**Email:**	samplereceipt@envirolabservices.com.au
Prior Storage:	Fridge	Do samples contain 'potential' HBM?	No		

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8A NEPM Asb	Combo 6	Lead, Zinc, NEPM Asb	Zinc	TRH / BTEX	Combo 1M	HM	Lead, Zinc		Notes/preservation
408/0.4-0.5	31	17/04//19		G/P										
408/0.6-0.7	32	17/04//19		G/P										
408/1.0-1.1	33	17/04//19		G/P										
BR1	34	16/04/19		G										
BR2	35	17/04/19		G										
TS														
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

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

Metals to Analyse: 8HM unless specified here: As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Zn

Lab Report/Reference No:

Total number of samples in container: 33 **Relinquished by:** KJ **Transported to laboratory by:** First Choice

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

Signed: **Received by:** T.Nguyen 216109 18/4/19 16:55 **Date & Time:** 18/04/2019

Analysis Recd 230419 0745

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 Unanderra
Attention	Michael Gol, Kyle Johannes

Sample Login Details

Your reference	78505.04, Proposed Long Stay Carpark
Envirolab Reference	216109
Date Sample Received	18/04/2019
Date Instructions Received	23/04/2019
Date Results Expected to be Reported	24/04/2019

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	35 Soil
Turnaround Time Requested	1 day
Temperature on Receipt (°C)	16.5
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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	Misc Inorg - Soil	Asbestos ID - soils NEPM	CEC	On Hold
401/0-0.1	✓	✓	✓	✓	✓	✓	✓	✓		✓		
401/0.2-0.3												✓
401/0.4-0.5												✓
401/1.0-1.1												✓
402/0-0.1	✓	✓	✓	✓	✓	✓	✓	✓		✓		
402/0.2-0.3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
402/0.6-0.7												✓
402/1.1-1.2												✓
403/0-0.1	✓	✓	✓	✓	✓	✓	✓	✓		✓		
403/0.2-0.3												✓
403/0.4-0.5												✓
403/1.0-1.1												✓
404/0-0.1												✓
404/0.2-0.3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
404/0.4-0.5												✓
404/0.9-1.0												✓
405/0-0.1	✓	✓	✓	✓	✓	✓	✓	✓		✓		
405/0.2-0.3												✓
405/0.4-0.5												✓
405/0.9-1.0												✓
406/0-0.1												✓
406/0.2-0.3	✓	✓	✓	✓	✓	✓	✓	✓		✓		
406/0.5-0.6												✓
406/1.0-1.1												✓
407/0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
407/0.2-0.3												✓
407/0.5-0.6												✓
407/0.9-1.0												✓
408/0.05-0.1												✓
408/0.2-0.3	✓	✓	✓	✓	✓	✓	✓	✓		✓		
408/0.4-0.5												✓
408/0.6-0.7												✓

Envirolab Services Pty Ltd
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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	Misc Inorg - Soil	Asbestos ID - soils NEPM	CEC	On Hold
408/1.0-1.1												✓
BR1												✓
BR2												✓

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
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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 216109

Client Details

Client	Douglas Partners Unanderra
Attention	Michael Gol, Kyle Johannes
Address	Unit 1, 1 Luso Drive, Unanderra, NSW, 2526

Sample Details

Your Reference	**78505.04, Proposed Long Stay Carpark**
Number of Samples	35 Soil
Date samples received	18/04/2019
Date completed instructions received	23/04/2019

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	24/04/2019
Date of Issue	24/04/2019

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Aida Marner
Authorised by Asbestos Approved Signatory: Matt Tang

Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor
Matthew Tang, Asbsestos Supervisor
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
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	%	79	79	77	77	76

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019
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	%	79	72	78	90

svTRH (C10-C40) in Soil						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	82	87	85	83	85

svTRH (C10-C40) in Soil					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50
Surrogate o-Terphenyl	%	91	80	88	85

PAHs in Soil						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	99	113	94	100	97

PAHs in Soil					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	83	96	96	95

Organochlorine Pesticides in soil						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
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	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	126	93	94	90	91

Organochlorine Pesticides in soil					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	81	112	92	89

Organophosphorus Pesticides						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
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	%	126	93	94	90	91

Organophosphorus Pesticides					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	81	112	92	89

PCBs in Soil						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
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	%	126	93	94	90	91

PCBs in Soil					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	81	112	92	89

Acid Extractable metals in soil						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Arsenic	mg/kg	5	<4	4	4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	27	10	36	29	28
Copper	mg/kg	30	140	18	19	15
Lead	mg/kg	21	10	16	20	16
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	11	7	13	12	9
Zinc	mg/kg	29	47	12	17	8
Manganese	mg/kg	75	410	18	22	14

Acid Extractable metals in soil					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Arsenic	mg/kg	4	<4	5	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	26	23	24	14
Copper	mg/kg	15	12	15	52
Lead	mg/kg	17	16	18	20
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	11	8	12	6
Zinc	mg/kg	11	7	12	120
Manganese	mg/kg	14	7	12	490

Misc Soil - Inorg						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Misc Soil - Inorg					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5

Misc Inorg - Soil				
Our Reference		216109-6	216109-14	216109-25
Your Reference	UNITS	402/0.2-0.3	404/0.2-0.3	407/0-0.1
Date Sampled		17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	24/04/2019	24/04/2019	24/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019
pH 1:5 soil:water	pH Units	4.7	5.1	5.3

Moisture						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Moisture	%	33	23	32	33	25

Moisture					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Moisture	%	21	24	30	12

Asbestos ID - soils NEPM						
Our Reference		216109-1	216109-5	216109-6	216109-9	216109-14
Your Reference	UNITS	401/0-0.1	402/0-0.1	402/0.2-0.3	403/0-0.1	404/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Sample mass tested	g	398.79	350.93	369.33	420.63	443.25
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown clayey soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–	–
FA and AF Estimation*	g	–	–	–	–	–
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001	<0.001

Asbestos ID - soils NEPM					
Our Reference		216109-17	216109-22	216109-25	216109-30
Your Reference	UNITS	405/0-0.1	406/0.2-0.3	407/0-0.1	408/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Sample mass tested	g	534.3	443.34	319.36	798.46
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos#1	g/kg	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–
FA and AF Estimation*	g	–	–	–	–
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001

CEC				
Our Reference		216109-6	216109-14	216109-25
Your Reference	UNITS	402/0.2-0.3	404/0.2-0.3	407/0-0.1
Date Sampled		17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	24/04/2019	24/04/2019	24/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019
Exchangeable Ca	meq/100g	0.2	0.9	1.4
Exchangeable K	meq/100g	<0.1	<0.1	0.1
Exchangeable Mg	meq/100g	5.3	5.0	3.5
Exchangeable Na	meq/100g	1.2	1.0	1.3
Cation Exchange Capacity	meq/100g	6.8	7.1	6.4

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.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.

Method ID	Methodology Summary
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
Date analysed	-			24/04/2019	1	24/04/2019	24/04/2019		24/04/2019	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	81	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	81	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	73	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	81	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	81	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	84	[NT]
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	86	[NT]
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	86	1	79	79	0	89	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
Date analysed	-			23/04/2019	1	23/04/2019	24/04/2019		23/04/2019	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	116	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	118	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	129	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	116	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	118	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	129	[NT]
Surrogate o-Terphenyl	%		Org-003	91	1	82	84	2	96	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
Date analysed	-			24/04/2019	1	24/04/2019	24/04/2019		24/04/2019	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	128	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	116	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	114	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	110	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	114	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	128	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	1	<0.05	<0.05	0	112	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	92	1	99	101	2	99	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
Date analysed	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
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	103	[NT]
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	109	[NT]
Heptachlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	106	[NT]
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	100	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	105	[NT]
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	112	[NT]
Dieldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	114	[NT]
Endrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	102	[NT]
pp-DDD	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	113	[NT]
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	104	[NT]
Methoxychlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	107	1	126	98	25	91	[NT]

QUALITY CONTROL: Organophosphorus Pesticides						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
Date analysed	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
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	88	[NT]
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	91	[NT]
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	105	[NT]
Fenitrothion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	100	[NT]
Malathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	76	[NT]
Parathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	87	[NT]
Ronnel	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	90	[NT]
Surrogate TCMX	%		Org-008	107	1	126	98	25	84	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
Date analysed	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
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	100	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	107	1	126	98	25	84	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
Date analysed	-			23/04/2019	1	23/04/2019	23/04/2019		23/04/2019	[NT]
Arsenic	mg/kg	4	Metals-020	<4	1	5	5	0	104	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	105	[NT]
Chromium	mg/kg	1	Metals-020	<1	1	27	27	0	99	[NT]
Copper	mg/kg	1	Metals-020	<1	1	30	34	12	103	[NT]
Lead	mg/kg	1	Metals-020	<1	1	21	23	9	98	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	106	[NT]
Nickel	mg/kg	1	Metals-020	<1	1	11	11	0	98	[NT]
Zinc	mg/kg	1	Metals-020	<1	1	29	36	22	100	[NT]
Manganese	mg/kg	1	Metals-020	<1	1	75	97	26	99	[NT]

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	216109-5
Date prepared	-			24/04/2019	1	24/04/2019	24/04/2019		24/04/2019	24/04/2019
Date analysed	-			24/04/2019	1	24/04/2019	24/04/2019		24/04/2019	24/04/2019
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	1	<5	<5	0	101	99

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			24/04/2019	14	24/04/2019	24/04/2019		24/04/2019	[NT]
Date analysed	-			24/04/2019	14	24/04/2019	24/04/2019		24/04/2019	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	14	5.1	5.2	2	102	[NT]

QUALITY CONTROL: CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			24/04/2019	6	24/04/2019	24/04/2019		24/04/2019	[NT]
Date analysed	-			24/04/2019	6	24/04/2019	24/04/2019		24/04/2019	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	6	0.2	0.2	0	107	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	6	<0.1	<0.1	0	103	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	6	5.3	4.8	10	105	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	6	1.2	1.1	9	105	[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-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Note: All samples analysed as received. However, samples 216109-1, 5, 6, 9, 14, 22 & 25 are below the minimum 500mL sample volume as per National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.

