Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Preliminary Site Investigation (Contamination)

Proposed Rezoning
Webber Circuit, Bardia, NSW

Prepared for
Jessica Investments Pty Ltd
c/- ACOR Consultants Pty Ltd

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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.

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1. Introduction

Douglas Partners Pty Ltd (DP) has been engaged by ACOR Consultants Pty Ltd (ACOR) on behalf of Jessica Investments Pty Ltd to complete a preliminary site investigation (contamination) (PSI). The PSI was undertaken for the rezoning of Lot 39 (southern portion) and Lot 40 (northern portion) Webber Circuit, Bardia, NSW (hereinafter referred to as the 'site'). The site location and layout are shown on Drawing 1, Appendix A.

It is understood that Campbelltown City Council (Council) has requested that a PSI be undertaken as part of the gateway determination to rezone the site for R3 development (Lot 39) and parkland (Lot 40). Council require the PSI to be completed to ensure consistency with S 9.1[1] Ministerial Direction, 2.6 Remediation of (Contaminated) Land, i.e. to provide advice on the suitability of the site for the proposed rezoning and establish whether or not further investigations are required for the proposed development.

The objective of the PSI is to address Council's request and assess the potential for contamination at the site based on past and present land uses and to comment on the need for further investigation and/or management with regard to the proposed re-zoning. It is understood that the report will be used to support a development application (DA) for the proposed re-zoning.

The following key guidelines were consulted in the preparation of this report:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013); and
- NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020).

This report must be read in conjunction with all appendices including the notes provided in Appendix B.

2. Scope of Works

DP completed the following scope of works for the PSI:

- Review of geological, soil, acid sulfate soil, salinity and hydrogeological published information to assess and document the site's environmental setting;
- Review of historical aerial imagery for the site and immediate surrounds through the Spatial Services section of the NSW Department of Customer Service and MetroMap;

[1] Direction issued under Section 9.1 (2) of the Environmental Planning and Assessment Act 1979. It is noted that the text quoted by Council states "S 9.11" however DP believes this to be an error or typo and is intended to refer to S 9.1.

- Search of the NSW EPA Land Information records for any relevant statutory notices or licences current on any parts of the site or nearby surrounds under the *Contaminated Land Management* (CLM) Act 1997 and the *Protection of the Environment Operations* (POEO) Act 1997;
- Search for groundwater bores on or adjacent to the site registered with the NSW Office of Water;
- Undertake a site walkover to identify potential areas of environmental concern (PAEC);
- Drill eight boreholes using a hand auger and excavate six inspection test pits using a shovel;
- From the eight boreholes, collect and analyse 11 shallow soil samples from a mixture of targeted and background locations across the site;
- Screen all samples with a photoionization detector (PID) to assess samples for the potential presence of volatile substances;
- Analysis of the 11 soil samples at a National Association of Testing Authorities (NATA) laboratory for a range of potential contaminants including:
  - Total recoverable hydrocarbons (TRH);
  - Benzene, toluene, ethyl benzene and xylene (BTEX);
  - Metals/metalloids (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
  - Polycyclic aromatic hydrocarbons (PAH);
  - Total phenols;
  - Organochlorine pesticides (OCP), organophosphorus pesticides (OPP) and polychlorinated biphenyls (PCB); and
  - Asbestos (presence/absence).

  It is noted that Volatile Organic Compounds, including solvents (VOCs) were not analysed as per the proposal as analysis was considered unnecessary based on the findings of the site history and the PID results.
- Selected samples were also analysed for physico-chemical characteristics including pH, EC and cation exchange capacity to establish appropriate ecological investigation levels (EILs); and
- Collect and analyse one replicate sample for TRH, BTEX and metals for quality control (QC) purposes.
- Preparation of a preliminary conceptual site model (CSM);
- Analysis of soil results against human health and ecological health guidelines provided in NEPC (2013); and
- Preparation of this report

3. Site Information

Site Address	Webber Circuit, Bardia, NSW
Legal Description	Lots 39 (southern portion) and 40 (northern portion) Deposited Plan 280076
Area	Lot 39: 6,331 m^2 Lot 40: 2,738 m^2
Zoning	RE2 Private Recreation
Local Council Area	Campbelltown City Council
Current Use	Vacant
Surrounding Uses	North –Residential and the South-West Rail Link East – The Hume Highway beyond which is open space and residential land use South – The Hume Highway beyond which is residential land use South West – Open space/recreational parkland West – Residential It is noted that the Meadows Swimming Pool is located between the two properties that make up the site

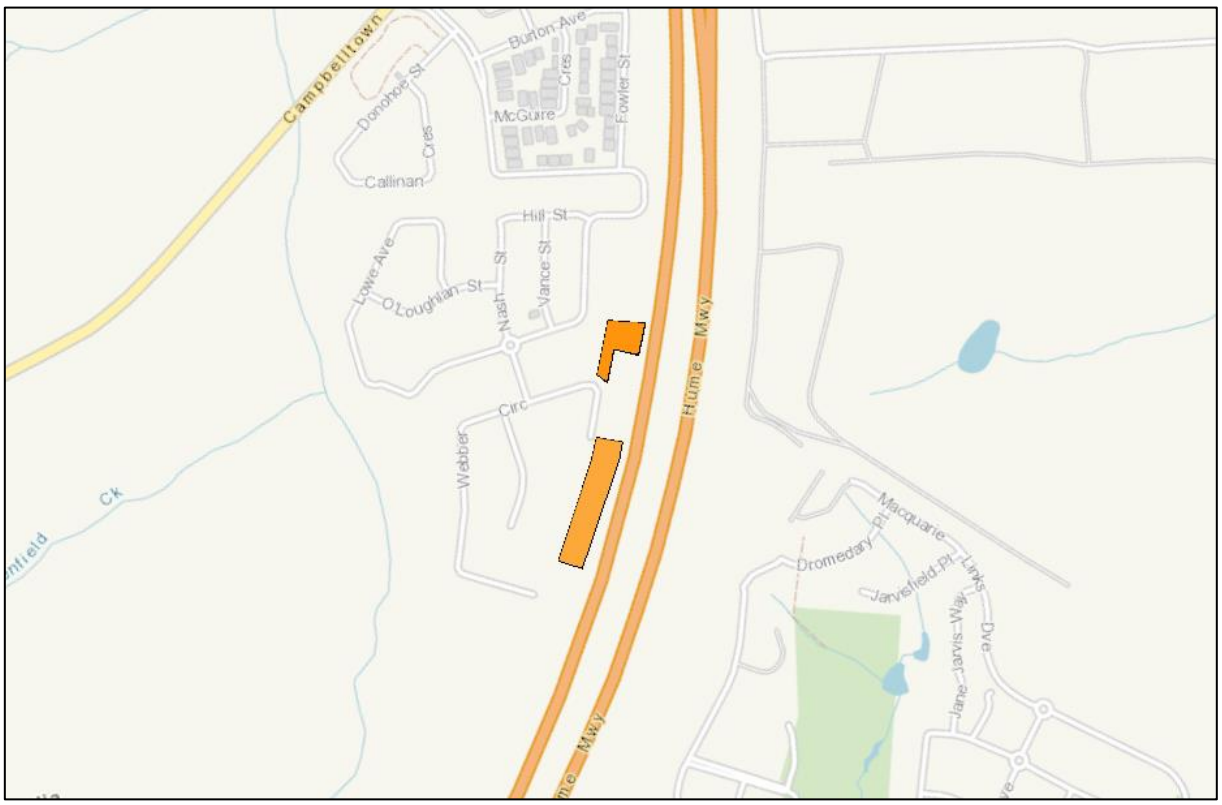

Figure 1: Site Location (shown in orange)

4. Environmental Setting

Regional Topography	With reference to NSW 2 m Contour Maps, the surrounding topography comprises mild undulating hills with peaks of approximately 68 m Australian Height Datum (AHD)
Site Topography	With reference to NSW 2 m Contour Maps, the site appears relatively flat - located at approximately 58 m to 60 m AHD
Soil Landscape	With reference to the Penrith 1:100 000 Soils Landscape Sheet, the site is located in the Blacktown Soils Landscape Group. Natural soils at the site are expected to comprise residual clays
Geology	With reference to the Penrith 1:100 000 Geology Sheet, the site is underlain with Bringelly Shale of the Wianamatta Group. The expected geology is expected to comprise shale, laminate, claystone, lithic sandstone, rare coal and tuff
Acid Sulfate Soils	With reference to Department of Infrastructure, Planning and Natural Resources (2002) *Salinity Potential of Western Sydney*, the site is located within an area of "Moderate Salinity Potential"
Salinity	With reference to Data NSW *Acid Sulfate Soils Planning Maps*, the site is located within an area of "Extremely Low Probability of Occurrence" for acid sulfate soils
Surface Water	The closest surface water (with the exception of The Meadows Swimming Pool) is Bunbury Curran Creek, a non-perennial watercourse located approximately 250 m west of the site
Groundwater	Based on the site topography, groundwater is expected to flow west, towards Bunbury Curran Creek A search of the publicly available registered groundwater bore database indicated that there is one registered groundwater bore within 1 km of the site. The bore (identified as GW104018) is located approximately 600 m southeast the site and was listed as a "test bore". No groundwater or salinity data was provided

5. Site History

5.1 Historical Aerial Photography

Several historical aerial photographs were obtained from public databases with recent aerial imagery obtained from MetroMap. Extracts of the aerial photographs are included in Appendix C. A summary of key features observed for the site and surrounding land is presented in Table 1.

Table 1: Summary of Historical Aerial Photographs

Year	Site	Surrounding Land Use
1956 – Drawing C1	The site comprised cleared and vacant land consistent with a likely pastoral land use	The surrounds comprised cleared lands consistent with likely pastoral land use. An area to the north appeared to have been cleared for potential agricultural crops. A number of tracks have been constructed
1965 – Drawing C2	The site appeared to have been subdivided into agricultural /pastoral lots. No structures were present and the site remained vacant	As with the site, the surrounds appeared to have been subdivided into agricultural or pastoral lots
1975 – Drawing C3	The land use appeared consistent with the previous photograph	The Hume Highway has been constructed to the east and south of the site. Some land disturbances (tracks) are observed to the southwest, likely associated with the construction of the Hume Highway
1986 – Drawing C4	The site and surrounding land use appeared consistent with the previous photograph	
1994 – Drawing C5	The site and surrounding land use appeared consistent with the previous photograph	
2005 – Drawing C6	The site appeared relatively unchanged from the previous photograph	The construction of roads associated with the adjacent subdivisions has begun to the northwest and southeast.
2016 – No drawing provided	Ground disturbances (tracks) were observed through the site likely associated with the adjacent subdivision works	Bulk earthworks and road construction was in progress for the adjacent subdivision (to the northwest).
2018 – Drawing C7	The site was being utilised for the stockpiling of soils and building materials associated with the adjacent subdivision. The area to the north of Lot 39, and Lot 40 appeared to be covered in aggregate/temporary hardstand for a potential site compound. Shipping containers and potential site sheds were present in Lot 40	House and road construction was in progress for the adjacent subdivision (to the northwest).
2019 – Drawing C8	The site had been cleared of stockpiled, stored and applied materials (i.e. road base) with the exception of one area of stockpiled soil in the north of Lot 40. The site appeared vacant and cleared of vegetation. It is possible that fill had also been applied to site based on the lack of vegetation.	House and road construction was in progress for the adjacent subdivision (to the northwest).

Except for vegetation regrowth, and the importation of small sand stockpiles in the centre of the Lot 40, no significant apparent changes have occurred on site since the 2019 photograph.