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SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Unanderra
Attention	Kyle Johannes

Sample Login Details

Your reference	78505.04, Proposed Passenger Terminal
Envirolab Reference	216111-A
Date Sample Received	18/04/2019
Date Instructions Received	01/05/2019
Date Results Expected to be Reported	02/05/2019

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	26 Soil
Turnaround Time Requested	1 day
Temperature on Receipt (°C)	16.3
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 NEPM	On Hold
501/0-0.1										✓
501/0.2-0.3										✓
501/0.5-0.6										✓
501/1.0-1.1										✓
502/0-0.1										✓
502/0.2-0.3										✓
502/0.5-0.6										✓
502/1.0-1.1										✓
503/0-0.1										✓
503/0.2-0.3										✓
503/0.5-0.6										✓
503/1.0-1.1										✓
504/0-0.1										✓
504/0.2-0.3										✓
504/0.5-0.6										✓
504/1.0-1.1										✓
505/0-0.1										✓
505/0.2-0.3										✓
505/0.6-0.7										✓
505/1.1-1.2										✓
506/0-0.1										✓
507/0.-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓	
507/0.2-0.3										✓
507/0.5-0.6										✓
507/1.0-1.1										✓
BR3							✓			

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 216109-A

Client Details

Client	Douglas Partners Unanderra
Attention	Kyle Johannes
Address	Unit 1, 1 Luso Drive, Unanderra, NSW, 2526

Sample Details

Your Reference	**78505.04, Proposed Long Stay Carpark**
Number of Samples	35 Soil
Date samples received	18/04/2019
Date completed instructions received	01/05/2019

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

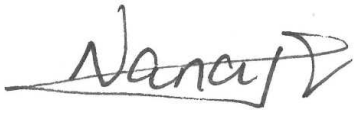
Date results requested by	02/05/2019
Date of Issue	02/05/2019

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Alexander Mitchell Maclean, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Acid Extractable metals in soil		
Our Reference		216109-A-34
Your Reference	UNITS	BR1
Date Sampled		17/04/2019
Type of sample		Soil
Date prepared	-	02/05/2019
Date analysed	-	02/05/2019
Arsenic	mg/kg	4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	26
Copper	mg/kg	16
Lead	mg/kg	16
Mercury	mg/kg	<0.1
Nickel	mg/kg	10
Zinc	mg/kg	9
Manganese	mg/kg	12

Moisture		
Our Reference		216109-A-34
Your Reference	UNITS	BR1
Date Sampled		17/04/2019
Type of sample		Soil
Date prepared	-	01/05/2019
Date analysed	-	02/05/2019
Moisture	%	31

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

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date prepared	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
Date analysed	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	103	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	109	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Manganese	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	122	[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.

Appendix G

Data Quality Assessment

DATA QUALITY ASSESSMENT

Q1. Data Quality Objectives

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

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

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

Table Q1: Data Quality Objectives

Data Quality Objective	Report Section where Addressed
State the Problem	S1 Introduction
Identify the Decision	S1 Introduction (objective) S9 Discussion S10 Conclusion and Recommendations
Identify Inputs to the Decision	S1 Introduction S2 Scope of Works S3 Site Identification and Description S4 Background S5 Conceptual Site Model S7 Site Assessment Criteria S8 Results
Define the Boundary of the Assessment	S3 Site Identification and Description Drawing 1 - Appendix B
Develop a Decision Rule	S7 Site Assessment Criteria
Specify Acceptable Limits on Decision Errors	S6 Sample Analysis Plan S7 Site Assessment Criteria S8 Results QA/QC Procedures and Results – Sections Q2, Q3
Optimise the Design for Obtaining Data	S2 Scope of Works S6 Sample Analysis Plan QA/QC Procedures and Results – Sections Q2, Q3

Q2. FIELD AND LABORATORY QUALITY CONTROL

The field and laboratory quality control (QC) procedures and results are summarised in Tables Q2 and Q3. Reference should be made to the field work and analysis procedures in Section 7 and the laboratory results certificates in Appendix I for further details.

Table Q2: Field QC

Item	Frequency	Acceptance Criteria	Achievement
Intra-laboratory replicates	5% primary samples	RPD <30% inorganics), <50% (organics)	yes[1]
Inter-laboratory replicates	5% primary samples	RPD <30% inorganics), <50% (organics)	no[2]
Trip Spikes	1 per field batch	60-140% recovery	no[2]
Trip Blanks	1 per field batch	<PQL/LOR	no[2]
Rinsates	1 per day	<PQL/LOR	no[2]

NOTES: 1 qualitative assessment of RPD results overall; refer Section Q2.1
2 not relevant to current investigation

Table Q3: Laboratory QC

Item	Frequency	Acceptance Criteria	Achievement
Analytical laboratories used		NATA accreditation[1]	yes
Holding times		In accordance with NEPC (2013) which references various Australian and international standards	yes
Laboratory / Reagent Blanks	1 per lab batch	<PQL	yes
Laboratory duplicates	10% primary samples	Laboratory specific [2]	
Matrix Spikes	1 per lab batch	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes
Surrogate Spikes	organics by GC	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes
Control Samples	1 per lab batch	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes

NOTES: 1 National Association of Testing Authorities
2 Envirolab Service Pty Ltd (ELS): <5xPQL – any RPD; >5xPQL – 0-50%RPD

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

Q2.1 Intra-Laboratory Replicates

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

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

Table Q4: Relative Percentage Difference Results – Intra-laboratory Replicates

Lab	Sample ID	Date Sampled	Media	Units	Metals								
					As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Mn
ELS	403/0-0.1	17/04/2019	filling	mg/kg	4	<0.4	29	19	20	<0.1	12	17	22
ELS	BR1	17/04/2019	filling	mg/kg	4	<0.4	26	16	16	<0.1	10	9	12
Difference				mg/kg	0	0	3	3	4	0	2	8	10
RPD				%	0	0	11	17	22	0	18	**62**	**59**

Notes: - not applicable, not tested

The calculated RPD values were within the acceptable range of ± 30% for inorganic analytes and ± 50% for organic analytes with the exception of two values (those in bold) out of nine calculated values. However, this is not considered to be significant because: The replicate pair were collected from fill soils which were observed to be heterogeneous in composition;

- Soil replicates, rather than homogenised soil duplicates, were used to minimise the risk of possible volatile loss, hence greater variability can be expected;
- The majority of RPDs within a replicate pair being within the acceptable limits; and
- All other QA/QC parameters met the DQIs.

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

Q3. Data Quality Indicators

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

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

The DQIs were assessed as outlined in Table Q5.

Table Q5: Data Quality Indicators

Data Quality Indicator	Method(s) of Achievement
Completeness	Planned systematic locations sampled; Preparation of field logs, sample location plan and chain of custody (CoC) records; Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the chain of custody; Samples analysed for contaminants of potential concern (CoPC) identified in the Conceptual Site Model (CSM); Completion of CoC documentation; NATA endorsed laboratory certificates provided by the laboratory; Satisfactory frequency and results for field and laboratory QC samples as discussed in Section Q2.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project; Works undertaken by appropriately experienced and trained DP environmental scientist / engineer; Use of NATA registered laboratory; Satisfactory results for field and laboratory QC samples.
Representativeness	Target media sampled; Spatial and temporal distribution of sample locations; Sample numbers recovered and analysed are considered to be representative of the target media and complying with DQOs; Samples were extracted and analysed within holding times; Samples were analysed in accordance with the analysis request.
Precision	Acceptable RPD between original samples and replicates; Satisfactory results for all other field and laboratory QC samples.
Accuracy	Satisfactory results for all field and laboratory QC samples.

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

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Detailed Site Investigation for Contaminated Land

Proposed Passenger Terminal
Illawarra Regional Airport, Albion Park Rail

Prepared for
Shellharbour City Council

Project 78505.04
May 2019

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	78505.04	Document No.	R.002.Rev0
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Report prepared for	Shellharbour City Council		
File name	78505.04.R.002.Rev0		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Kyle Johannes	Glyn Eade	3 May 2019

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Mr Nathan McColl , Shellharbour City Council

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

	Signature		Date
Author			3 May 2019
Reviewer		For Glyn Eade	3 May 2019

bsi. ISO 9001 Quality Management
FS 604853

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Report on Detailed Site Investigation for Contaminated Land
Proposed Passenger Terminal
Illawarra Regional Airport, Albion Park Rail

1. Introduction

This report presents the results of a detailed site investigation for contaminated land (DSI) undertaken prior to the construction of a proposed passenger terminal at Illawarra Regional Airport, Albion Park Rail. The investigation was commissioned in an email dated 9 April 2019 by Mr Nathan McColl of Shellharbour City Council (Council) and was undertaken in general accordance with Douglas Partners (DP)' proposal WOL190199 dated 16 April 2019. This report should be read with the *Notes About this Report* provided in Appendix A and other explanatory information, and should be kept in its entirety without separation of individual pages or sections.

It is understood that the proposed development will consist of the construction of a passenger terminal and associated on ground pavement areas to the north and south east. The subject site is shown on Drawing 1, Appendix B.

This DSI is required to support a development application and is based on the recommendations of a preliminary site investigation for contaminated land previously completed by DP. This was reported in DP's *Report on Preliminary Site Investigation for Contaminated Land, Proposed Passenger Terminal, Illawarra Regional Airport, Albion Park Rail*, DP Project 78505.03, dated April 2019 (DP 2019a).

2. Scope of Work

The scope of work for this DSI consisted of:

- A review of previous DP investigations;
- A review of anecdotal information and previous reports provided by council;
- Excavation of seven test pits in a grid-based pattern targeting the former terminal area. The test pits were excavated using an excavator, to depths of between 0.2 m below ground level (bgl) and 1.3 m bgl;
- Collection of soil samples from each test pit at regular intervals, change in strata or at points of environmental concern. Each sample included one soil jar and one 500 ml plastic bag for asbestos analysis;
- Collected replicate samples were tested using a photo-ionisation detector (PID) for volatile contaminants to assist with laboratory scheduling;

- Laboratory analysis of nine samples for a range of the following common contaminants:
  - Metals/metalloids (arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel and zinc);
  - Polycyclic aromatic hydrocarbons (PAH)
  - Total recoverable hydrocarbons (TRH)
  - Benzene, toluene ethylbenzene and xylene (BTEX);
  - Phenols;
  - Organochlorine pesticides (OCP) and organophosphorous pesticides (OPP);
  - Polychlorinated biphenyls (PCB); and
  - Asbestos (sieving, Identification, friable asbestos (FA) and asbestos fines (AF)).
- Field sampling and laboratory analysis conducted in compliance with standard environmental protocols, including a Quality Assurance/Quality Control (QA/QC) plan consisting of approximately 10% replicate sampling, and appropriate Chain of Custody procedures and in-house laboratory QA/QC testing; and
- Provision of this report detailing the methodology and results of the DSI

3. Site Description, Geology and Hydrogeology

The site consists of the footprint of the proposed passenger terminal together with associated on ground pavement areas located to the north and south east, which is identified as part of Lot 10, Deposited Plan 1157377 and is located to the north west of the existing airport terminal. The site locality and features are shown on Drawing 1, Appendix B. The site consists of an irregularly shaped area covering an area of approximately 3,000 m^2 that extends over the airports perimeter security fence dividing the airside and non-airside areas of the airport. The site is bounded to the north by aircraft holding areas (air side) and the existing short stay car park (non-airside) with large commercial buildings beyond; to the west (airside) by an aircraft holding area and taxi ways with the runway beyond; to the east (non-airside) by the existing short stay car park with Airport Road and a Rural Fire Service control centre, station house and training facility beyond; and to the south by an aircraft holding and boarding area (airside) and the existing airport terminal (non-airside) with large commercial buildings beyond.

At the time of the DSI, the site was observed to be lightly grassed with hard stand areas including on ground concrete slabs and parts of the short stay car park. Refer to Section 6 and Site Photographs presented in Appendix C for further detail on the condition of the site at the time of the DSI.

The site lies on the coastal plain adjacent to the Illawarra Escarpment and based on online mapping, surface levels of the site are indicated to have a slight fall to the north east with a difference in level of approximately 0.5 m between 7.0 m to 6.5 m relative to Australian Height Datum (AHD).

Reference to the 1:50 000 Kiama Geology Sheet indicates that the site is underlain by Quaternary Sediments of the Quaternary Age. This formation typically comprises alluvium, gravel, beach and dune sand.