The site appeared to comprise vacant, cleared, likely pastoral land use since prior to 1956 to 2014 when the northern portion of the site (Lot 39) appeared to be used as a compound associated with the adjacent subdivision.

The surrounds largely appeared to comprised vacant pastoral land use until the construction of the Hume Highway (observed in the 1975 photograph), the construction of roads associated with the adjacent subdivision commencing 2009, the construction of the South-West Rail Line between 2009 and 2014, and the construction of the adjacent residential subdivision between 2014 and 2016.

5.2 Public Registers and Planning Records

EPA Notices	No Notices for the site or any site within 1 km; accessed 8 April 2021
EPA Licences	No Notices for the site or any site within 1 km; accessed 8 April 2021
SafeWork NSW	Search not undertaken due to the previous and current land use
Council Records	No records were available at the time of reporting

5.3 Interviews

Based on phone conversations and emails with Josh Craggs of ACOR (dated 4 and 15 March 2021), the north of Lot 39 was used as a temporary compound for the storage of sheds and various building materials and the parking of vehicles and plant. It was reported that no re-fuelling or maintenance was undertaken in the compound areas, which were covered in road-base gravel. Lot 39 was used for the temporary storage of stockpiles.

Based on the JDC *Cut and Fill Diagram* (ref. NW150149) dated December 2016, (i.e. the cut and fill plans) provided by ACOR, a portion of land in the centre of Lot 39 was in an area of fill up to 1 m in depth. A copy of the cut and fill plan is provided in Appendix C.

Upon the completion of works, the compounds were decommissioned, and the sheds and road-base gravel were removed. No known potential contamination was expected to have been introduced to the site (such as potential asbestos waste) and no potentially contaminating activities were known to have taken place (such as chemical spills). No chemicals were reported to be stored on site. The stockpiled material in Lot 39 is to be removed and disposed of off-site. The date of this removal is currently unknown.

5.4 Other Sources

With reference to Campbelltown City Council, History of Bardia[2] and NSW Office of Heritage[3], the Bardia Military Barracks, located approximately 1.7 km to the west of the site was in operation between 1939 and 1997. Operations at the barracks included military training. It is noted that based on available information, no military operations have been identified to have occurred on the site or immediate surrounds. Military operations appear to have been confined to the barracks.

5.5 Site History Integrity Assessment

The information used to establish the history of the site was sourced from reputable and reliable reference documents, many of which were official records held by Government departments/agencies. The databases maintained by various Government agencies potentially can contain high quality information, but some of these do not contain any data.

In particular, aerial photographs provide high quality information that is generally independent of memory or documentation. They are only available at intervals of several years, so some gaps exist in the information from this source. The observed site features are open to different interpretations and can be affected by the time of day and/or year at which they were taken, as well as specific events, such as flooding. Care has been taken to consider different possible interpretations of aerial photographs and to consider them in conjunction with other lines of evidence.

5.6 Summary of Site History

The site appeared to comprise vacant, cleared, likely pastoral land use since prior to 1956 to 2018 when the northern portion of the site was used as a site compound for the storage of site sheds, soils, plant and construction materials associated with the adjacent subdivision.

By 2019, the site had been cleared of stored site sheds and road based with the exception of one stockpile in the north of Lot 40. Based on the cut and fill plan, up to 1 m of fill was placed in a small area in the centre of Lot 40 (refer cut and fill plan – Appendix C).

Upon the completion of works, the compounds were decommissioned, and the sheds and road-base gravel were removed. No known potential contamination was expected to have been introduced to the site (such as potential asbestos waste) and no potentially contaminating activities were known to have taken place (such as chemical spills). No chemicals were reported to be stored on site. The stockpiled material in Lot 39 is to be removed and disposed of off-site. The date of this removal is currently unknown.

[2] https://www.campbelltown.nsw.gov.au/AboutCampbelltown/History/Historyofoursuburbs/HistoryofBardia Accessed 8 April 2021
[3] https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5060333 Accessed 8 April 2021

6. Preliminary Conceptual Site Model

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

Potential Sources

Based on the current investigation, the following potential sources of contamination and associated contaminants of potential concern (CoPC) have been identified.

- S1: Fill: Associated with the storage of stockpiled materials and potential levelling of site.
  - Various CoPC and may include metals/metalloids, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylene (BTEX), polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), organochlorine pesticides (OCP), phenols and asbestos.
- S2: Potential spills from stored vehicles/plant.
  - CoPC include TRH and BTEX.

Potential Receptors

The following potential human receptors have been identified:

- R1: Construction and maintenance workers;
- R2: End users [residential and recreational]; and
- R3: Adjacent site users [residential].

The following potential environmental receptors have been identified:

- R4: Surface water [Bunbury Curran Creek located 250 m west (i.e. downgradient) of the site];
- R5: Groundwater; and
- R6: Terrestrial ecology.

Potential Pathways

The following potential pathways have been identified:

- P1: Ingestion and dermal contact;
- P2: Inhalation of dust and/or vapours;
- P3: Surface water run-off;
- P4: Lateral migration of groundwater providing base flow to water bodies;
- P5: Leaching of contaminants and vertical migration into groundwater; and
- P6: Contact with terrestrial ecology.

Summary of Potentially Complete Exposure Pathways

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways (potential complete pathways). The possible pathways between the above sources (S1 to S2) and receptors (R1 to R5) are provided in below Table 2.

Table 2: Summary of Potentially Complete Exposure Pathways

Source and COPC	Transport Pathway	Receptor	Risk Management Action
S1: Fill: Metals/metalloids, TRH, BTEX, PAH, OCP and asbestos S2: Potential spills: TRH, BTEX and metals	P1: Ingestion and dermal contact P2: Inhalation of dust and/or vapours P3: Surface water run-off P4: Lateral migration of groundwater providing base flow to water bodies P5: Leaching of contaminants and vertical migration into groundwater P6: Contact with terrestrial ecology	R1: Construction and maintenance workers R2: End users residential and recreational] R3: Adjacent site users [residential]. R4: Surface water [Bunbury Curran Creek located 250 m west (ie: downgradient) of the site]; R5: Groundwater; and R6: Terrestrial ecology.	An intrusive soil investigation is recommended to assess for the presence of possible contamination

7. Site Assessment Criteria

The Site Assessment Criteria (SAC) applied in this PSI have been informed by the proposed land use (i.e. public recreation) and the CSM - which identified human and ecological receptors to potential contamination on the site. Analytical results are to be assessed (as a Tier 1 assessment) against the adopted investigation and screening levels as per Schedule B1 of NEPC (2013).

As the site is proposed to be developed for public recreation, the investigation and screening levels adopted are consistent with generic residential and public recreation land use scenarios. The derivation of the SAC is included in Appendix D and the adopted SAC are listed in the analytical results tables Table F1 presented in Appendix F).

8. Field Work

8.1 Site Walkover

A site walkover was undertaken during field works by a DP environmental scientist on 3 February 2021. The general site topography was consistent with that described in Section 4. The site layout appears to have remained unchanged from the 2019 aerial photograph. The following key site features pertinent to the PSI were observed (refer to photographs presented in Appendix E).

- Areas of exposed fill were observed in four locations across the site. Trace non-soil aggregate and demolition waste (brick, porcelain and terracotta tile, glass and concrete) were also observed (Photograph 1);
- The stockpile in the north (Lot 40) comprised of multiple soil stockpiles. The stockpile area measured approximately 16 m x 13 m 1 m (LxWxH). The stockpiles contained soil, demolition waste (bricks, tile, glass and concrete) and woodchips;
- Apart from demolition waste on the surface, no other obvious signs of potential contamination (i.e. staining, odours or potential asbestos-containing materials (PACM)) were observed; and
- Long grass prevented the inspection of the ground surface in multiple locations.

8.2 Data Quality Objectives

The field investigation was designed in accordance with the seven-step data quality objectives (DQO) process provided in Appendix D, Schedule B2 of the ASC NEPM. The DQO adopted for this investigation is provided in Appendix D.

8.3 Sampling Rationale

The adopted sampling rationale is provided in Table 4 below.

Table 4: Sampling and Analysis Rationale

Test pit/ Surface Sample ID	Location and Sample Rationale	Laboratory Analysis
BH1 and TP12	Stockpiles located at Lot 30	Metals/metalloids, TRH, BTEX, PAH, OCP, OPP, PCB, phenols, and asbestos
BH2, BH3, BH4, TP10 and TP11	Former compound at Lot 39 (applied gravel and stockpiled material) / exposed fill area	
BH5, BH6, BH7 and BH9	Former compound at Lot 40 (stored vehicles / site shed and applied gravel) / exposed fill area	
BH8	Former stockpiled fill location and area of fill (as per cut and fill plan)	
TP13 and TP14	Former stockpile/exposed fill area	

The sample locations are presented in Drawing 1, Appendix A.

As the stockpiled materials in Lot 39 are reported by to be removed from site (as stated in Section 5.3), they were not tested as a part of this assessment.

8.4 Methodology

Field investigations were undertaken on 3 and 17 March 2020 28 April 2020 by a DP Environmental Scientist and comprised the excavation of:

- Eight bore holes (BH1 to BH8) to depths of between 0.25 m and 1.0 m bgl using a hand auger; and
- Six inspection test pits (TP9 to TP14) to depths of between 0.25 m and 0.4 m bgl using a shovel – no samples were collected from inspection test pits.

All samples collected were recorded on DP bore hole and test pit logs (Appendix D) with samples selected for analysis also recorded on Chain-of-Custody (CoC) documentation.

The general adopted soil sampling collection procedure is summarised below:

- Collection of soil samples was completed using disposable sampling equipment (new nitrile glove for each sample). Samples were collected from the centre of the excavated soil taking care to not include soil that was directly in contact with either the surface of the centre of the auger;
- Transfer of soil samples into laboratory-prepared glass jars, filled to ensure the headspace within the sample jar is minimised, and capping immediately with a Teflon® lined lid to minimise loss of volatiles;
- Label sample containers with individual and unique identification details, including project number, sample location and sample depth;
- Place the glass jars into a cooled, insulated and sealed container for transport to the laboratory; and
- Collection of additional replicate samples at a rate of 10% for quality control (QC) requirements.

Soil samples were collected at the surface of each borehole location and from the underlying natural materials.

9. Results

9.1 Field Work Results

The test pit logs are included in Appendix E and should be read in conjunction with the accompanying standard notes defining classification methods and descriptive terms. Selected representative photographs taken during field work are provided in Appendix C.

Field work was undertaken during mild and sunny conditions.

The succession of strata observed in the test pits is broadly summarised as follows.

FILL Type 1: Brown and red brown silty clay and clayey silt with gravel and rootlets in all test locations to depths generally ranging between 0.15 m and 0.2 m with a depth of 0.45 m reported in BH6 and of 0.7 m in BH8. BH2 terminated in fill (due to refusal) at 0.6 m depth.

FILL Type2: Brown sand and gravel in BH1, BH3, TP12. BH3 and TP12 was reported to a depth of 0.4 m bgl with the BH1 refusing on sandy gravel.

All test pits apart from BH1 and BH2 terminated in natural grey mottled red silty clay.

Except for trace demolition on the surface, no apparent signs of potential contamination such as PACM, staining or odours were observed in the test pits or bore holes.

9.2 Analytical Results

Analytical results for soil samples are provided in Tables F1 and F2, (Appendix F) together with the adopted SAC. Laboratory certificates are provided in Appendix G.

Soil analytical results from samples sent for analysis are summarised below:

- The results of PID analysis reported concentrations of <1.0 ppm for all samples analysed indicating that no volatile substances were present in the soils;
- Concentrations of metals/metalloids reported in all samples analysed were below the adopted SAC;
- Concentrations of TRH, BTEX, PAH, OPC, OPP, PCB and phenols reported in all samples analysed were below the laboratory LOR and the adopted SAC; and
- Asbestos was not detected at the laboratory limits of reporting (LOR) in any of the samples analysed.

9.3 Quality Assurance and Quality Control Assessment

The field and laboratory quality assurance and quality control procedures and results are provided in Appendix H. In summary, the results are considered to be reliable and useable for this investigation.

10. Discussion

Based on the results of the desktop assessment, the site land use comprised vacant, cleared and likely pastoral land use since prior to 1956 to 2018 when the northern portion of the site (Lot 40) was used as a site compound for the storage of site sheds, soils, plant and construction materials associated with the adjacent subdivision.

By 2019, the site had been cleared of stored and applied materials (i.e. site sheds and road base gravel) except for one stockpile located in the northern portion of Lot 40. Based on the site cut and fill plan, up to 1 m of fill was placed in a small area in the centre of Lot 40 (refer cut and fill plan – Appendix C).

This investigation identified that imported fill and potential fuel spills were the most likely sources of potential contamination at the site. To investigate the potential for contamination, DP conducted a site inspection and a limited programme of intrusive soil sampling and analysis. Given the site history findings, a limited sampling regime was considered suitable to assess for the potential for contamination.

The results of sample analysis reported analytical concentrations below the adopted SAC in all samples tested and no obvious signs of contamination were encountered in the test locations. While trace demolition waste was observed on the surface in pockets across most exposed fill areas, it was not present in fill below the surface, and was considered to represent imported remnant waste materials from the adjacent subdivision works that were previously stockpiled on site as opposed to historically applied fill. As such, the trace demolition waste is not expected to represent a significant risk and therefore further assessment is considered unwarranted.

Given that it is understood, based on discussions with ACOR, the current stockpiled materials present on the northern portion of Lot 39 are to be disposed off-site, no sampling and analysis of these materials were undertaken as a part of this assessment. Notwithstanding, further assessment of this material will be required for the purposes of disposal (i.e. to waste classify the materials). If the materials are to remain on site, they must be assessed for their suitability to remain. If considered suitable to remain, given the presence of oversized materials observed during field works, the stockpiled materials may not be suitable to remain at the surface at the conclusion of works, from an aesthetic perspective. Additionally, the geotechnical suitability will also need to be assessed if the material is to remain on site.

11. Conclusions and Recommendations

Based on the results of the PSI, we consider that the site is compatible with the proposed rezoning subject to either:

- The removal of the stockpiles presently located in the northern portion of the site under an assigned waste classification; or
- Assessment of these stockpiles to assess their suitability to remain on site.

DP recommends the preparation and implementation of an unexpected finds protocol (UFP) to manage any potential contamination (such as asbestos, or malodorous or discoloured soils) which may be encountered during any future development of the site.

12. References

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

NSW EPA. (2020). *Guidelines for Consultants Reporting on Contaminated Land.* Contaminated Land Guidelines: NSW Environment Protection Authority.

13. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Webber Circuit, Bardia in accordance with DP's proposal P202007.P.001 dated 22 February 2021. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Jessica Investments Pty Ltd 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 site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the environmental components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

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, brick and tile, were, however, located on the site surface in localised locations, 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. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), or to parts of the site being inaccessible and not available for inspection, or to vegetation preventing visual inspection. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

Douglas Partners Pty Ltd

Appendix A

Drawing 1

Site Locality

BH1
TP12
BH3
TP11
BH2
BH4
TP10
Lot 40
BH6
BH5
TP9
BH7
Webber Circuit
BH8
TP13
Lot 39
TP14

0 25 50 75 m

Site Boundary
Test Locations
MetroMap Aerial Image (December 2021)

Douglas Partners
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TITLE:			N MGA	OFFICE: Macarthur
				DRAWN BY: LOC
				DATE:
CLIENT:	PROJ. #:	DRAWING No: 1	REVISION: 0	SCALE: As Shown

Appendix B

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.

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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

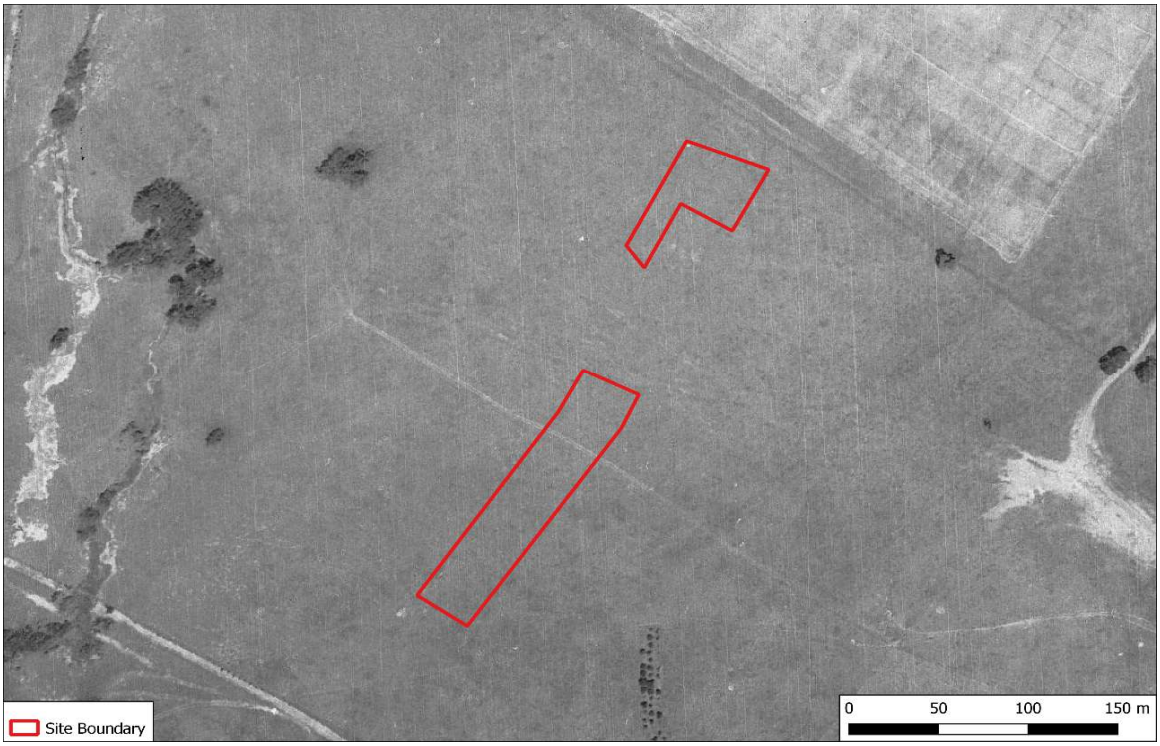
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate 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

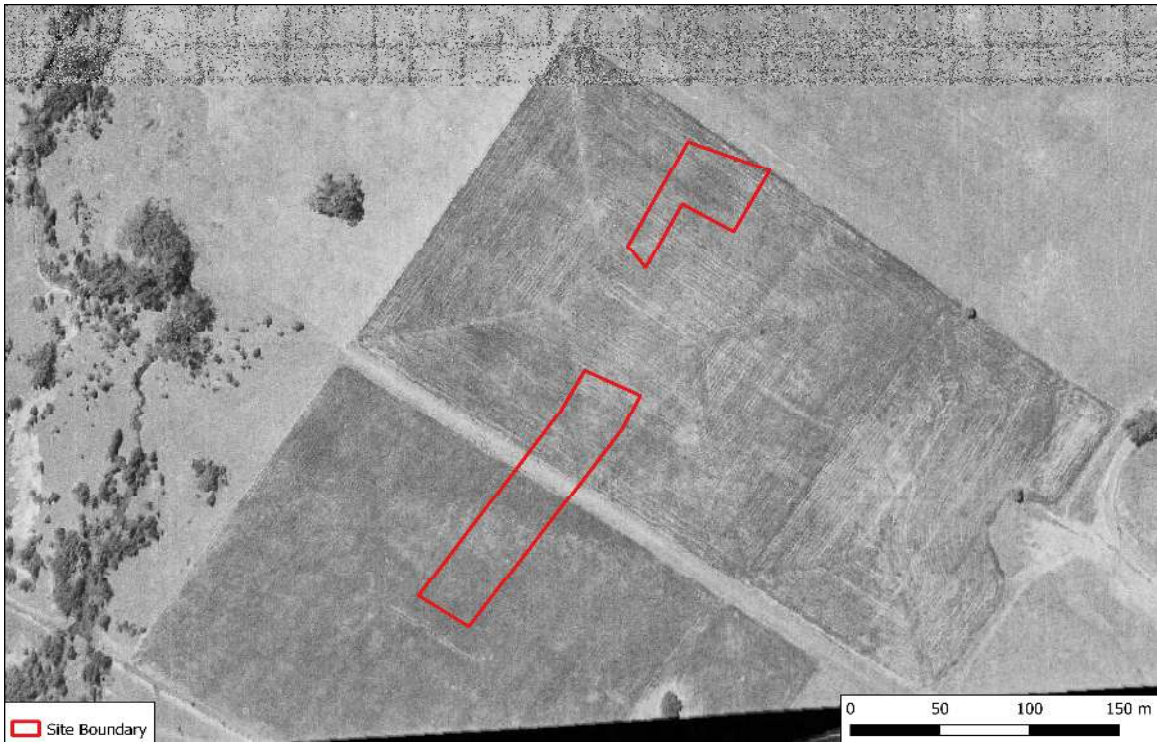
The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix C