Reference to the *Acid Sulfate Risk Map*, published by the Department of Land and Water Conservation indicates that the site is in an area of "*low probability of occurrence"* at depths of greater than 3 m. This mapped area is described as generally not expected to contain acid sulfate soil (ASS), although highly localised occurrences may occur, especially near boundaries with environments with a high probability of ASS occurrence.

A search of the NSW Department of Primary Industries Office of Water (DPI Water) registered groundwater works (http://allwaterdata.water.nsw.gov.au/water.stm - Department of Primary Industries Office of Water – All Groundwater Map), was undertaken on 26 March 2019. Four groundwater bores, GW114888, GW114889, GW114891 and GW114890 were located approximately 290 m, 295 m, 300 m and 305 m east respectively of the site. A brief summary of the groundwater bores is shown in Table 1, with further detail provided in the Work Summary Reports, Appendix D

Table 1: Summary of Groundwater Bores

Identification	Installation Date	Borehole Depth (m bgl	Water level (m) bgl	Distance and Direction from Site	Authorised Purpose
GW114888	11/11/2013	7.5	5.5	290 m East	Monitoring Bore
GW114889		7.5	4.0	295 m East	
GW114891		7.5	5.2	300 m East	
GW114890		5.6	4.8	305 m East	

*Below ground level

The nearest surface water receptor to the site is an unnamed dam located 140 m east of the site. Lake Illawarra is located approximately 820 m east of the site. To the north west of the site another unnamed dam is located 550 m from the site and beyond this is Frazors Creek located approximately 720 m from the site. Localised groundwater is anticipated to follow the topography of the site towards Lake Illawarra in a general north easterly direction.

4. Background

4.1 DP's Preliminary Site Investigation for Contaminated Land DP (2019a)

DP (2019a) was undertaken to provide preliminary information on the contamination of the site and included review of previous DP reports, a review of readily available site and site history information, a site walkover and the preparation of the report.

As part of DP (2019a), a review of a contaminated land investigation previously prepared by DP for a formerly proposed aeromedical facility at the Illawarra Regional Airport (within the north eastern portion of the current site) was conducted. The contaminated land investigation was reported in DP's *Report on Preliminary Site Investigation, Proposed Aeromedical Facility, Illawarra Regional Airport, Albion Park Rail*, DP Project 78505.01, Document R.001.Rev0 dated 6 November 2013 (DP 2013).

DP (2013) identified that a former airport terminal was previously located within south eastern corner of the footprint of the proposed aeromedical facility, which had burnt down in May 2013 and was subsequently demolished in June 2013.

Analytical results from laboratory testing conducted as part of DP (2013) indicated that all samples returned results less than the laboratory's practical quantitation limit (PQL) or below the adopted site assessment criteria with the exception of benzo(a)pyrene which exceeded the adopted Ecological Screening Level (ESL) in filling at a number of locations. These locations included three test pits (7, 8 and 10) within the current site.

DP (2013) discussed that the benzo(a)pyrene concentrations were well within the adopted commercial health-based investigation level and noted that the site is not considered to comprise an area of ecological significance due to the surrounding land use, and would have limited environmental value related to terrestrial ecosystems. It was also noted that the vegetation within the site comprised dense grass growth with no obvious indications of distress. On this basis, the minor exceedances of the ESL for benzo(a)pyrene were not considered to be significant.

DP (2013) concluded that from a contamination perspective the proposed aeromedical facility site was considered suitable for the then proposed development.

The sampling locations from DP (2013), relevant to the current site are shown on Drawing 1, Appendix B

Based on the findings of DP (2019) it is understood that the site was densely vegetated until being cleared of vegetation between 1949 and 1963. Subsequently the site has previously been developed as a former airport terminal, which was approved for construction in 1993 and subsequently burnt down and was demolished in 2013. Council records and a Section 10.7 planning certificate also indicate that the site may have been partially filled under control as part of subdivision.

Based on the findings of DP (2019), the following potential sources of contamination were identified:

- The potential use of per- and poly-fluoroakyl substances (PFAS) as a result of fire fighting foams that may have been used when the former terminal burnt down.
- Uncontrolled fill of unknown origin associated with progressive development of the site including vegetation clearance, construction, burning down and subsequent demolition of the former airport terminal building and construction of existing site features including airport infrastructure, aircraft taxiways, on-ground slabs and car park.

DP (2019) concluded that there was a low to moderate risk for the potential of significant contamination at the site. As such DP 2019a recommended that further intrusive investigation work be undertaken across the site to assess its contamination status and compatibility with the proposed development.

4.2 DP's Geotechnical Site Investigation (DP 2019b)

DP previously conducted a geotechnical investigation for the site. This was reported in DP's *Report on Geotechnical Investigation, Proposed Passenger Terminal, Illawarra Regional Airport, Albion Park Rail* DP project 78505.02 dated April 2019 (DP 2019b)

Eight boreholes (Bores 101 – 108) to depths of 4 m were undertaken as part of DP (2019b).

The field investigation encountered relatively uniform conditions underlying the site (consistent with the results of the DP 2013 investigation), with the succession of strata broadly summarised as follows:

TOPSOIL (FILL):	Brown silty clay topsoil fill with some rootlets encountered to depths in the range of between 0.2 and 0.3 m in Bores 102 to 108;
FILL (PAVEMENT):	40 mm thick asphaltic concrete overlying grey, fine to coarse gravel (road base) fill to a depth of 0.14 m in Bore 101;
FILL (CLAY):	Brown silty clay fill with some gravel encountered to a depth of 0.4 m in Bore 102. Possible fill (likely re-worked natural clay material) was also encountered in Bore 108 to a depth of 0.7 m;
CLAY:	Variably soft up to hard (but typically stiff to very stiff) silty clay and/or silty sandy clay in all boreholes underlying the fill and continuing to the limit of investigation depth of 4.0 m.

No obvious asbestos or other signs of potential contamination, such as malodourous or discoloured soil, were observed during DP (2019b).

The sampling locations for DP (2019) are shown in Drawing 1, Appendix B.

4.3 Anecdotal Information

The anecdotal information reviewed included a Fire and Rescue NSW Incident Report received by DP from Mr Nathan McColl of Shellharbour City Council on 17 April 2019. The Incident Report included information on the fire fighting activities that took place to extinguish the fire that burnt down the former airport terminal. In the Incident Report it states that water was the only extinguishing medium used to extinguish the burning airport terminal.

Based on this review it is considered that the site does not present a potential source of PFAS contamination.

5. Summary of Conceptual Site Model

A conceptual site model (CSM) has been developed based on the reviewed historical information and observations made during the site inspection. The CSM identifies potential sources of contaminants of concern, sensitive receptors, and potential transport mechanisms that could expose sensitive receptors to unacceptable ecological and/or health risks. The objective of the CSM is to highlight actual or potential exposure pathways that may exist, and identify any data gaps that may need to be addressed during this investigation.

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 (potential complete pathways). For potential ecological and/or health risks to be present, all of the following elements of an exposure pathway are required:

1. Contaminant source (such as a fuel tank or fill);
2. Receptor (eg site worker, visitor, aquatic and terrestrial ecosystems); and
3. Transport mechanism/exposure route between the source and receptor (eg ingestion, inhalation or dermal contact).

If all three elements are present, it is considered that a complete exposure pathway exists. Partial or incomplete exposure pathways may also be present.

For this site uncontrolled fill of unknown origin associated with progressive development of the site is still considered a potential contamination source.

The possible pathways between the source (S1) and receptors (R1 to R7) are provided in Table 2 on the following page.

Table 2: Potential Complete Pathways

Source	Transport Pathway	Receptor	Action Recommended
S1 – Uncontrolled Fill of unknown origin associated with the progressive development of the site.	P1 - Ingestion and dermal contact P2 - Inhalation of dust / vapours	R1 - Current Users R2 – Construction and Maintenance Workers R3 - End users	An intrusive investigation is required to assess possible contamination including chemical testing of the soils. Testing of soils will be used as a screen for the assessment of potential surface water and groundwater contamination.
	P2 - Inhalation of dust / vapours	R4 – Adjacent site users	
	P5 - Leaching of contaminants	R5 – Groundwater	
	P3 - Surface water run-off P4 - Lateral migration of groundwater	R6 - Surface water	
	P6 - Contact with terrestrial ecology	R7 - Terrestrial ecology	

6. Sampling and Analysis Plan

6.1 Sample Location, Density and Pattern

In order to address the objectives of this DSI, a sampling plan for the site was established with reference to *Schedule B2, Guideline on Site Characterisation* of the National Environment Protection Council's *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended 2013 (NEPC, 2013) and the NSW EPA *Contaminated Sites Sampling Design Guidelines* 1995 (NSW EPA 1995).

Based on the findings of the previous preliminary site investigation report (DP 2019) the adopted sampling density was established based on the minimum sampling points required for characterisation as detailed in NSW EPA 1995. The sampling pattern was established using systematic grid-based sampling as detailed in *Schedule B2* of NEPC (2013). The density and sampling pattern were based on the area of the former airport terminal building footprint only.

Based on an area of 0.05 ha (targeting the area of the former airport terminal building footprint only), five grid-based sampling locations were required in order to meet the minimum sampling points required for site characterisation recommended in NSW EPA 1995.

Two additional sampling locations (test pits 502 and 504) situated adjacent to the existing hardstand stormwater drainage platforms associated to the former airport terminal were excavated in order assess the underlying material.

Field work was carried out on 17 April 2019. The seven test pits (501 to 507) were excavated to depths of between 0.2 m and 1.3 m bgl using a 5 tonne Bobcat excavator. All test pits were logged on site by a qualified environmental engineer who collected samples for contamination assessment purposes.

The levels shown on the test pit logs are to Australian Height Datum (AHD) and were determined using a differential GPS to obtain accurate ground surface levels for the test pit.

The DSI sampling locations are shown on Drawing 1, Appendix B.

6.2 Sample Depths

Soil samples were collected for soil logging and laboratory analysis from near surface, at signs of potential contamination (including fill) and the shallowest natural stratum encountered. From the seven test pits, a total of 25 soil samples collected. Replicate samples were taken at a rate of 10% of the total number of primary samples, for QC purposes. Sample depths ranged from ground surface to 1.2 m bgl.

The test pit logs and borehole log detailing all of the samples collected are provided in Appendix D.

6.3 Sampling Methodology

Environmental sampling was conducted with reference to standard operating procedures described in the DP *Field Procedures Manual* which included:

- The use of disposable gloves for the collection of soil samples by hand directly from the centre of the excavator bucket. The gloves were replaced between each sample;
- Labelling of the sample containers with individual and unique identification details including Project No., Sample Location. and depth;
- Collection of at least 10% intra-laboratory replicate samples;
- Placement of containers into a chilled, enclosed and secure container for transport to the laboratory;
- Use of chain-of-custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory;
- All samples were tested in the field for potential volatile organic contaminants using a calibrated photo-ionisation detector (PID).

6.4 Analytical Rationale

Nine primary soil samples and one intra-laboratory replicate sample collected from fill and natural soils were submitted to a National Association of Testing Authorities (NATA) accredited laboratory (Envirolab Services Pty Ltd) for the analysis of contaminants of potential concern, which were selected based on the potential for contamination identified in the preliminary CSM for the site (as discussed in Section 5). The fill samples were selected based on the type and depth of the ground conditions encountered.

7. Site Assessment Criteria

Based on the proposed development at the site being a passenger terminal, criteria pertaining to a commercial land use have been adopted.