Historical Aerial Photographs
Cut and Fill Plan
Site Photographs

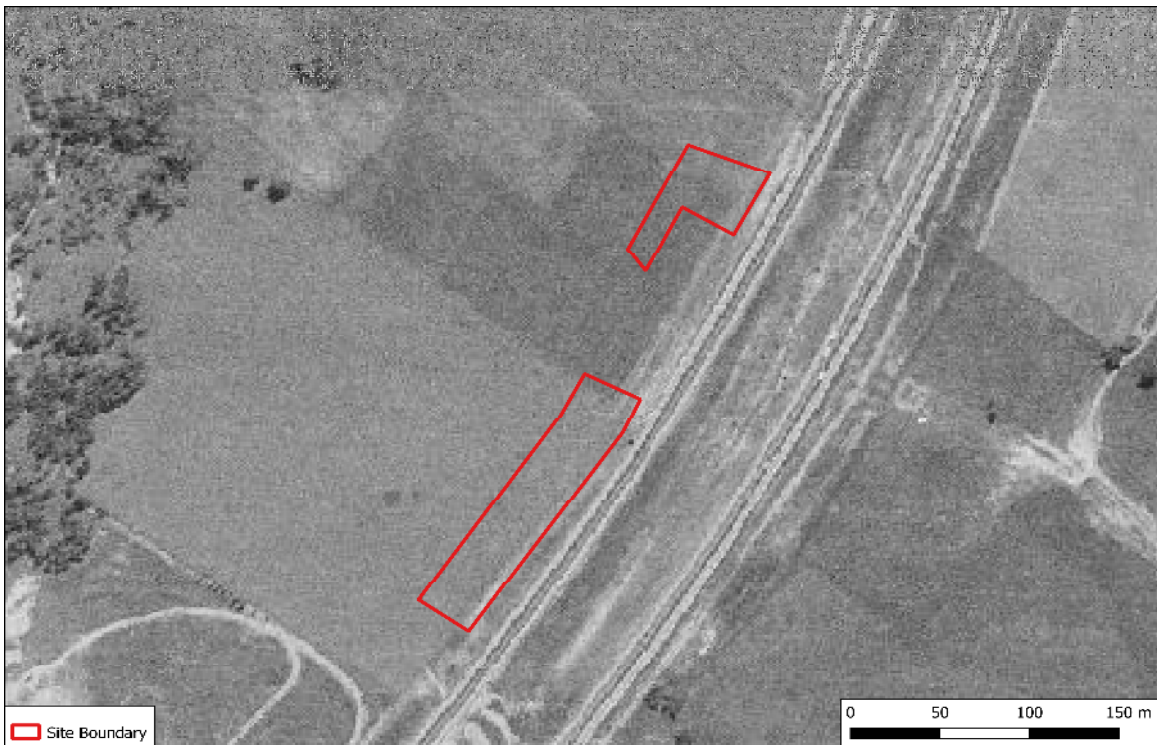


Drawing C1 - 1956



Drawing C2 - 1965

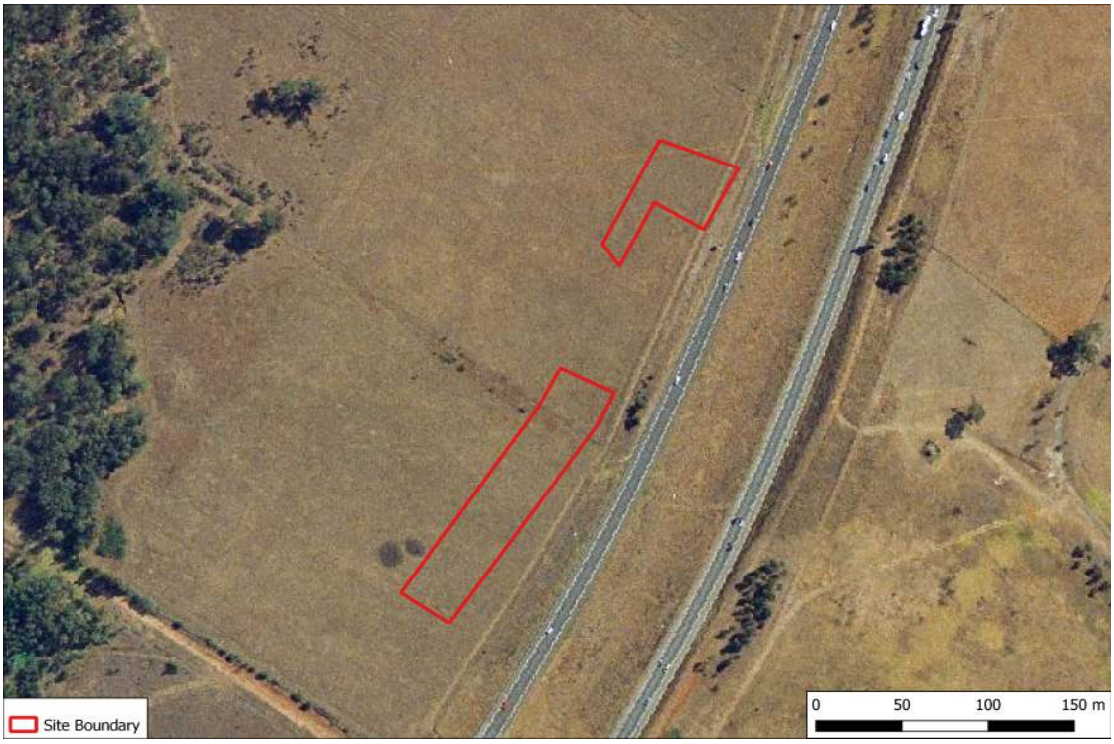
Douglas Partners Geotechnics / Environment / Groundwater	Historical Aerial Photographs	PROJECT: 202007.00
	Proposed Rezoning	PLATE No: 1
	Lots 39 and 40 Webber Circuit, Bardia	REV: A
	CLIENT: Jessica Investments	DATE: Apr-21



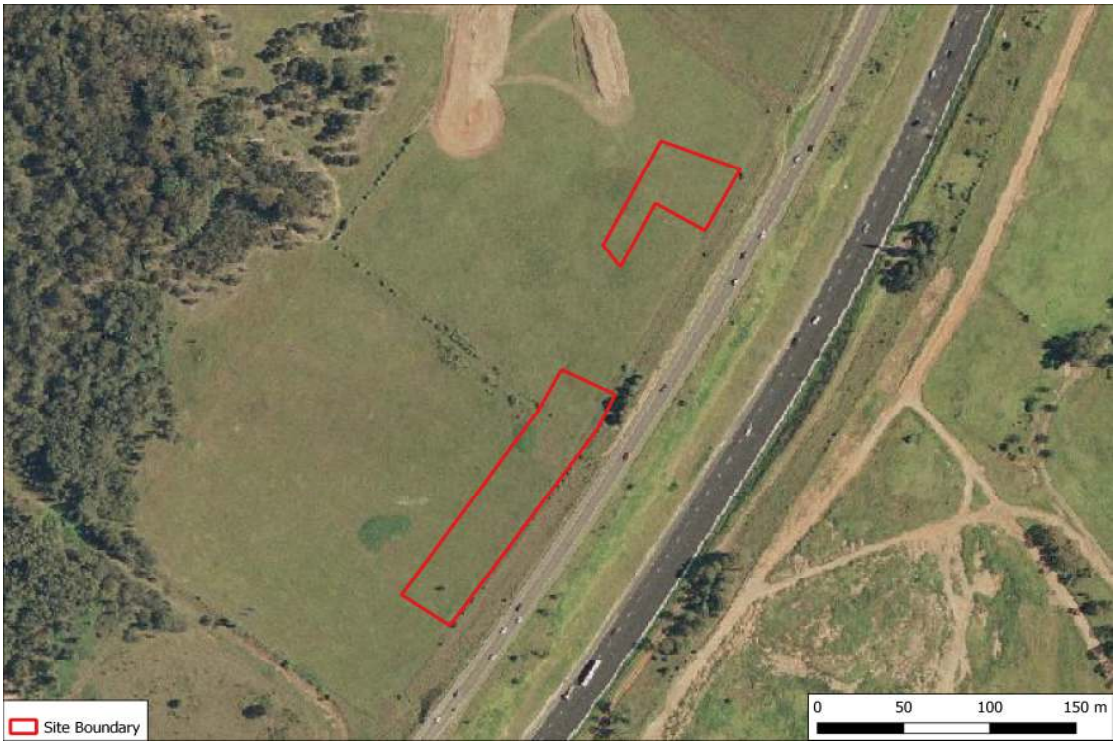
Drawing C3 - 1975

Drawing C4 - 1986

Douglas Partners Geotechnics / Environment / Groundwater	Historical Aerial Photographs Historical Aerial Photographs Lots 39 and 40 Webber Circuit, Bardia CLIENT: Jessica Investments	PROJECT: 202007.00 PLATE No: 2 REV: A DATE: Apr-21



Drawing C5 - 1994



Drawing C6 - 2005

Douglas Partners Geotechnics / Environment / Groundwater	Historical Aerial Photographs	PROJECT: 202007.00
	Proposed Rezoning	PLATE No: 3
	Lots 39 and 40 Webber Circuit, Bardia	REV: A
	CLIENT: Jessica Investments	DATE: Apr-21

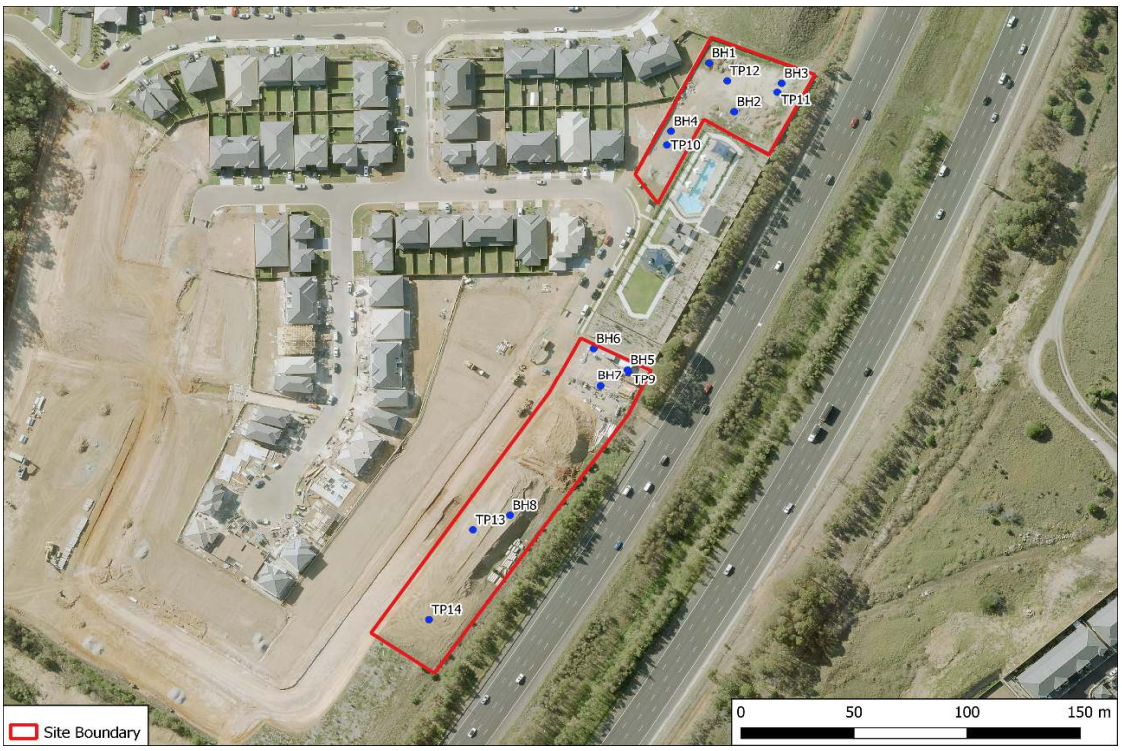
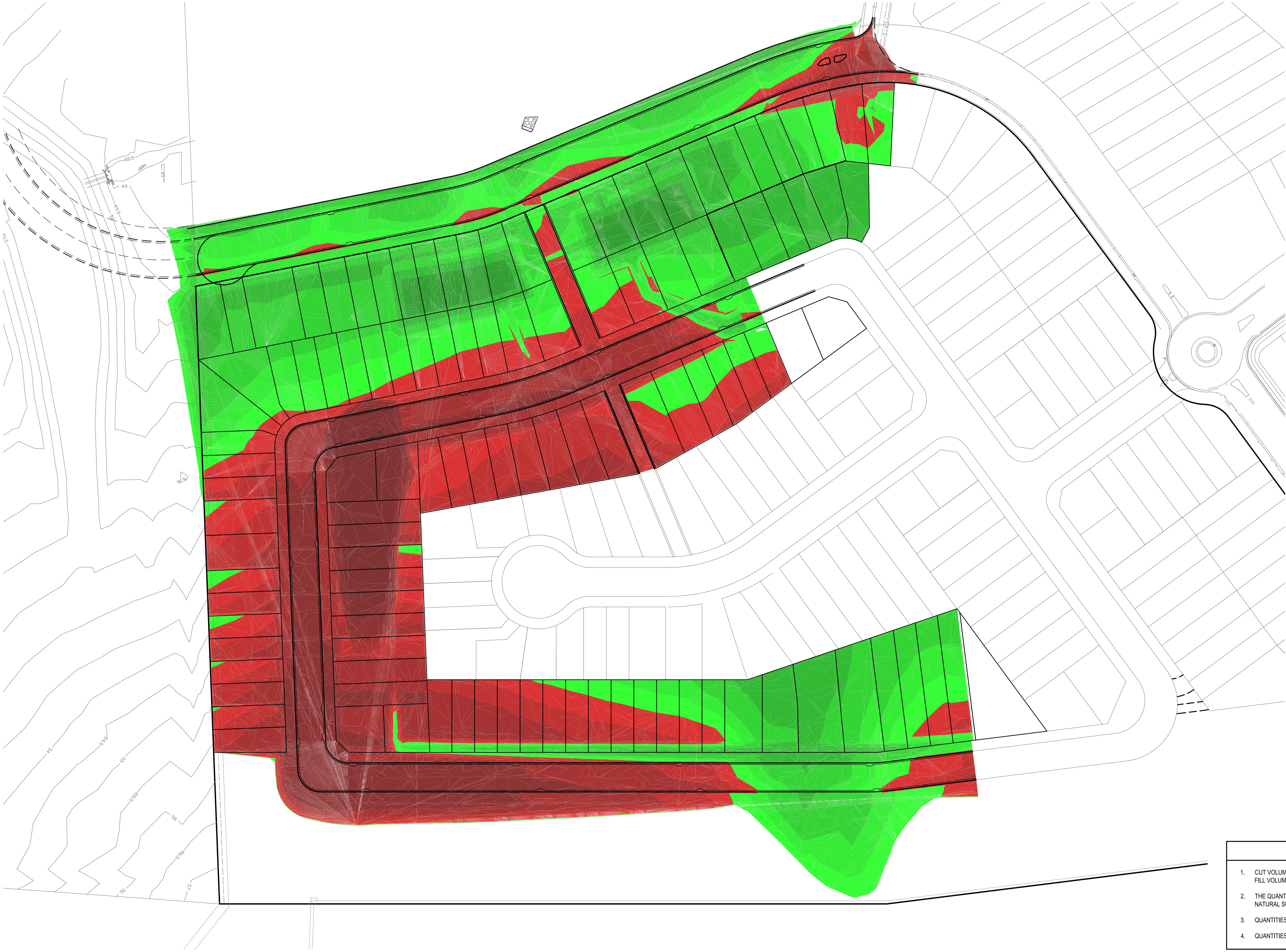