The Site Assessment Criteria (SAC) applied in the current investigation are informed by the CSM which identified human and ecological receptors of potential contamination on the site (refer to Section 5). Analytical results were assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of NEPC (2013). NEPC (2013) is endorsed by the NSW EPA under the CLM Act 1997. Petroleum based health screening levels for direct contact have been 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) as referenced by NEPC (2013).

7.1 Health Investigation and Screening Levels

The generic Health Investigation Levels (HIL) and Health Screening Levels (HSL) for a commercial land use are considered to be appropriate for the assessment of contamination at the site given the proposed development as a passenger terminal. The adopted soil HIL and HSL for the potential contaminants of concern are presented in Table 3.

Table 3: Commercial HIL and HSL in mg/kg unless otherwise indicated

Contaminants		HIL – D / HSL - D Direct Contact	HSL - D Vapour Intrusion[3]
Metals	Arsenic	3000	-
	Cadmium	900	-
	Chromium (VI)	3600	-
	Copper	240000	-
	Lead	1500	-
	Mercury (inorganic)	730	-
	Nickel	6000	-
	Zinc	400000	-
PAH	Benzo(a)pyrene TEQ[1]	40	-
	Naphthalene	11000	NL[4]
	Total PAH	4000	-
TRH	[F1]	26000	260
	[F2]	20000	NL
	>C_{16}-C_{34} [F3]	27000	-
	>C_{34}-C_{40} [F4]	38000	-
BTEX	Benzene	430	3
	Toluene	99000	NL
	Ethylbenzene	27000	NL
	Xylenes	81000	230
Phenol	Pentachlorophenol	660	-
OCP	Aldrin + Dieldrin	45	-
	Chlordane	530	-
	DDT+DDE+DDD	3600	-
	Endosulfan	2000	-
	Endrin	100	-
	Heptachlor	50	-
	HCB	80	-
	Methoxychlor	2500	-
OPP	Chlorpyrifos	2000	-
PCB [2]		7	-

1. Sum of carcinogenic PAH
2. non dioxin-like PCBs only.
3. 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 results 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'.
4. The vapour intrusion HSL have been calculated for a sand soil as a conservative approach given the presence of heterogeneous fill at the site and an assumed depth to contamination 0 m to <1 m.

7.2 Ecological Investigation Levels

Ecological Investigation Levels (EIL) and Added Contaminant Limits (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.

The adopted EIL, were derived using the *Interactive (Excel) Calculation Spreadsheet* (NEPC website http://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox#hils) are shown in the following Table 4.

Table 4: EIL in mg/kg

Analyte		EIL Commercial	Comments
Metals	Arsenic	160	Adopted parameters: pH = 7.6 (range 6.1 to 8.4); CEC = 13.2 $cmol_c/kg$ (range 9.7 to 20.0 $cmol_c/kg$); assumed clay content = 10%; "Aged" (>2 years) source of contamination low for traffic volumes in NSW
	Copper	310	
	Nickel	350	
	Chromium III	670	
	Lead	1800	
	Zinc	850	
PAH	Naphthalene	370	
OCP	DDT	640	

7.3 Ecological Screening Levels

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The ESL adopted are shown in the following Table 5.

Table 5: ESL in mg/kg

Analyte		ESL Commercial	Comments
TRH	[F1]	215*	All ESLs are low reliability apart from those marked with * which are moderate reliability
	[F2]	170*	
	>C16-C34 [F3]	2500	
	>C34-C40 [F4]	6600	
BTEX	Benzene	95	
	Toluene	135	
	Ethylbenzene	185	
	Xylenes	95	
PAH	Benzo(a)pyrene	0.7	

1. The ESL have been calculated for a fine soil based on the heterogeneous fill encountered and commercial land use

7.4 Management Limits

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;
- Effects on buried infrastructure eg penetration of, or damage to, in-ground services.

The management limits adopted from Schedule B1 of NEPC (2013) are shown in the following Table 6.

Table 6: Management Limits in mg/kg

Analyte		Management Limit Commercial	
TRH	C6 – C10	800	The management limits have been calculated for a fine soil as a conservative approach based on the heterogeneous fill encountered.
	>C10-C16	1000	
	>C16-C34 (F3)	5000	
	>C34-C40 (F4)	10000	

7.5 Asbestos in Soil

NEPC (2013) defines the various asbestos types referred to above as follows:

Bonded ACM: Asbestos-containing material which is in sound condition, bound in a matrix of cement or resin, and cannot pass through a 7mm x 7mm sieve.

FA: Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically unbonded or was previously bonded and is now significantly degraded and crumbling.

AF: Asbestos fines including free fibres, small fibre bundles and also small fragments of bonded ACM that pass through a 7mm x 7mm sieve.

Health Screening Levels (HSLs) for asbestos in soil, which are based on likely exposure levels for different scenarios, have been adopted in NEPC (2013) based on DoH (2009). The HSLs have been developed for various land use scenarios including Residential A (gardens and accessible soil), Residential B (minimal opportunities for soil access), Recreational C (parks and public open space) and Commercial / Industrial D.

On the basis of the potential sensitive land use and in accordance with Table 7, Schedule B1, NEPC (2013) the following HSLs have been adopted:

- 0.05% w/w of bonded ACM in soil (Commercial D)
- 0.001% w/w friable asbestos (FA) and asbestos fines (AF), where quantifiable; and
- No visible asbestos on the ground surface.

8. Results

8.1 Field Work Observations

Details of the subsurface conditions encountered are given on the test pit and borehole logs included in Appendix D. These should be read in conjunction with the accompanying notes defining clarification methods and descriptive terms.

Slightly variable conditions were encountered underlying the site, with the principal succession of strata broadly summarised as follows:

FILL:	Dark brown and brown silty clay or sandy silty clay of slightly variable consistency and composition each Pit to depths of between 0.2 m bgl and 0.6 m bgl.
SILTY CLAY:	Brown silty clay underlying the filling in each Pit to termination depths of between 1.1 m bgl and 1.3 m bgl.

Anthropogenic material was encountered in fill in all pits except Pit 502. Concrete fragments were observed in pits 501, 503, 504, 505, 506 and 507. Other anthropogenic materials encountered included a fabric fragment in Pit 504 and a plastic bag in Pit 505.

No free groundwater was observed in any of the pits for the short time that they were left open. However, the pits were immediately backfilled following the field investigation which precluded long term monitoring of groundwater levels. Furthermore, groundwater levels are dependent on preceding climatic conditions and soil permeability and can, therefore, fluctuate spatially and with time.

8.2 Analytical Results

All reported chemical analytical results for arsenic, cadmium, mercury, BTEX, phenols, OPP, PCB and asbestos were less than the laboratory's practical quantitation limit (PQL) for each of these analytes.

Concentrations of chromium, copper, lead, nickel, zinc and manganese, TRH, PAH and OCP were reported above the laboratory's PQL, but below the adopted SAC.

The soil laboratory test results are summarised in Table E1 and Table E2, Appendix E along with the adopted SAC.

The laboratory certificates of analysis, chain-of-custody documentation and sample receipt are included in Appendix F.

In order to confirm the quality of the assessment data, the seven-step data quality objective process has been completed in accordance with Appendix B, Schedule B2 of NEPC (2013). The full DQO are included in the Data Quality Assessment included in Appendix G.

The QA/QC assessment is also included in the Data Quality Assessment provided in Appendix G. The results of the QA/QC assessment indicate that there are no issues precluding the use of the analytical results in the assessment.

9. Discussion

Following review of anecdotal information provided by Shellharbour City Council, it is understood that firefighting foams were not utilised and instead water was the only extinguishing medium used to extinguish the fire that burnt down the former airport terminal. Therefore it is considered that the site does not present a potential source of PFAS contamination and hence PFAS contamination was not investigated as part of this DSI.

The field work for this DSI found minor amounts of fill to depths of 0.6 m bgl. Anthropogenic material (concrete, paper and fabric) were observed in six of the seven test pits.

All soil analytical results were either less than the laboratory's practical quantitation limits (PQL) or within the relevant adopted SAC.

10. Conclusions and Recommendations

It is considered that, based on the findings of this DSI from a contamination viewpoint the site is deemed to be compatible with the proposed passenger terminal development.

However an unexpected finds protocol (UFP) should be included as part of a construction environmental management plan (CEMP) for the proposed development, to manage any unexpected contamination encountered during the development works.

11. References

1. DP (2013) *Report on Preliminary Site Investigation, Proposed Aeromedical Facility, Illawarra Regional Airport, Albion Park Rail,* 78505.01.R.001.Rev0, Douglas Partners Pty Ltd, dated November 2013;
2. DP (2019a) *Report on Preliminary Site Investigation for Contaminated Land, Proposed Passenger Terminal, Illawarra Regional Airport, Albion Park Rail,* 78505.03.R.002.Rev0 Douglas Partners Pty Ltd, dated March 2019;
3. DP (2019b) *Report on Geotechnical Investigation, Proposed Passenger Terminal, Illawarra Regional Airport, Albion Park Rail,* 78505.02.R.001.Rev0, Douglas Partners Pty Ltd, dated April 2019;
4. NEPC (2013), *National Environment Protection (Assessment of Site Contamination) Measure 1999 Amended 2013 (NEPM),* National Environment Protection Council.
5. NSW EPA (1997), *Guidelines for Consultants Reporting on Contaminated Sites*, NSW Environment Protection Authority;
6. NSW EPA (1995) *Contaminated Sites Sampling Design Guidelines,* NSW Environment Protection Authority; and

12. Limitations

Douglas Partners (DP) has prepared this report for this project at Illawarra Regional Airport, Albion Park Rail in accordance with DP's proposal dated 16 April 2019 and acceptance received from Mr Nathan McColl dated 9 April 2019. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Shellharbour City Council 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.

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

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

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. Building demolition materials, such as concrete, paper and fabric, were, however, located in previous below-ground filling, and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

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

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

Douglas Partners Pty Ltd

Appendix A

About This Report

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.

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.

Soil Descriptions

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Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. 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	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

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

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

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	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

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;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

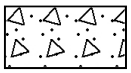
Symbols & Abbreviations

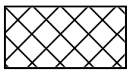
Graphic Symbols for Soil and Rock

General

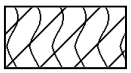

Asphalt

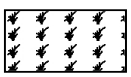

Road base

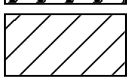

Concrete


Filling

Soils


Topsoil

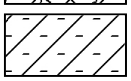

Peat


Clay


Silty clay

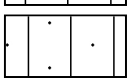

Sandy clay

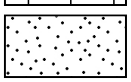

Gravelly clay

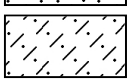

Shaly clay

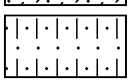

Silt


Clayey silt


Sandy silt

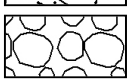

Sand


Clayey sand


Silty sand


Gravel

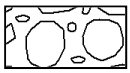

Sandy gravel


Cobbles, boulders

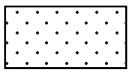

Talus

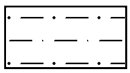
Sedimentary Rocks

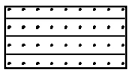

Boulder conglomerate

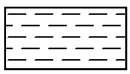

Conglomerate


Conglomeratic sandstone

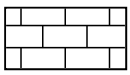

Sandstone


Siltstone

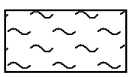

Laminite

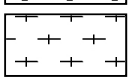

Mudstone, claystone, shale

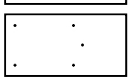

Coal


Limestone

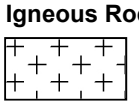
Metamorphic Rocks

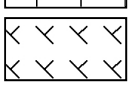

Slate, phyllite, schist

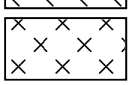

Gneiss

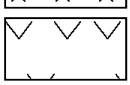

Quartzite

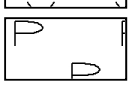
Igneous Rocks


Granite


Dolerite, basalt, andesite

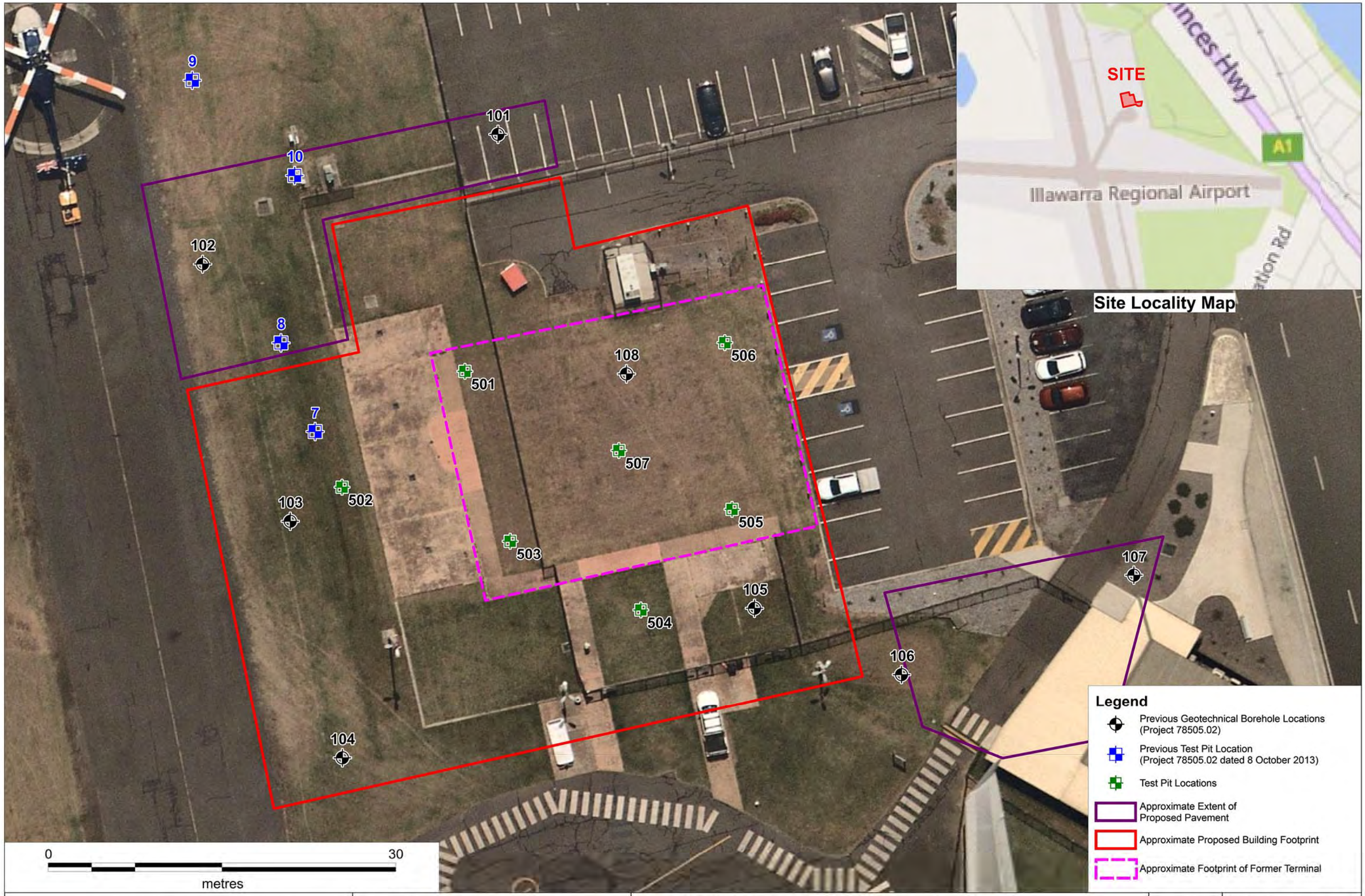

Dacite, epidote


Tuff, breccia


Porphyry

Appendix B

Drawing 1



Site Locality Map

Legend

- Previous Geotechnical Borehole Locations (Project 78505.02)
- Previous Test Pit Location (Project 78505.02 dated 8 October 2013)
- Test Pit Locations
- Approximate Extent of Proposed Pavement
- Approximate Proposed Building Footprint
- Approximate Footprint of Former Terminal

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Shellharbour City Council		TITLE: **Detailed Site Investigation for Contaminated Land** **Proposed Passenger Terminal** **Illawarra Regional Airport, Albion Park Rail**
OFFICE: Wollongong	DRAWN BY: KJ	
SCALE: As shown	DATE: 03.05.2019	

MGA

PROJECT No: 78505.04
DRAWING No: 1
REVISION: 0

Appendix C

Site Photographs

Photo 1: View of strata in Pit 507

Photo 2: View of spoil from Pit 507

Photo 3: View of pit 505

Photo 4: View of reinstated pit at the site.

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Shellharbour City Council	**Site Photographs 1 to 4**	PROJECT No: 78505.04
	OFFICE: Wollongong — Undertaken By: KJ	**Detailed Site Investigation for Contaminated Land**	PLATE No: 1
	SCALE: NTS — Date: 3 May 2019	**Proposed Passenger Terminal, Illawarra Regional Airport**	REVISION: 0

Appendix D

Test Pit Logs

TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Passenger Terminal
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 6.52 AHD
EASTING: 297222
NORTHING: 6173533

PIT No: 501
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
					0.0		PID < 1ppm		5 10 15 20
		FILLING - dark brown silty clay with some root fibres and trace gravel (concrete)		E	0.1				
	0.15	FILLING - brown sandy silty clay with some gravel (concrete, sandstone) and trace root fibres			0.2		PID < 1ppm		
				E	0.3				
6	0.5	SILTY CLAY - brown mottled grey silty clay			0.5		PID < 1ppm		
				E	0.6				
	1				1.0		PID < 1ppm		1
				E	1.1				
	1.3	Pit discontinued at 1.3m Limit of investigation							
5									

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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

TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Passenger Terminal
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 6.42 AHD
EASTING: 297212
NORTHING: 6173523

PIT No: 502
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
		FILLING - dark brown silty clay with some root fibres and trace gravel (siltstone)		E	0.0		PID < 1ppm		
					0.1				
				E	0.2		PID < 1ppm		
					0.3				
	0.4	SILTY CLAY - brown silty clay							
				E	0.5		PID < 1ppm		
					0.6				
		- becoming brown mottled grey below 0.8m							
	1			E	1.0		PID < 1ppm		1
	1.1	Pit discontinued at 1.1m Limit of investigation			1.1				

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

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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

TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Passenger Terminal
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 6.58 AHD
EASTING: 297226
NORTHING: 6173518

PIT No: 503
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
					0.0		PID < 1ppm		5 10 15 20
		FILLING - dark brown silty clay with some root fibres and gravel (concrete)		E	0.1				
	0.2	FILLING - brown silty clay with gravel (concrete, basalt) and trace root fibres		E	0.2		PID < 1ppm		
					0.3				
	0.5	SILTY CLAY - brown mottled grey silty clay		E	0.5		PID < 1ppm		
6					0.6				
	1			E	1.0		PID < 1ppm		1
					1.1				
	1.2	Pit discontinued at 1.2m Limit of investigation							
5									

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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

TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Passenger Terminal
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 6.42 AHD
EASTING: 297237
NORTHING: 6173512

PIT No: 504
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
6	0.0	FILLING - dark brown silty clay with some root fibres and gravel (basalt and concrete) light grey silty sandy clay band observed at 0.2m		E	0.0		PID < 1ppm		
	0.1				0.1				
	0.2	- fabric fragment observed at 0.2m		E	0.2		PID < 1ppm		
	0.3	SILTY CLAY - brown silty clay with trace root fibres			0.3				
	0.5			E	0.5		PID < 1ppm		
	0.6	- becoming brown mottled grey below 0.6m			0.6				
1	1.0			E	1.0		PID < 1ppm		1
	1.1				1.1				
	1.2	Pit discontinued at 1.2m Limit of investigation							
5									

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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

TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Passenger Terminal
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 6.50 AHD
EASTING: 297245
NORTHING: 6173521

PIT No: 505
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
6	0.0	FILLING - dark brown silty clay with some root fibres and trace gravel (concrete, basalt)		E	0.0		PID < 1ppm		
					0.1				
	0.15	FILLING - brown silty sandy clay with some gravel (sandstone, gravel) and trace root fibres - light grey clayey sand band and plastic bag observed at 0.2m		E	0.2		PID < 1ppm		
					0.3				
	0.6	SILTY CLAY - brown mottled grey silty clay with trace gravel (sandstone)		E	0.6		PID < 1ppm		
					0.7				
5	1								1
				E	1.1		PID < 1ppm		
					1.2				
	1.3	Pit discontinued at 1.3m Limit of investigation							

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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

TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Passenger Terminal
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 6.52 AHD
EASTING: 297245
NORTHING: 6173535

PIT No: 506
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
		FILLING - dark brown sandy silty clay with some root fibres and gravel (concrete)		E	0.0 0.1		PID < 1ppm		
	0.2	Pit discontinued at 0.2m Pit terminated due to service							

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Shellharbour City Council
PROJECT: Proposed Passenger Terminal
LOCATION: Illawarra Regional Airport, Albion Park Rail

SURFACE LEVEL: 6.58 AHD
EASTING: 297236
NORTHING: 6173526

PIT No: 507
PROJECT No: 78505.04
DATE: 17/4/2019
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 mm)
					0.0		PID < 1ppm		5 10 15 20
		FILLING - dark brown silty clay with some root fibres and trace gravel (concrete, basalt, sandstone)		E					
	0.1				0.1				
		FILLING - brown sandy silty clay with some gravel (sandstone, concrete) and trace root fibres			0.2		PID < 1ppm		
				E					
					0.3				
	0.4								
6		SILTY CLAY - brown mottled grey silty clay with trace gravel (sandstone)			0.5		PID < 1ppm		
				E					
					0.6				
	1								1
					1.0		PID < 1ppm		
				E					
					1.1				
	1.2								
		Pit discontinued at 1.2m Limit of investigation							
5									

RIG: 5 Ton Bobcat with 450mm bucket

LOGGED: KJ

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: BR3 taken at 0-0.1m

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

SAMPLING & IN SITU TESTING LEGEND

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

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Appendix E

Table E1 and E2 Summary of Laboratory Results

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Table E1: Summary of Laboratory Results – Metals, TRH, BTEX, PAH