Photo 7 - 2018

Photo 8 - 2019

Douglas Partners Geotechnics / Environment / Groundwater	Historical Aerial Photographs	PROJECT:	202007.00
	Proposed Rezoning	PLATE No:	4
	Lots 39 and 40 Webber Circuit, Bardia	REV:	A
	CLIENT: Jessica Investments	DATE:	Apr-21



PLAN

CUT / FILL DEPTH LEGEND

RANGE			COLOUR
-10.00 m	to	-5.00 m	CUT
-5.00 m	to	-2.00 m	CUT
-2.00 m	to	-1.00 m	CUT
-1.00 m	to	-0.50 m	CUT
-0.50 m	to	-0.25 m	CUT
-0.25 m	to	0.00 m	CUT
0.000 m	to	0.250 m	FILL
0.250 m	to	0.500 m	FILL
0.500 m	to	1.000 m	FILL
1.000 m	to	2.000 m	FILL
2.000 m	to	5.000 m	FILL

NOTES

1. CUT VOLUME: 15055m³
   FILL VOLUME: 14223m³
2. THE QUANTITIES PROVIDED ARE BETWEEN EARTHWORKS BOXING LEVELS AND STRIPPED NATURAL SURFACE
3. QUANTITIES ARE RAW FIGURES AND DO NOT INCLUDE COMPACTION FACTORS
4. QUANTITIES DO NOT INCLUDE MATERIAL FROM SERVICE TRENCHES

FOR CONSTRUCTION

This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

Issue	Description	Date	Drawn	Approved
01	CONSTRUCTION	12.03.18	ROB	SE
B	ISSUED FOR CONSTRUCTION CERTIFICATE	30.01.18	KBM	SE
A	ISSUED FOR CONSTRUCTION CERTIFICATE	15.01.18	KBM	SE

1cm at full size 10cm 20cm

North

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ENGINEERS | MANAGERS | INFRASTRUCTURE PLANNERS | DEVELOPMENT CONSULTANTS

Project
THE MEADOWS AT BARDIA - STAGE 4 to 7
CAMPBLETOWN ROAD
INGLEBURN, NSW, 2565

Drawing Title
CUT AND FILL DIAGRAM

Drawn	Date	Scale A1	Q.A. Check	Date
JDC	DEC 2016	NOT TO SCALE		

Designed	Project No.	Dwg. No.	Issue
JDC	NW150149	C5.01	01

P:\NW15\NW150149\Drawings\CIV\CC\stage 4 to 7\C5.01.dwg
Mar 13, 2018 - 1:49pm

Photo 1 - View of exposed fill and trace remenant gravel in the north of Lot 40 (facing south)

Photo 2 - Trace demolition waste (tile) observed on the surface of exposed fill areas

Photo 3 - Long grass preventing the inspection of the ground surface in Lot 40 (facing south)

Photo 4 - Stockpiled materials located in the north (Lot 39).

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT:	Jessica Investments Pty Ltd		PROJECT No:	202007.00
	OFFICE:		PREPARED BY: CKM	PLATE No:	1
	SCALE:	NTS	DATE: Aug-2019	REVISION:	0

Site Photographs
Proposed Rezoning
Webber Circuit, Bardia

Appendix D

Data Quality Objectives and Site Assessment Criteria

Appendix D
Data Quality Objectives

D1.0 Data Quality Objectives

The DSI has been devised broadly in accordance with the seven-step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [the 'NEPM']* (NEPC, 2013).

Step	Summary
1: State the problem	The objective of the investigation is to confirm the contamination status of the site with respect to the proposed land use which is to change from RE2 (Private Recreation) to residential and open space land use. The requirements of the regulator, Campbelltown City Council, will also be considered by consulting their Development Control Plan (DCP), Local Environment Plan (LEP) and any other requirements based on our recent experience with Council on similar sites. A preliminary conceptual site model (CSM) has been prepared (Section 6) for the proposed development. The project team consisted of experienced environmental engineers and scientists working in the roles of Project Principal, Project Reviewer, Project Manager and Field Staff.
2: Identify the decisions / goal of the study	The site history has identified possible contaminating previous uses which are identified in the CSM (Section 6). The CSM identifies the associated contaminants of potential concern (CoPC) and the likely impacted media. The site assessment criteria (SAC) for each of the CoPC are detailed in Section 7. The decision is to establish whether or not the results fall below the SAC. On this basis, an assessment of the site's suitability from a contamination perspective and whether (or not) further assessment and / or remediation will be required.
3: Identify the information inputs	Inputs to the investigation will be the results of analysis of samples to measure the concentration of CoPC identified in the CSM (Section 6) at the site using National Association of testing Authorities (NATA) accredited laboratories and methods, where possible. The adopted SAC for each of the CoPC are detailed in Section 7. A photoionization detector (PID) was used on-site to screen soils for VOC. PID readings were used to inform laboratory analysis.
4: Define the study boundaries	The lateral boundaries of the investigation area are shown on Drawing 1, Appendix A. The vertical boundaries are to the extent of contamination impact as established from the site history assessment and site observations. The assessment was limited to the timeframe over which the field investigation was undertaken.
5: Develop the analytical approach (or decision rule)	The decision rule is to compare all analytical results with SAC (Section 7, based on NEPC (2013)). Where guideline values are absent, other sources of guideline values accepted by NEPC (2013) shall be adopted where possible.

Step	Summary
	Where a sample result exceeds the adopted criterion, a further site-specific assessment will be made as to the risk posed by the presence of that contaminant(s). Initial comparisons will be with individual results then, where required, summary statistics (including mean, standard deviation and 95% upper confidence limit (UCL) of the arithmetic mean (95% UCL) to assess potential risks posed by the site contamination. Quality control (QC) results are to be assessed according to their relative percent difference (RPD) values. For field duplicates, triplicates and laboratory results, RPDs should generally be below 30%; for field blanks and rinsates, results should be at or less than the limits of reporting (NEPC, 2013). A field and laboratory quality assurance assessment is included in Appendix H.
6: Specify the performance or acceptance criteria	Baseline condition: Contaminants at the site exceed human health and environmental SAC and poses a potentially unacceptable risk to receptors (null hypothesis). Alternative condition: Contaminants at the site complies with human health and environmental SAC and as such, does not pose a potentially unacceptable risk to receptors (alternative hypothesis). Unless conclusive information from the collected data is sufficient to reject the null hypothesis, it is assumed that the baseline condition is true.
7: Optimise the design for obtaining data	As the purpose of the sampling program is to assess for potential contamination across the site, the sampling program is reliant on professional judgement to identify and sample the potentially affected areas. Further details regarding the proposed sampling plan are presented in Section 8.3.

References

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

Appendix D
Site Assessment Criteria

D1.0 Introduction

The following key guidelines were consulted for deriving the site assessment criteria (SAC):

NEPC National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [the 'NEPM'] (NEPC, 2013).

D1.1 General

The SAC applied in the current investigation are informed by the Conceptual Site Model (CSM) which identified human and environmental receptors to potential contamination at the site. Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of the NEPM (NEPC, 2013).

The following inputs are relevant to the selection and/or derivation of the SAC:

D2.0 Land Use: Residential / Recreational

Corresponding to land use category 'A', residential with garden / accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry)), also includes children's day care centres, preschools and primary schools.

Corresponding to land use category 'C', public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate.

D3.0 Soils – Sand and Clay

D3.1 Health Investigation and Screening Levels

The generic health investigation levels (HIL) and health screening levels (HSL) are considered to be appropriate for the assessment of human health risk via all relevant pathways of exposure associated with contamination at the site. The adopted soil HIL and HSL for the contaminants of concern are presented in Table 1 and 2.

Table 1: Health Investigation Levels (mg/kg)

Contaminant	HIL-A	HIL-C
Metals		
Arsenic	100	300
Cadmium	20	90
Chromium (VI)	100	300
Copper	6000	17 000
Lead	300	600
Mercury (inorganic)	40	80
Nickel	400	1200
Zinc	7400	30 000
PAH		
B(a)P TEQ	3	3
Total PAH	300	300
Phenols		
Phenol	3000	40 000
Pentachlorophenol	100	120
OCP		
DDT+DDE+DDD	240	400
Aldrin and dieldrin	6	10
Chlordane	50	70
Endosulfan	270	340
Endrin	10	20
Heptachlor	6	10
HCB	10	10
Methoxychlor	300	400
OPP		
Chlorpyrifos	160	250
PCB		
PCB	1	1

Table 2: Health Screening Levels (mg/kg)

Contaminant	HSL-A&B	HSL-A&B	HSL-A&B	HSL-A&B
SAND	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	0.5	0.5	0.5	0.5
Toluene	160	220	310	540
Ethylbenzene	55	NL	NL	NL
Xylenes	40	60	95	170
Naphthalene	3	NL	NL	NL
TRH F1	45	70	110	200
TRH F2	110	240	440	NL
CLAY	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	0.7	1	2	3
Toluene	480	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	110	310	NL	NL
Naphthalene	5	NL	NL	NL
TRH F1	50	90	150	290
TRH F2	280	NL	NL	NL

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX

TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

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'

Table 3: Health Screening Levels (mg/kg)

Contaminant	HSL-C	HSL-C	HSL-C	HSL-C
SAND	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	NL	NL	NL	NL
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	NL	NL	NL	NL
TRH F2	NL	NL	NL	NL

Contaminant	HSL-C	HSL-C	HSL-C	HSL-C
CLAY	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	NL	NL	NL	NL
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	NL	NL	NL	NL
TRH F2	NL	NL	NL	NL

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX

TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

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'

Table 4: Health Screening Levels for Direct Contact (mg/kg)

Contaminant	DC HSL-A	DC HSL-B	DC HSL-C	DC HSL-D
Benzene	100	140	120	430
Toluene	14 000	21 000	18 000	99 000
Ethylbenzene	4500	5900	5300	27 000
Xylenes	12 000	17 000	15 000	81 000
Naphthalene	1400	2200	1900	11 000
TRH F1	4400	5600	5100	26 000
TRH F2	3300	4200	3800	20 000
TRH F3	4500	5800	5300	27 000
TRH F4	6300	8100	7400	38 000

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX

TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

D3.2 Asbestos in Soil

Based on the CSM and/or current site access limitations, a detailed asbestos assessment was not considered to be warranted at this stage. However, due to the history of widespread use of ACM products across Australia, ACM can be encountered unexpectedly and sporadically at a site. Therefore, the presence or absence of asbestos at a limit of reporting of 0.1 g/kg (AS:4964) has been adopted for this investigation / assessment as an initial screen.