			Metals									TRH						BTEX				PAH			
			Arsenic	Cadmium	Chromium (VI)	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Manganese	TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs
		PQL	4	0.4	1	1	1	0.1	1	1	1	25	50	25	50	100	100	0.2	0.5	1	1	1	0.05	0.5	0.05
Sample ID	Depth	Sampled Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
501/0.2-0.3	0.2 - 0.3m	17/04/2019	<4	<0.4	<1	**210**	**12**	<0.1	**4**	**50**	**400**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 310	1500 1800	730 NC	6000 350	400000 850	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC NC	40 0.7	4000 NC
502/0-0.1	0 - 0.1m	17/04/2019	<4	<0.4	**15**	**31**	**12**	<0.1	**6**	**24**	**120**	<25	<50	<25	<50	**110**	<100	<0.2	<0.5	<1	<1	<1	**1.7**	**2.4**	**17**
			3000 160	900 NC	3600 670	240000 300	1500 1800	730 NC	6000 280	400000 690	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC NC	40 0.7	4000 NC
504/0.2-0.3	0.2 - 0.3m	17/04/2019	<4	<0.4	**4**	**130**	**6**	<0.1	**5**	**35**	**480**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	**0.2**
			3000 160	900 NC	3600 670	240000 320	1500 1800	730 NC	6000 460	400000 1200	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC NC	40 0.7	4000 NC
505/0-0.1	0 - 0.1m	17/04/2019	<4	<0.4	**9**	**49**	**19**	<0.1	**6**	**43**	**420**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 290	1500 1800	730 NC	6000 270	400000 690	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC NC	40 0.7	4000 NC
507/0.2-0.3	0.2 - 0.3m	17/04/2019	<4	<0.4	<1	**200**	**10**	<0.1	**4**	**48**	**690**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 310	1500 1800	730 NC	6000 350	400000 850	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC NC	40 0.7	4000 NC
507/0.-0.1	0 - 0.1m	17/04/2019	<4	<0.4	**2**	**150**	**10**	<0.1	**4**	**42**	**670**	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			3000 160	900 NC	3600 670	240000 310	1500 1800	730 NC	6000 350	400000 850	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC NC	40 0.7	4000 NC
BR3	0 - 0.1m	17/04/2019	<4	<0.4	**2**	**130**	**9**	<0.1	**4**	**42**	**440**	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
			3000 160	900 NC	3600 670	240000 310	1500 1800	730 NC	6000 350	400000 850	60000 NC	NC NC	NC NC	310 215	NL 170	NC 2500	NC 6600	4 35	NL 135	NL 185	NL 95	NL 370	NC NC	40 0.7	4000 NC

HIL / HSL exceedance EIL / ESL exceedance ML exceedance HIL/HSL and EIL/ESL exceedance **Bold** = Lab detections Key: Lab result (HIL/HSL value / EIL/ESL value)

ML and HIL/HSL/EIL/ESL exceedance **red** = DC exceedance NT = Not tested NL = Non limiting NC = No criteria NAD = No asbestos detected

Indicates that asbestos has been detected by the lab below the PQL, refer to the lab report

Notes:

a QA/QC replicate of sample listed directly below the primary sample

HIL/HSL HIL D / HSL D - NEPC 2013, Schedule B1
EIL/ESL Commercial and Industrial - NEPC 2013, Schedule B1

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Table E2: Summary of Laboratory Results – Phenol, OCP, OPP, PCB, Asbestos (500 ml)

			Phenol	OCP								OPP	PCB	Asbestos (500 ml)
			Phenol	DDT+DDE+DDD	Aldrin & Dieldrin	Total Chlordane	Total Endosulfan	Endrin	Heptachlor	HCB	Methoxychlor	Chlorpyriphos	Total PCB	Calculated Asbestos (Nepm)
		PQL	5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Sample ID	Depth	Sampled Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
501/0.2-0.3	0.2 - 0.3m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
502/0-0.1	0 - 0.1m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
504/0.2-0.3	0.2 - 0.3m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
505/0-0.1	0 - 0.1m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	**3** 530 NC	<0.1 2000 NC	<0.1 100 NC	**0.6** 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
507/0.2-0.3	0.2 - 0.3m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	<0.1 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
507/0.-0.1	0 - 0.1m	17/04/2019	<5 660 NC	<0.1 3600 640	<0.1 45 NC	**3** 530 NC	<0.1 2000 NC	<0.1 100 NC	<0.1 50 NC	<0.1 80 NC	<0.1 2500 NC	<0.1 2000 NC	<0.1 7 NC	NAD
BR3	0 - 0.1m	17/04/2019	NT 660 NC	NT 3600 640	NT 45 NC	NT 530 NC	NT 2000 NC	NT 100 NC	NT 50 NC	NT 80 NC	NT 2500 NC	NT 2000 NC	NT 7 NC	NT

HIL / HSL exceedance EIL / ESL exceedance ML exceedance HIL/HSL and EIL/ESL exceedance **Bold** = Lab detections Key: Lab result (HIL/HSL value / EIL/ESL value)

ML and HIL/HSL/EIL/ESL exceedance **red** = DC exceedance NT = Not tested NL = Non limiting NC = No criteria NAD = No asbestos detected

Indicates that asbestos has been detected by the lab below the PQL, refer to the lab report

Notes:

a QA/QC replicate of sample listed directly below the primary sample

HIL/HSL HIL D / HSL D - NEPC 2013, Schedule B1
EIL/ESL Commercial and Industrial - NEPC 2013, Schedule B1

Appendix F

Laboratory Certificate of Analysis, Sample Receipt Advice and Chain-of –Custody Documentation

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CHAIN OF CUSTODY DESPATCH SHEET

Project No:	78505.04	**Suburb:**	Albion Park Rail	**To:**	Envirolab Services Pty Ltd
Project Name:	Proposed Passenger Terminal	**Order Number**	78505.04		12 Ashley Street, Chatswood
Project Manager:	Michael Gol	**Sampler:**	KJ	**Attn:**	Simon Song
Emails:	michael.gol@douglaspartners.com.au	kyle.johannes@douglaspartners.com.au		**Phone:**	02 9910 6200
Date Required:				**Email:**	samplereceipt@envirolabservices.com.au
Prior Storage:	Fridge	Do samples contain 'potential' HBM?	No		

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8A NEPM Asb	pH, CEC								Notes/preservation
501/0-0.1	1	17/04/19		G/P										
501/0.2-0.3	2	17/04/19		G/P	X									
501/0.5-0.6	3	17/04/19		G/P										
501//1.0-1.1	4	17/04/19		G/P										
502/0-0.1	5	17/04/19		G/P	X	X								
502/0.2-0.3	6	17/04/19		G/P										
502/0.5-0.6	7	17/04/19		G/P										
502/1.0-1.1	8	17/04/19		G/P										
503/0-0.1	9	17/04/19		G/P										
503/0.2-0.3	10	17/04/19		G/P										
503/0.5-0.6	11	17/04/19		G/P										
503/1.0-1.1	12	17/04/19		G/P										
504/0-0.1	13	17/04/19		G/P										
504/0.2-0.3	14	17/04/19		G/P	X	X								
504/0.5-0.6	15	17/04/19		G/P										
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: 210111

Date Received: 18/4/19
Time Received: 16:55
Received by: TN
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: As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Zn

Lab Report/Reference No:

Total number of samples in container: 25 **Relinquished by:** KJ **Transported to laboratory by:** First Choice

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

Signed: **Received by:** T.Nguyen 18/4/19 16:55 **Date & Time:** 18/04/2019

Analysis Recd 23410 0745

Douglas Partners
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CHAIN OF CUSTODY DESPATCH SHEET

Project No:	78505.04	**Suburb:**	Albion Park Rail	**To:**	Envirolab Services Pty Ltd
Project Name:	Proposed Passenger Terminal	**Order Number**	78505.04		12 Ashley Street, Chatswood
Project Manager:	Michael Gol	**Sampler:**	KJ	**Attn:**	Simon Song
Emails:	michael.gol@douglaspartners.com.au	kyle.johannes@douglaspartners.com.au		**Phone:**	02 9910 6200
Date Required:				**Email:**	samplereceipt@envirolabservices.com.au
Prior Storage:	Fridge	Do samples contain 'potential' HBM?	No		

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8A NEPM Asb	Analytes: pH, CEC	Analytes	Analytes	Analytes	Analytes	Analytes	Analytes	Analytes	Notes/preservation
504/1.0-1.1	16	17/04/19		G/P										
505/0-0.1	17	17/04/19		G/P	X	X								
505/0.2-0.3	18	17/04/19		G/P										
505/0.6-0.7	19	17/04/19		G/P										
505/1.1-1.2	20	17/04/19		G/P										
506/0-0.1	21	17/04/19		G/P										
507/0-0.1	22	17/04/19		G/P										
507/0.2-0.3	23	17/04/19		G/P	X									
507/0.5-0.6	24	17/04/19		G/P										
507/1.0-1.1	25	17/04/19		G/P										
BR3	26	17/04/19		G										
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐	

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

Metals to Analyse: 8HM unless specified here: As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Zn

Lab Report/Reference No:

Total number of samples in container: 25 **Relinquished by:** KJ **Transported to laboratory by:** First Choice

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

Signed: **Received by:** 21611 T. Nguyen **Date & Time:** 18/04/2019

18/4/19. Analysis Recd 23419 0745

Ellen Wandala Gamage

From: Kyle Johannes <Kyle.Johannes@douglaspartners.com.au>
Sent: Tuesday, 23 April 2019 7:45 AM
To: Customer Service
Subject: 78505.04 Illawarra Regional Airport Proposed Carpark and Terminal COCs
Attachments: Chain of Custody Despatch Sheet 78505.04 (Carpark).pdf; Chain of Custody Despatch Sheet 78505.04 (Terminal).pdf

Hi,

Please see the attached COC's for 78505.04 (Illawarra Regional Airport proposed carpark and terminal) samples that were sent last week.
Can we please get **fast turnaround (1-day)** on both COC's.

Thanks
Kyle

216111

Kyle Johannes | Environmental Engineer
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au
1/1 Luso Drive Unanderra NSW 2526 | PO Box 486 Unanderra NSW 2526
P: 02 4271 1836 | E: Kyle.Johannes@douglaspartners.com.au

Disclaimer

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 Unanderra
Attention	Michael Gol, Kyle Johannes

Sample Login Details

Your reference	78505.04, Proposed Passenger Terminal
Envirolab Reference	216111
Date Sample Received	18/04/2019
Date Instructions Received	23/04/2019
Date Results Expected to be Reported	24/04/2019

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	26 Soil
Turnaround Time Requested	1 day
Temperature on Receipt (°C)	16.3
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	Misc Inorg - Soil	Asbestos ID - soils NEPM	CEC	On Hold
501/0-0.1												✓
501/0.2-0.3	✓	✓	✓	✓	✓	✓	✓	✓		✓		
501/0.5-0.6												✓
501/1.0-1.1												✓
502/0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
502/0.2-0.3												✓
502/0.5-0.6												✓
502/1.0-1.1												✓
503/0-0.1												✓
503/0.2-0.3												✓
503/0.5-0.6												✓
503/1.0-1.1												✓
504/0-0.1												✓
504/0.2-0.3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
504/0.5-0.6												✓
504/1.0-1.1												✓
505/0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
505/0.2-0.3												✓
505/0.6-0.7												✓
505/1.1-1.2												✓
506/0-0.1												✓
507/0.-0.1												✓
507/0.2-0.3	✓	✓	✓	✓	✓	✓	✓	✓		✓		
507/0.5-0.6												✓
507/1.0-1.1												✓
BR3												✓

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 216111

Client Details

Client	Douglas Partners Unanderra
Attention	Michael Gol, Kyle Johannes
Address	Unit 1, 1 Luso Drive, Unanderra, NSW, 2526

Sample Details

Your Reference	**78505.04, Proposed Passenger Terminal**
Number of Samples	26 Soil
Date samples received	18/04/2019
Date completed instructions received	23/04/2019

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	24/04/2019
Date of Issue	24/04/2019

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Aida Marner
Authorised by Asbestos Approved Signatory: Matt Tang

Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor
Matthew Tang, Asbsestos Supervisor
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
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	%	87	83	80	96	91

svTRH (C10-C40) in Soil						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	110	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	110	<50	<50	<50
Surrogate o-Terphenyl	%	87	80	86	85	88

PAHs in Soil						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	0.3	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	1.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	2.8	0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	3.0	0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	1.3	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	1.9	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	2.5	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	1.7	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	0.9	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	1.3	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	17	0.2	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	2.4	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	2.4	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	2.4	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	97	99	93	98	92

Organochlorine Pesticides in soil						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
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	0.6	<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	0.3	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	0.4	<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	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	87	103	89	102	107

Organophosphorus Pesticides						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
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	%	87	103	89	102	107

PCBs in Soil						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
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	%	87	103	89	102	107

Acid Extractable metals in soil						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	<1	15	4	9	<1
Copper	mg/kg	210	31	130	49	200
Lead	mg/kg	12	12	6	19	10
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	4	6	5	6	4
Zinc	mg/kg	50	24	35	43	48
Manganese	mg/kg	400	120	480	420	690

Misc Soil - Inorg						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Misc Inorg - Soil				
Our Reference		216111-5	216111-14	216111-17
Your Reference	UNITS	502/0-0.1	504/0.2-0.3	505/0-0.1
Date Sampled		17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	24/04/2019	24/04/2019	24/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019
pH 1:5 soil:water	pH Units	6.1	8.4	8.2

Moisture						
Our Reference		216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference	UNITS	501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/04/2019	23/04/2019	23/04/2019	23/04/2019	23/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Moisture	%	15	21	9.2	10	12

Asbestos ID - soils NEPM						
Our Reference	UNITS	216111-2	216111-5	216111-14	216111-17	216111-23
Your Reference		501/0.2-0.3	502/0-0.1	504/0.2-0.3	505/0-0.1	507/0.2-0.3
Date Sampled		17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	24/04/2019	24/04/2019	24/04/2019	24/04/2019	24/04/2019
Sample mass tested	g	616.91	467.99	743.39	477.93	773.17
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–	–
FA and AF Estimation*	g	–	–	–	–	–
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001	<0.001

CEC				
Our Reference		216111-5	216111-14	216111-17
Your Reference	UNITS	502/0-0.1	504/0.2-0.3	505/0-0.1
Date Sampled		17/04/2019	17/04/2019	17/04/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	24/04/2019	24/04/2019	24/04/2019
Date analysed	-	24/04/2019	24/04/2019	24/04/2019
Exchangeable Ca	meq/100g	5.6	19	8.6
Exchangeable K	meq/100g	0.1	0.2	0.3
Exchangeable Mg	meq/100g	3.8	1.2	0.83
Exchangeable Na	meq/100g	0.24	<0.1	<0.1
Cation Exchange Capacity	meq/100g	9.8	20	9.7

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.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.

Method ID	Methodology Summary
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	216111-5
Date extracted	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Date analysed	-			24/04/2019	2	24/04/2019	24/04/2019		24/04/2019	24/04/2019
TRH C_6 - C_9	mg/kg	25	Org-016	<25	2	<25	<25	0	81	78
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	2	<25	<25	0	81	78
Benzene	mg/kg	0.2	Org-016	<0.2	2	<0.2	<0.2	0	73	70
Toluene	mg/kg	0.5	Org-016	<0.5	2	<0.5	<0.5	0	81	79
Ethylbenzene	mg/kg	1	Org-016	<1	2	<1	<1	0	81	76
m+p-xylene	mg/kg	2	Org-016	<2	2	<2	<2	0	84	81
o-Xylene	mg/kg	1	Org-016	<1	2	<1	<1	0	86	81
naphthalene	mg/kg	1	Org-014	<1	2	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	86	2	87	82	6	89	74

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	216111-5
Date extracted	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Date analysed	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	2	<50	<50	0	116	120
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	2	<100	<100	0	118	120
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	2	<100	<100	0	129	126
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	2	<50	<50	0	116	120
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	2	<100	<100	0	118	120
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	2	<100	<100	0	129	126
Surrogate o-Terphenyl	%		Org-003	91	2	87	88	1	96	80

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	216111-5
Date extracted	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Date analysed	-			24/04/2019	2	24/04/2019	24/04/2019		24/04/2019	24/04/2019
Naphthalene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	128	123
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	116	110
Phenanthrene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	114	#
Anthracene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	110	#
Pyrene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	114	#
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	128	#
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	2	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	2	<0.05	<0.05	0	112	#
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	92	2	97	95	2	99	97

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	216111-5
Date extracted	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Date analysed	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
HCB	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	103	100
gamma-BHC	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	109	91
Heptachlor	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	106	104
delta-BHC	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	100	99
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	105	101
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	112	111
Dieldrin	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	114	110
Endrin	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	102	98
pp-DDD	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	113	108
Endosulfan II	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	104	99
Methoxychlor	mg/kg	0.1	Org-005	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	107	2	87	108	22	91	90

QUALITY CONTROL: Organophosphorus Pesticides						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	216111-5
Date extracted	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Date analysed	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	88	109
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	91	87
Dimethoate	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	105	110
Fenitrothion	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	100	107
Malathion	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	76	73
Parathion	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	87	90
Ronnel	mg/kg	0.1	Org-008	<0.1	2	<0.1	<0.1	0	90	114
Surrogate TCMX	%		Org-008	107	2	87	108	22	84	103

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	216111-5
Date extracted	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Date analysed	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	2	<0.1	<0.1	0	100	109
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	107	2	87	108	22	84	103

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	216111-5
Date prepared	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Date analysed	-			23/04/2019	2	23/04/2019	23/04/2019		23/04/2019	23/04/2019
Arsenic	mg/kg	4	Metals-020	<4	2	<4	<4	0	104	96
Cadmium	mg/kg	0.4	Metals-020	<0.4	2	<0.4	<0.4	0	105	100
Chromium	mg/kg	1	Metals-020	<1	2	<1	<1	0	99	101
Copper	mg/kg	1	Metals-020	<1	2	210	180	15	103	111
Lead	mg/kg	1	Metals-020	<1	2	12	10	18	98	95
Mercury	mg/kg	0.1	Metals-021	<0.1	2	<0.1	<0.1	0	106	111
Nickel	mg/kg	1	Metals-020	<1	2	4	3	29	98	96
Zinc	mg/kg	1	Metals-020	<1	2	50	43	15	100	94
Manganese	mg/kg	1	Metals-020	<1	2	400	260	42	99	#

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			24/04/2019	2	24/04/2019	24/04/2019		24/04/2019	[NT]
Date analysed	-			24/04/2019	2	24/04/2019	24/04/2019		24/04/2019	[NT]
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	2	<5	<5	0	93	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			24/04/2019	[NT]	[NT]	[NT]	[NT]	24/04/2019	[NT]
Date analysed	-			24/04/2019	[NT]	[NT]	[NT]	[NT]	24/04/2019	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			24/04/2019	[NT]	[NT]	[NT]	[NT]	24/04/2019	[NT]
Date analysed	-			24/04/2019	[NT]	[NT]	[NT]	[NT]	24/04/2019	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	105	[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

PAHs in Soil - # Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample 5 has caused interference.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Note: All samples analysed as received. However, samples 216111-5 & 17 are below the minimum 500mL sample volume as per National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.

Acid Extractable Metals in Soil:
Percent recovery is not possible to report due to the inhomogeneous nature of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Andrew Fitzsimons

From: Nancy Zhang
Sent: Wednesday, 1 May 2019 10:16 AM
To: Customer Service
Subject: FW: 78505.04, Proposed Passenger Terminal and Long Stay Carpark

Ref: 216111-A

Regards,

TAT: 1 day
Due: 2/5/19

Nancy Zhang | Laboratory Manager, Sydney | Envirolab Services Pty Ltd

Great Science, Great Service.

12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 F 612 9910 6201
E nzhang@envirolab.com.au | W www.envirolab.com.au

From: Kyle Johannes [mailto:Kyle.Johannes@douglaspartners.com.au]
Sent: Wednesday, 1 May 2019 7:49 AM
To: SydneyMailbox <sydney@envirolab.com.au>
Subject: 78505.04, Proposed Passenger Terminal and Long Stay Carpark

Hi,

Could I please get the following tested and added to the respective COC's.

For 78505.04 Proposed Long Stay Carpark:
Could I get **BR1 tested for metals.**

NEPM ASB

For **78505.04 Proposed Passenger Terminal**
Could I get **507/0-0.1 tested for Combo 8A and BR3 tested for metals.**

#22 #26

Could get all of these tested **on a very fast turnaround (1-day).**

Much Appreciated,
Kyle

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 Unanderra
Attention	Kyle Johannes

Sample Login Details

Your reference	78505.04, Proposed Passenger Terminal
Envirolab Reference	216111-A
Date Sample Received	18/04/2019
Date Instructions Received	01/05/2019
Date Results Expected to be Reported	02/05/2019

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	26 Soil
Turnaround Time Requested	1 day
Temperature on Receipt (°C)	16.3
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
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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 NEPM	On Hold
501/0-0.1										✓
501/0.2-0.3										✓
501/0.5-0.6										✓
501/1.0-1.1										✓
502/0-0.1										✓
502/0.2-0.3										✓
502/0.5-0.6										✓
502/1.0-1.1										✓
503/0-0.1										✓
503/0.2-0.3										✓
503/0.5-0.6										✓
503/1.0-1.1										✓
504/0-0.1										✓
504/0.2-0.3										✓
504/0.5-0.6										✓
504/1.0-1.1										✓
505/0-0.1										✓
505/0.2-0.3										✓
505/0.6-0.7										✓
505/1.1-1.2										✓
506/0-0.1										✓
507/0.-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓	
507/0.2-0.3										✓
507/0.5-0.6										✓
507/1.0-1.1										✓
BR3							✓			

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
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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 216111-A

Client Details

Client	Douglas Partners Unanderra
Attention	Kyle Johannes
Address	Unit 1, 1 Luso Drive, Unanderra, NSW, 2526

Sample Details

Your Reference	**78505.04, Proposed Passenger Terminal**
Number of Samples	26 Soil
Date samples received	18/04/2019
Date completed instructions received	01/05/2019

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	02/05/2019
Date of Issue	02/05/2019

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

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

Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Jeremy Faircloth, Operations Manager, Sydney
Lucy Zhu, Senior Asbestos Analyst
Nancy Zhang, Laboratory Manager, Sydney
Nick Sarlamis, Inorganics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		216111-A-22
Your Reference	UNITS	507/0.-0.1
Date Sampled		17/04/2019
Type of sample		Soil
Date extracted	-	01/05/2019
Date analysed	-	02/05/2019
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	129

svTRH (C10-C40) in Soil		
Our Reference		216111-A-22
Your Reference	UNITS	507/0.-0.1
Date Sampled		17/04/2019
Type of sample		Soil
Date extracted	-	01/05/2019
Date analysed	-	02/05/2019
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	80