D3.3 Ecological Investigation Levels

Ecological investigation levels (EIL) and added contaminant limits (ACL), where appropriate, have been derived in NEPC (2013) for arsenic, copper, chromium (III), nickel, lead, zinc, DDT and naphthalene. The adopted EIL, derived using the interactive (excel) calculation spreadsheet on the NEPM toolbox website are shown in Table 6, with inputs into their derivation shown in Table 5.

Table 5: Inputs to the Derivation of the Ecological Investigation Levels

Variable	Input	Rationale
Age of contaminants	"Aged" (>2 years)	
pH	4.5	DP has assumed a conservative pH of 4.5 for this assessment
CEC	10 $cmol_c/kg$	DP has assumed a CEC of 10 $cmol_c/kg$ for this assessment based on knowledge of similar sites
Clay content	10 %	DP has assumed a conservative clay content of 10% for this assessment
Traffic volumes	low	Site is in an area not previously developed with no known contamination
State / Territory	NSW	

Table 6: Ecological Investigation Levels (mg/kg)

Contaminant	EIL-A-B-C
Metals	
Arsenic	100
Copper	75
Nickel	170
Chromium III	410
Lead	1100
Zinc	200
PAH	
Naphthalene	170
OCP	
DDT	180

D3.4 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 adopted ESL are shown in Table 7.

Table 7: Ecological Screening Levels (mg/kg)

Contaminant	Soil Type	EIL-A-B-C
Benzene	Coarse	50
Toluene	Coarse	85
Ethylbenzene	Coarse	70
Xylenes	Coarse	105
TRH F1	Coarse/ Fine	180*
TRH F2	Coarse/ Fine	120*
TRH F3	Coarse	300
TRH F4	Coarse	2800
B(a)P	Coarse	0.7
Benzene	Fine	65
Toluene	Fine	105
Ethylbenzene	Fine	125
Xylenes	Fine	45
TRH F1	Coarse/ Fine	180*
TRH F2	Coarse/ Fine	120*
TRH F3	Fine	1300
TRH F4	Fine	5600
B(a)P	Fine	0.7

Notes: ESL are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability
TRH F1 is TRH C_6-C_{10} minus BTEX
TRH F2 is TRH >C_{10}-C_{16} including naphthalene

D3.5 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 adopted management limits are in Table 8.

Table 8: Management Limits (mg/kg)

Contaminant	Soil Type	ML-A-B-C	ML-D
TRH F1	Coarse	700	700
TRH F2	Coarse	1000	1000
TRH F3	Coarse	2500	3500
TRH F4	Coarse	10 000	10 000
TRH F1	Fine	800	800
TRH F2	Fine	1000	1000
TRH F3	Fine	3500	5000
TRH F4	Fine	10 000	10 000

Notes: TRH F1 is TRH C_6-C_{10} including BTEX
TRH F2 is TRH >C_{10}-C_{16} including naphthalene

D4.0 Soil Vapour

D4.1 Health Screening Levels

Soil vapour HSL for petroleum hydrocarbons were published by NEPC (2013) to assess the vapour intrusion exposure pathway.

The HSL derived from NEPC (2013) are in Table 9.

Table 9: Soil Vapour Health Screening Levels for Vapour Intrusion (µg/m^3)

Contaminant	HSL-A&B	HSL-A&B	HSL-A&B	HSL-A&B	HSL-A&B
SAND	0-1 m	1-2 m	2-4 m	4-8 m	>8 m
Benzene	1000	3000	6000	10 000	20 000
Toluene	1 300 000	3 800 000	7 300 000	15 000 000	29 000 000
Ethylbenzene	330 000	1 100 000	2 200 000	4300000	8 700 000
Xylene Total	220 000	750 000	1 500 000	3 000 000	6 100 000
Naphthalene	800	3000	6000	10000	25000
TRH F1	180 000	640 000	1 300 000	2 600 000	5 300 000
TRH F2	130 000	560 000	1 200 000	2 400 000	4 800 000

Contaminant	HSL-A&B	HSL-A&B	HSL-A&B	HSL-A&B	HSL-A&B
SILT	0-1 m	1-2 m	2-4 m	4-8 m	>8 m
Benzene	1000	10 000	25 000	55 000	110 000
Toluene	1 400 000	14 000 000	32 000 000	69 000 000	140 000 000
Ethylbenzene	380 000	4 200 000	9 700 000	21 000 000	43 000 000
Xylene Total	260 000	2 900 000	6 800 000	15 000 000	30 000 000
Naphthalene	900	10 000	25 000	60 000	120 000
TRH F1	210 000	2 600 000	6 000 000	13 000 000	26 000 000
TRH F2	160 000	2 300 000	5 400 000	NL	NL
CLAY	0-1 m	1-2 m	2-4 m	4-8 m	>8 m
Benzene	1000	15 000	40 000	90 000	180 000
Toluene	1 600 000	23 000 000	53 000 000	110 000 000	NL
Ethylbenzene	420 000	6 800 000	16 000 000	35 000 000	NL
Xylene Total	280 000	4 800 000	11 000 000	24 000 000	50 000 000
Naphthalene	1000	20 000	45 000	95 000	200 000
TRH F1	230 000	4 200 000	9 900 000	21 000 000	44 000 000
TRH F2	180 000	3 800 000	NL	NL	NL

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX

TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

The maximum possible soil vapour concentrations have been calculated based on vapour pressures of the pure chemicals. Where soil vapour HSL exceed these values, a soil-specific source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

Table 10: Soil Vapour Health Screening Levels for Vapour Intrusion (µg/m^3)

Contaminant	HSL-C	HSL-C	HSL-C	HSL-C	HSL-C
SAND	0-1 m	1-2 m	2-4 m	4-8 m	>8 m
Benzene	360 000	2 400 000	4 700 000	9 500 000	19 000 000
Toluene	NL	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL	NL
Xylene Total	NL	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL	NL
TRH F1	86 000 000	NL	NL	NL	NL
TRH F2	NL	NL	NL	NL	NL

Contaminant	HSL-C	HSL-C	HSL-C	HSL-C	HSL-C
SILT	0-1 m	1-2 m	2-4 m	4-8 m	>8 m
Benzene	1 800 000	12 000 000	24 000 000	48 000 000	97 000 000
Toluene	NL	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL	NL
Xylene Total	NL	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL	NL
TRH F1	NL	NL	NL	NL	NL
TRH F2	NL	NL	NL	NL	NL
CLAY	0-1 m	1-2 m	2-4 m	4-8 m	>8 m
Benzene	3 000 000	20 000 000	40 000 000	81 000 000	160 000 000
Toluene	NL	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL	NL
Xylene Total	NL	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL	NL
TRH F1	NL	NL	NL	NL	NL
TRH F2	NL	NL	NL	NL	NL

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX

TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

The maximum possible soil vapour concentrations have been calculated based on vapour pressures of the pure chemicals. Where soil vapour HSL exceed these values, a soil-specific source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

D5.0 References

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Appendix E

Bore Hole and Test Pit Logs

BOREHOLE LOG

CLIENT: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303354
NORTHING: 6238705
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 202007.00
DATE: 17/3/2021
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
		FILL/TOPSOIL: Silty CLAY CH, trace rootlets, siltstone gravel and sandstone gravel, w~PL		E	0.0 0.1				
	0.2				0.2				
	0.25	FILL/SAND: beige, with sandstone gravel, dry		E	0.25				
		Bore discontinued at 0.25m - refusal on sandstone gravel							
	1								
	2								
	3								

RIG: Hand tools **DRILLER:** AWB **LOGGED:** AWB **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

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)

BOREHOLE LOG

CLIENT: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303365
NORTHING: 6238682
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 202007.00
DATE: 17/3/2021
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
		FILL/TOPSOIL: Silty CLAY, mottled red and brown, trace rootlets, siltstone gravel and sandstone gravel, w~PL		E	0.0 0.1				
	0.3	FILL/Sandy SILT: brown, with siltstone gravel, trace rootlets, sandstone gravel and clods of silty clay, w<<PL		E	0.4				
	0.6	Bore discontinued at 0.6m - refusal on gravel			0.6				
	1								1
	2								2
	3								3

RIG: Hand tools **DRILLER:** AWB **LOGGED:** AWB **CASING:** N/A
TYPE OF BORING: Hand auger
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303386
NORTHING: 6238695
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 202007.00
DATE: 17/3/2021
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
	0.0			E	0.0				
		FILL/TOPSOIL: Silty CLAY CH, brown, with sand, trace siltstone gravel, sandstone gravel, rootlets, brick fragment, quartz gravel, w<<PL			0.1				
	0.15								
		FILL/Silty SAND: light brown, trace sandstone cobbles and gravel, rootlets and siltstone gravel, dry			0.2				
				E					
	0.4				0.4				
		Silty CLAY CH: mottled red and grey, w<<PL							
					0.6				
				E					
					0.8				
1	1.0								1
		Bore discontinued at 1.0m - limit of investigation							
2									2
3									3

RIG: Hand tools **DRILLER:** AWB **LOGGED:** AWB **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303336
NORTHING: 6238667
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 202007.00
DATE: 17/3/2021
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
		FILL/TOPSOIL: Silty CLAY CH, brown, trace siltstone gravel, sandstone gravel, rootlets and sand, w<<PL		E	0.0				
	0.15	Silty CLAY: red mottled grey, w~PL			0.1				
					0.2				
				E					
					0.4				
	0.65	Bore discontinued at 0.65m - limit of investigation							
	1								1
	2								2
	3								3

RIG: Hand tools **DRILLER:** AWB **LOGGED:** AWB **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Surface siltstone and sandstone gravel

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303318
NORTHING: 6238561
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 202007.00
DATE: 17/3/2021
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
		FILL/TOPSOIL: Clayey SILT ML, light brown, trace sandstone gravel, siltstone gravel and sand, w<<PL		E	0.0				
	0.2	Silty CLAY CH: red mottled grey			0.1				
				E	0.3				
					0.5				
		- becoming grey mottled red below 0.6m							
	0.7	Bore discontinued at 0.7m - limit of investigation							
	1								1
	2								2
	3								3