PAHs in Soil		
Our Reference		216111-A-22
Your Reference	UNITS	507/0.-0.1
Date Sampled		17/04/2019
Type of sample		Soil
Date extracted	-	01/05/2019
Date analysed	-	01/05/2019
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Total +ve PAH's	mg/kg	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Surrogate p-Terphenyl-d14	%	108

Organochlorine Pesticides in soil		
Our Reference		216111-A-22
Your Reference	UNITS	507/0.-0.1
Date Sampled		17/04/2019
Type of sample		Soil
Date extracted	-	01/05/2019
Date analysed	-	02/05/2019
HCB	mg/kg	<0.1
alpha-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	0.2
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	95

Organophosphorus Pesticides		
Our Reference		216111-A-22
Your Reference	UNITS	507/0.-0.1
Date Sampled		17/04/2019
Type of sample		Soil
Date extracted	-	01/05/2019
Date analysed	-	02/05/2019
Azinphos-methyl (Guthion)	mg/kg	<0.1
Bromophos-ethyl	mg/kg	<0.1
Chlorpyriphos	mg/kg	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1
Diazinon	mg/kg	<0.1
Dichlorvos	mg/kg	<0.1
Dimethoate	mg/kg	<0.1
Ethion	mg/kg	<0.1
Fenitrothion	mg/kg	<0.1
Malathion	mg/kg	<0.1
Parathion	mg/kg	<0.1
Ronnel	mg/kg	<0.1
Surrogate TCMX	%	95

PCBs in Soil		
Our Reference		216111-A-22
Your Reference	UNITS	507/0.-0.1
Date Sampled		17/04/2019
Type of sample		Soil
Date extracted	-	01/05/2019
Date analysed	-	02/05/2019
Aroclor 1016	mg/kg	<0.1
Aroclor 1221	mg/kg	<0.1
Aroclor 1232	mg/kg	<0.1
Aroclor 1242	mg/kg	<0.1
Aroclor 1248	mg/kg	<0.1
Aroclor 1254	mg/kg	<0.1
Aroclor 1260	mg/kg	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1
Surrogate TCLMX	%	95

Acid Extractable metals in soil			
Our Reference		216111-A-22	216111-A-26
Your Reference	UNITS	507/0.-0.1	BR3
Date Sampled		17/04/2019	17/04/2019
Type of sample		Soil	Soil
Date prepared	-	02/05/2019	02/05/2019
Date analysed	-	02/05/2019	02/05/2019
Arsenic	mg/kg	<4	<4
Cadmium	mg/kg	<0.4	<0.4
Chromium	mg/kg	2	2
Copper	mg/kg	150	130
Lead	mg/kg	10	9
Mercury	mg/kg	<0.1	<0.1
Nickel	mg/kg	4	4
Zinc	mg/kg	42	42
Manganese	mg/kg	670	440

Misc Soil - Inorg		
Our Reference		216111-A-22
Your Reference	UNITS	507/0.-0.1
Date Sampled		17/04/2019
Type of sample		Soil
Date prepared	-	02/05/2019
Date analysed	-	02/05/2019
Total Phenolics (as Phenol)	mg/kg	<5

Moisture			
Our Reference		216111-A-22	216111-A-26
Your Reference	UNITS	507/0.-0.1	BR3
Date Sampled		17/04/2019	17/04/2019
Type of sample		Soil	Soil
Date prepared	-	01/05/2019	01/05/2019
Date analysed	-	02/05/2019	02/05/2019
Moisture	%	12	7.0

Asbestos ID - soils NEPM		
Our Reference		216111-A-22
Your Reference	UNITS	507/0.-0.1
Date Sampled		17/04/2019
Type of sample		Soil
Date analysed	-	02/05/2019
Sample mass tested	g	859.35
Sample Description	-	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected
Total Asbestos#1	g/kg	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected
ACM >7mm Estimation*	g	–
FA and AF Estimation*	g	–
FA and AF Estimation*#2	%(w/w)	<0.001

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.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.

Method ID	Methodology Summary
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date extracted	-			01/05/2019	[NT]	[NT]	[NT]	[NT]	01/05/2019	[NT]
Date analysed	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	88	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	88	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	95	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	91	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	86	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	84	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	117	[NT]	[NT]	[NT]	[NT]	93	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date extracted	-			01/05/2019	[NT]	[NT]	[NT]	[NT]	01/05/2019	[NT]
Date analysed	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	95	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	102	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	95	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	102	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate o-Terphenyl	%		Org-003	92	[NT]	[NT]	[NT]	[NT]	121	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date extracted	-			01/05/2019	[NT]	[NT]	[NT]	[NT]	01/05/2019	[NT]
Date analysed	-			01/05/2019	[NT]	[NT]	[NT]	[NT]	01/05/2019	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	122	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	124	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	[NT]	[NT]	120	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	106	[NT]	[NT]	[NT]	[NT]	111	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date extracted	-			01/05/2019	[NT]	[NT]	[NT]	[NT]	01/05/2019	[NT]
Date analysed	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
HCB	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	107	[NT]
gamma-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Heptachlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	111	[NT]
delta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Dieldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Endrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	108	[NT]
pp-DDD	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Endosulfan II	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Methoxychlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-005	100	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: Organophosphorus Pesticides					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date extracted	-			01/05/2019	[NT]	[NT]	[NT]	[NT]	01/05/2019	[NT]
Date analysed	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Dimethoate	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Fenitrothion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	126	[NT]
Malathion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Parathion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Ronnel	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Surrogate TCMX	%		Org-008	100	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: PCBs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date extracted	-			01/05/2019	[NT]	[NT]	[NT]	[NT]	01/05/2019	[NT]
Date analysed	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCLMX	%		Org-006	100	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date prepared	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
Date analysed	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	103	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	109	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Manganese	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	122	[NT]

QUALITY CONTROL: Misc Soil - Inorg					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-12	[NT]
Date prepared	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
Date analysed	-			02/05/2019	[NT]	[NT]	[NT]	[NT]	02/05/2019	[NT]
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	[NT]	[NT]	[NT]	[NT]	102	[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-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Appendix G

Data Quality Assessment

DATA QUALITY ASSESSMENT

Q1. Data Quality Objectives

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

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

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

Table Q1: Data Quality Objectives

Data Quality Objective	Report Section where Addressed
State the Problem	S1 Introduction
Identify the Decision	S1 Introduction (objective) S9 Discussion S10 Conclusion and Recommendations
Identify Inputs to the Decision	S1 Introduction S2 Scope of Works S3 Site Identification and Description S4 Background S5 Conceptual Site Model S7 Site Assessment Criteria S8 Results
Define the Boundary of the Assessment	S3 Site Identification and Description Drawing 1 - Appendix B
Develop a Decision Rule	S7 Site Assessment Criteria
Specify Acceptable Limits on Decision Errors	S6 Sample Analysis Plan S7 Site Assessment Criteria S8 Results QA/QC Procedures and Results – Sections Q2, Q3
Optimise the Design for Obtaining Data	S2 Scope of Works S6 Sample Analysis Plan QA/QC Procedures and Results – Sections Q2, Q3

Q2. FIELD AND LABORATORY QUALITY CONTROL

The field and laboratory quality control (QC) procedures and results are summarised in Tables Q2 and Q3. Reference should be made to the field work and analysis procedures in Section 7 and the laboratory results certificates in Appendix I for further details.

Table Q2: Field QC

Item	Frequency	Acceptance Criteria	Achievement
Intra-laboratory replicates	5% primary samples	RPD <30% inorganics), <50% (organics)	yes[1]
Inter-laboratory replicates	5% primary samples	RPD <30% inorganics), <50% (organics)	no[2]
Trip Spikes	1 per field batch	60-140% recovery	no[2]
Trip Blanks	1 per field batch	<PQL/LOR	no[2]
Rinsates	1 per day	<PQL/LOR	no[2]

NOTES: 1 qualitative assessment of RPD results overall; refer Section Q2.1
2 not relevant to current investigation

Table Q3: Laboratory QC

Item	Frequency	Acceptance Criteria	Achievement
Analytical laboratories used		NATA accreditation[1]	yes
Holding times		In accordance with NEPC (2013) which references various Australian and international standards	yes
Laboratory / Reagent Blanks	1 per lab batch	<PQL	yes
Laboratory duplicates	10% primary samples	Laboratory specific [2]	
Matrix Spikes	1 per lab batch	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes
Surrogate Spikes	organics by GC	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes
Control Samples	1 per lab batch	70-130% recovery (inorganics); 60-140% (organics); 10-140% (SVOC, speciated phenols)	yes

NOTES: 1 National Association of Testing Authorities
2 Envirolab Service Pty Ltd (ELS): <5xPQL – any RPD; >5xPQL – 0-50%RPD

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

Q2.1 Intra-Laboratory Replicates

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

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

Table Q4: Relative Percentage Difference Results – Intra-laboratory Replicates

Lab	Sample ID	Date Sampled	Media	Units	Metals								
					As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Mn
ELS	507/0-0.1	17/04/2019	filling	mg/kg	<4	<0.4	2	150	10	<0.1	4	42	670
ELS	BR3	17/04/2019	filling	mg/kg	<4	<0.4	2	130	9	<0.1	4	42	440
Difference				mg/kg	0	0	0	20	1	0	0	0	230
RPD				%	0	0	0	14	11	0	0	0	41

Notes: - not applicable, not tested

The calculated RPD values were within the acceptable range of ± 30% for inorganic analytes and ± 50% for organic analytes with the exception of one value (those in bold) out of nine calculated values. However, this is not considered to be significant because: The replicate pair were collected from fill soils which were observed to be heterogeneous in composition;

- Soil replicates, rather than homogenised soil duplicates, were used to minimise the risk of possible volatile loss, hence greater variability can be expected;
- The majority of RPDs within a replicate pair being within the acceptable limits; and
- All other QA/QC parameters met the DQIs.

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

Q3. Data Quality Indicators

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

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

The DQIs were assessed as outlined in Table Q5.

Table Q5: Data Quality Indicators

Data Quality Indicator	Method(s) of Achievement
Completeness	Planned systematic locations sampled; Preparation of field logs, sample location plan and chain of custody (CoC) records; Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the chain of custody; Samples analysed for contaminants of potential concern (CoPC) identified in the Conceptual Site Model (CSM); Completion of CoC documentation; NATA endorsed laboratory certificates provided by the laboratory; Satisfactory frequency and results for field and laboratory QC samples as discussed in Section Q2.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project; Works undertaken by appropriately experienced and trained DP environmental scientist / engineer; Use of NATA registered laboratory; Satisfactory results for field and laboratory QC samples.
Representativeness	Target media sampled; Spatial and temporal distribution of sample locations; Sample numbers recovered and analysed are considered to be representative of the target media and complying with DQOs; Samples were extracted and analysed within holding times; Samples were analysed in accordance with the analysis request.
Precision	Acceptable RPD between original samples and replicates; Satisfactory results for all other field and laboratory QC samples.
Accuracy	Satisfactory results for all field and laboratory QC samples.

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