RIG: Hand tools **DRILLER:** AWB **LOGGED:** AWB **CASING:** N/A
TYPE OF BORING: Hand auger
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303303
NORTHING: 6238571
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 202007.00
DATE: 17/3/2021
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
	0.0	FILL/TOPSOIL: Silty CLAY CH, brown, trace rootlets, siltstone gravel and sandstone gravel, w~PL		E	0.0				
	0.15	FILL/Clayey SILT ML: light brown, trace sandstone gravel and cobbles, siltstone gravel, rootlets and sand, w<<PL			0.1				
				E	0.2				
	0.45	Silty CLAY CH: red and orange, w<<PL			0.4				
				E	0.6				
1	1.0	Bore discontinued at 1.0m - limit of investigation			0.8				1
2									2
3									3

RIG: Hand tools **DRILLER:** AWB **LOGGED:** AWB **CASING:** N/A
TYPE OF BORING: Hand auger
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303306
NORTHING: 6238553
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 202007.00
DATE: 17/3/2021
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
	0.0	FILL/TOPSOIL: Silty CLAY, dark brown, trace rootlets, siltstone gravel and sandstone gravel, w~PL		E	0.0				
	0.15	FILL/Gravelly SILT ML: light brown, sandstone gravel, trace siltstone gravel, rootlets, sandstone cobbles and clods of silty clay, S<<PL			0.1				
				E*	0.2				
	0.45	FILL/Clayey SILT ML: brown, trace siltstone gravel, sandstone gravel, rootlets, charcoal, sandstone cobbles and bitumen gravel, w<<PL			0.4				
				E	0.5				
					0.7				
	0.9	Silty CLAY CH: w<<PL		E	0.9				
1	1.0	Bore discontinued at 1.0m - limit of investigation			1.0				1
2									2
3									3

RIG: Hand tools **DRILLER:** AWB **LOGGED:** AWB **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Replicate sample BD1/170321 collected

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303266
NORTHING: 6238491
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 202007.00
DATE: 17/3/2021
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
	0.0			E	0.0				
		FILL/TOPSOIL: Silty CLAY CH: dark brown, trace rootlets and siltstone gravel, w~PL			0.1				
	0.15								
		FILL/Clayey SILT ML: light brown, trace rootlets, siltstone gravel, sandstone gravel and sand, w<<PL			0.2				
				E					
					0.4				
	0.7				0.7				
		Silty CLAY CH: mottled red and grey, w<<PL		E					
					0.9				
1	1.0	Bore discontinued at 1.0m - limit of investigation							1
2									2
3									3

RIG: Hand tools **DRILLER:** AWB **LOGGED:** AWB **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Replicate sample BD1/170321 collected

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303320
NORTHING: 6238552

PIT No: 9
PROJECT No: 202007.00
DATE: 2/3/2021
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)
	0.1	FILL/Sandy SILT: pale brown and grey, with siltstone, blue metal and sandstone gravel, rootlets and ceramic tile fragments, w<<PL,							
	0.25	FILL/Clayey SILT: brown, trace siltstone and blue metal gravel and rootlets							
	0.4	Silty CLAY: red brown							
		Pit discontinued at 0.4m - limit of investigation							

RIG: Hand tools - shovel

LOGGED: AWB

SURVEY DATUM: MGA94 Zone 56

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303341
NORTHING: 6238678

PIT No: 10
PROJECT No: 202007.00
DATE: 2/3/2021
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)
	0.15	Clayey SILT ML: brown, with siltstone gravel, sand and sandstone gravel, w<<PL							
	0.3	Silty CLAY CH: red brown, trace siltstone gravel and rootlets, w<<PL							
		Pit discontinued at 0.3m - limit of investigation							

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

RIG: Hand tools - shovel

LOGGED: AWB

SURVEY DATUM: MGA94 Zone 56

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303385
NORTHING: 6238702

PIT No: 11
PROJECT No: 202007.00
DATE: 2/3/2021
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)
	0.15	Clayey Silty SAND: brown, trace siltstone gravel and rootlets, dry							
	0.35	Silty CLAY CH: brown, trace siltstone gravel, sand and rootlets, w<<PL							
		Pit discontinued at 0.35m - limit of investigation							

RIG: Hand tools - shovel

LOGGED: AWB

SURVEY DATUM: MGA94 Zone 56

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303360
NORTHING: 6238698

PIT No: 12
PROJECT No: 202007.00
DATE: 2/3/2021
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)
	0.3	Silty CLAY CH: brown, terracotta tile fragments, sandstone and siltstone gravel, trace rootlets, w<<PL, surface brick fragments							
		Pit discontinued at 0.3m - limit of investigation							

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

RIG: Hand tools - shovel

LOGGED: AWB

SURVEY DATUM: MGA94 Zone 56

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303249
NORTHING: 6238484

PIT No: 13
PROJECT No: 202007.00
DATE: 2/3/2021
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)
		Clayey SILT ML: dark brown, trace sandstone and siltstone fragments and rootlets							
	0.2	Pit discontinued at 0.2m - limit of investigation							

RIG: Hand tools - shovel

LOGGED: AWB

SURVEY DATUM: MGA94 Zone 56

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: ACOR Consultants Pty Ltd
PROJECT: Proposed Residential and Parkland
LOCATION: Webber Circuit, Bardia, NSW

SURFACE LEVEL: --
EASTING: 303235
NORTHING: 6238446

PIT No: 14
PROJECT No: 202007.00
DATE: 2/3/2021
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)
	0.1	SILTY CLAY CH/Clayey SILT ML: orange and red, with siltstone, blue metal and sandstone gravel, ceramic tile fragments and rootlets, trace sand, w<<PL							
		Silty CLAY CH: dark brown, trace siltstone gravel and roots, w~PL							
	0.35	Pit discontinued at 0.35m - limit of investigation							

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20; 1, 2, 3

RIG: Hand tools - shovel

LOGGED: AWB

SURVEY DATUM: MGA94 Zone 56

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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Description and Classification Methods

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

Soil Types

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

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

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

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

Definitions of grading terms used are:

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

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

In fine grained soils (>35% fines)

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

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

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

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

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

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

Soil Descriptions

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Origin

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

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

Moisture Condition – Coarse Grained Soils

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

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

Moisture Condition – Fine Grained Soils

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

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

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.

Symbols & Abbreviations

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

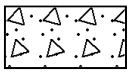
Symbols & Abbreviations

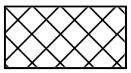
Graphic Symbols for Soil and Rock

General

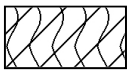

Asphalt

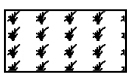

Road base

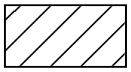

Concrete

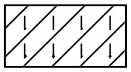

Filling

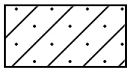
Soils


Topsoil

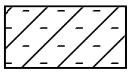

Peat

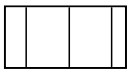

Clay

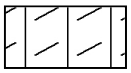

Silty clay

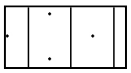

Sandy clay

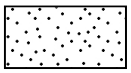

Gravelly clay

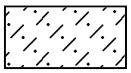

Shaly clay

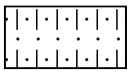

Silt


Clayey silt


Sandy silt

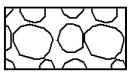

Sand

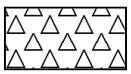

Clayey sand


Silty sand


Gravel

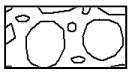

Sandy gravel


Cobbles, boulders

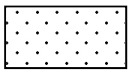

Talus

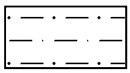
Sedimentary Rocks

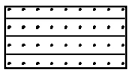

Boulder conglomerate

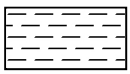

Conglomerate


Conglomeratic sandstone

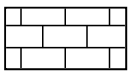

Sandstone


Siltstone

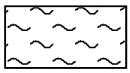

Laminite

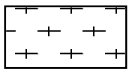

Mudstone, claystone, shale

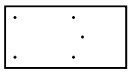

Coal


Limestone

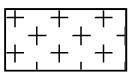
Metamorphic Rocks

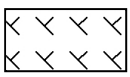

Slate, phyllite, schist

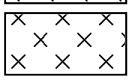

Gneiss

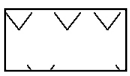

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Appendix F

Results Tables F1 and F2

Table 1: Summary of Laboratory Results – Metals, TRH, BTEX, PAH

			Metals								TRH						BTEX				PAH			
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	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 [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs
		PQL	4	0.4	1	1	1	0.1	1	1	25	50	25	50	100	100	0.2	0.5	1	1	1	0.05	0.5	0.05
Sample ID	Depth	Sample 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
BH1	0.2 - 0.25 m	17/03/2021	<4	<0.4	5	6	9	<0.1	4	18	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	45 180	110 -	- 300	- 2800	0.5 50	160 85	55 70	40 105	3 170	- 0.7	3 -	300 -
BH2	0 - 0.1 m	17/03/2021	<4	<0.4	8	10	12	<0.1	3	18	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	50 180	280 -	- 1300	- 5600	0.7 65	480 105	NL 125	110 45	5 170	- 0.7	3 -	300 -
BH3	0 - 0.1 m	17/03/2021	<4	<0.4	8	18	16	<0.1	5	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	50 180	280 -	- 1300	- 5600	0.7 65	480 105	NL 125	110 45	5 170	- 0.7	3 -	300 -
BH3	0.2 - 0.4 m	17/03/2021	<4	<0.4	6	8	13	<0.1	4	22	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	45 180	110 -	- 300	- 2800	0.5 50	160 85	55 70	40 105	3 170	- 0.7	3 -	300 -
BH4	0 - 0.1 m	17/03/2021	5	<0.4	11	12	17	<0.1	5	22	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	50 180	280 -	- 1300	- 5600	0.7 65	480 105	NL 125	110 45	5 170	- 0.7	3 -	300 -
BH5	0 - 0.1 m	17/03/2021	6	<0.4	10	11	22	<0.1	6	29	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	40 180	230 -	- 1300	- 5600	0.6 65	390 105	NL 125	95 45	4 170	- 0.7	3 -	300 -
BH6	0.2 - 0.4 m	17/03/2021	4	<0.4	8	14	21	<0.1	5	38	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	-	-
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	40 180	230 -	- 1300	- 5600	0.6 65	390 105	NL 125	95 45	4 170	- 0.7	3 -	300 -
BH7	0.2 - 0.4 m	17/03/2021	5	<0.4	7	16	14	<0.1	11	36	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	40 180	230 -	- 1300	- 5600	0.6 65	390 105	NL 125	95 45	4 170	- 0.7	3 -	300 -
BD1/210317	0 m	17/03/2021	8	<0.4	13	19	20	<0.1	14	54	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	45 180	110 -	- 300	- 2800	0.5 50	160 85	55 70	40 105	3 170	- 0.7	3 -	300 -
BH7	0.5 - 0.7 m	17/03/2021	5	<0.4	9	10	18	<0.1	5	24	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	40 180	230 -	- 1300	- 5600	0.6 65	390 105	NL 125	95 45	4 170	- 0.7	3 -	300 -
BH8	0 - 0.1 m	17/03/2021	8	<0.4	14	14	24	<0.1	6	25	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	<0.05	<0.5	<0.05
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	50 180	280 -	- 1300	- 5600	0.7 65	480 105	NL 125	110 45	5 170	- 0.7	3 -	300 -
BH8	0.2 - 0.4 m	17/03/2021	8	<0.4	16	8	20	<0.1	4	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	40 180	230 -	- 1300	- 5600	0.6 65	390 105	NL 125	95 45	4 170	- 0.7	3 -	300 -
BH1 - [TRIPLICATE]	0.2 - 0.25 m	17/03/2021	<4	<0.4	5	6	9	<0.1	5	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			100 100	20 -	100 410	6000 75	300 1100	40 -	400 170	7400 200	- -	- 120	45 180	110 -	- 300	- 2800	0.5 50	160 85	55 70	40 105	3 170	- 0.7	3 -	300 -

Lab result
HIL/HSL value EIL/ESL value

HIL/HSL exceedance EIL/ESL exceedance HIL/HSL and EIL/ESL exceedance ML exceedance ML and HIL/HSL or EIL/ESL exceedance
Indicates that asbestos has been detected by the lab, refer to the lab report **Blue** = DC exceedance HSL 0-<1 Exceedance
Bold = Lab detections - = Not tested or No HIL/HSL/EIL/ESL (as applicable) or Not applicable NL = Non limiting AD = Asbestos detected NAD = No Asbestos detected
HIL = Health investigation level HSL = Health screening level (excluding DC) EIL = Ecological investigation level ESL = Ecological screening level ML = Management Limit DC = Direct Contact HSL

Notes:

a QA/QC replicate of sample listed directly below the primary sample
b Reported naphthalene laboratory result obtained from BTEXN suite
c Criteria applies to DDT only

Site Assessment Criteria (SAC):

Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

SAC based on generic land use thresholds for Residential A with garden/accessible soil

HIL A	Residential / Low - High Density (NEPC, 2013)
HSL A/B	Residential / Low - High Density (vapour intrusion) (NEPC, 2013)
DC HSL A	Direct contact HSL A Residential (Low density) (direct contact) (CRC CARE, 2011)
EIL/ESL UR/POS	Urban Residential and Public Open Space (NEPC, 2013)
ML R/P/POS	Residential, Parkland and Public Open Space (NEPC, 2013)

Appendix G

Laboratory Certificate of Analysis and
Chain of Custody documentation

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 264779

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Bradley Harris
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**202007.00, Bardia**
Number of Samples	22 SOIL
Date samples received	19/03/2021
Date completed instructions received	19/03/2021

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	26/03/2021
Date of Issue	26/03/2021

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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: Panika Wongchanda
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Josh Williams, LC Supervisor
Lucy Zhu, Asbestos Supervisor
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		264779-2	264779-3	264779-6	264779-8	264779-10
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.2-0.25	0-0.1	0.2-0.4	0-0.1	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
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	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	88	86	88	86	88

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		264779-13	264779-17	264779-19
Your Reference	UNITS	BH6	BH7	BH8
Depth		0.2-0.4	0.5-0.7	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	24/03/2021	24/03/2021	24/03/2021
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	83	89	85

svTRH (C10-C40) in Soil						
Our Reference		264779-2	264779-3	264779-6	264779-8	264779-10
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.2-0.25	0-0.1	0.2-0.4	0-0.1	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
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	%	78	78	78	81	77

svTRH (C10-C40) in Soil				
Our Reference		264779-13	264779-17	264779-19
Your Reference	UNITS	BH6	BH7	BH8
Depth		0.2-0.4	0.5-0.7	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	24/03/2021	24/03/2021	24/03/2021
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	78	79	77

PAHs in Soil						
Our Reference		264779-2	264779-3	264779-6	264779-8	264779-10
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.2-0.25	0-0.1	0.2-0.4	0-0.1	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	26/03/2021	26/03/2021	26/03/2021	26/03/2021	26/03/2021
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	%	105	99	100	103	97

PAHs in Soil			
Our Reference		264779-17	264779-19
Your Reference	UNITS	BH7	BH8
Depth		0.5-0.7	0-0.1
Date Sampled		17/03/2021	17/03/2021
Type of sample		SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021
Date analysed	-	26/03/2021	26/03/2021
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	100	99

Organochlorine Pesticides in soil						
Our Reference		264779-2	264779-3	264779-6	264779-8	264779-10
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.2-0.25	0-0.1	0.2-0.4	0-0.1	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	26/03/2021	26/03/2021	26/03/2021	26/03/2021	26/03/2021
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	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
gamma-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
Endosulfan II	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
Endrin Aldehyde	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
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	%	109	102	104	107	101

Organochlorine Pesticides in soil				
Our Reference		264779-13	264779-17	264779-19
Your Reference	UNITS	BH6	BH7	BH8
Depth		0.2-0.4	0.5-0.7	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	26/03/2021	26/03/2021	26/03/2021
alpha-BHC	mg/kg	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	104	104	104

Organophosphorus Pesticides in Soil						
Our Reference		264779-2	264779-3	264779-6	264779-8	264779-10
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.2-0.25	0-0.1	0.2-0.4	0-0.1	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	26/03/2021	26/03/2021	26/03/2021	26/03/2021	26/03/2021
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
Diazinon	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
Ronnel	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
Chlorpyriphos	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
Bromophos-ethyl	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
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	109	102	104	107	101

Organophosphorus Pesticides in Soil				
Our Reference		264779-13	264779-17	264779-19
Your Reference	UNITS	BH6	BH7	BH8
Depth		0.2-0.4	0.5-0.7	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	26/03/2021	26/03/2021	26/03/2021
Dichlorvos	mg/kg	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	104	104	104

PCBs in Soil						
Our Reference		264779-2	264779-3	264779-6	264779-8	264779-10
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.2-0.25	0-0.1	0.2-0.4	0-0.1	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	26/03/2021	26/03/2021	26/03/2021	26/03/2021	26/03/2021
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 TCMX	%	109	102	104	107	101

PCBs in Soil				
Our Reference		264779-13	264779-17	264779-19
Your Reference	UNITS	BH6	BH7	BH8
Depth		0.2-0.4	0.5-0.7	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	26/03/2021	26/03/2021	26/03/2021
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	104	104	104

Acid Extractable metals in soil						
Our Reference		264779-2	264779-3	264779-5	264779-6	264779-8
Your Reference	UNITS	BH1	BH2	BH3	BH3	BH4
Depth		0.2-0.25	0-0.1	0-0.1	0.2-0.4	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	25/03/2021	25/03/2021	25/03/2021	25/03/2021	25/03/2021
Date analysed	-	25/03/2021	25/03/2021	25/03/2021	25/03/2021	25/03/2021
Arsenic	mg/kg	<4	<4	<4	<4	5
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	5	8	8	6	11
Copper	mg/kg	6	10	18	8	12
Lead	mg/kg	9	12	16	13	17
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	4	3	5	4	5
Zinc	mg/kg	18	18	36	22	22

Acid Extractable metals in soil						
Our Reference		264779-10	264779-13	264779-16	264779-17	264779-19
Your Reference	UNITS	BH5	BH6	BH7	BH7	BH8
Depth		0-0.1	0.2-0.4	0.2-0.4	0.5-0.7	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	25/03/2021	25/03/2021	25/03/2021	25/03/2021	25/03/2021
Date analysed	-	25/03/2021	25/03/2021	25/03/2021	25/03/2021	25/03/2021
Arsenic	mg/kg	6	4	5	5	8
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	10	8	7	9	14
Copper	mg/kg	11	14	16	10	14
Lead	mg/kg	22	21	14	18	24
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	6	5	11	5	6
Zinc	mg/kg	29	38	36	24	25

Acid Extractable metals in soil				
Our Reference		264779-20	264779-22	264779-23
Your Reference	UNITS	BH8	BD1/210317	BH1 - [TRIPLICATE]
Depth		0.2-0.4	-	0.2-0.25
Date Sampled		17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL
Date prepared	-	25/03/2021	25/03/2021	25/03/2021
Date analysed	-	25/03/2021	25/03/2021	25/03/2021
Arsenic	mg/kg	8	8	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	16	13	5
Copper	mg/kg	8	19	6
Lead	mg/kg	20	20	9
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	4	14	5
Zinc	mg/kg	16	54	19

Misc Soil - Inorg			
Our Reference		264779-3	264779-17
Your Reference	UNITS	BH2	BH7
Depth		0-0.1	0.5-0.7
Date Sampled		17/03/2021	17/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	23/03/2021	23/03/2021
Date analysed	-	23/03/2021	23/03/2021
Total Phenolics (as Phenol)	mg/kg	<5	<5

Moisture						
Our Reference		264779-2	264779-3	264779-5	264779-6	264779-8
Your Reference	UNITS	BH1	BH2	BH3	BH3	BH4
Depth		0.2-0.25	0-0.1	0-0.1	0.2-0.4	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
Moisture	%	9.8	13	10	6.8	13

Moisture						
Our Reference		264779-10	264779-13	264779-16	264779-17	264779-19
Your Reference	UNITS	BH5	BH6	BH7	BH7	BH8
Depth		0-0.1	0.2-0.4	0.2-0.4	0.5-0.7	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
Moisture	%	9.2	13	7.6	8.5	18

Moisture			
Our Reference		264779-20	264779-22
Your Reference	UNITS	BH8	BD1/210317
Depth		0.2-0.4	-
Date Sampled		17/03/2021	17/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	23/03/2021	23/03/2021
Date analysed	-	24/03/2021	24/03/2021
Moisture	%	9.1	13

Asbestos ID - soils						
Our Reference		264779-2	264779-3	264779-5	264779-8	264779-10
Your Reference	UNITS	BH1	BH2	BH3	BH4	BH5
Depth		0.2-0.25	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date analysed	-	24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
Sample mass tested	g	Approx. 65g	Approx. 45g	Approx. 25g	Approx. 30g	Approx. 40g
Sample Description	-	Beige fine-grained soil & debris	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg 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

Asbestos ID - soils				
Our Reference		264779-13	264779-16	264779-20
Your Reference	UNITS	BH6	BH7	BH8
Depth		0.2-0.4	0.2-0.4	0.2-0.4
Date Sampled		17/03/2021	17/03/2021	17/03/2021
Type of sample		SOIL	SOIL	SOIL
Date analysed	-	24/03/2021	24/03/2021	24/03/2021
Sample mass tested	g	Approx. 40g	Approx. 45g	Approx. 25g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg 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

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
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-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-020	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-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-021	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-022	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. 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.

Method ID	Methodology Summary
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/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-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	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-023	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-2	[NT]
Date extracted	-			23/03/2021	2	23/03/2021	23/03/2021		23/03/2021	[NT]
Date analysed	-			24/03/2021	2	24/03/2021	24/03/2021		24/03/2021	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	<25	2	<25	<25	0	96	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	2	<25	<25	0	96	[NT]
Benzene	mg/kg	0.2	Org-023	<0.2	2	<0.2	<0.2	0	114	[NT]
Toluene	mg/kg	0.5	Org-023	<0.5	2	<0.5	<0.5	0	95	[NT]
Ethylbenzene	mg/kg	1	Org-023	<1	2	<1	<1	0	87	[NT]
m+p-xylene	mg/kg	2	Org-023	<2	2	<2	<2	0	92	[NT]
o-Xylene	mg/kg	1	Org-023	<1	2	<1	<1	0	95	[NT]
naphthalene	mg/kg	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	93	2	88	85	3	87	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			23/03/2021	2	23/03/2021	23/03/2021		23/03/2021	[NT]
Date analysed	-			24/03/2021	2	24/03/2021	24/03/2021		24/03/2021	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	2	<50	<50	0	121	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	2	<100	<100	0	99	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	2	<100	<100	0	100	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	2	<50	<50	0	121	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	2	<100	<100	0	99	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	2	<100	<100	0	100	[NT]
Surrogate o-Terphenyl	%		Org-020	80	2	78	78	0	100	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			23/03/2021	2	23/03/2021	23/03/2021		23/03/2021	[NT]
Date analysed	-			26/03/2021	2	26/03/2021	26/03/2021		26/03/2021	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	95	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	97	[NT]
Fluorene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	102	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	101	[NT]
Anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	100	[NT]
Pyrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	98	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	112	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	2	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	2	<0.05	<0.05	0	93	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	101	2	105	97	8	100	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			23/03/2021	2	23/03/2021	23/03/2021		23/03/2021	[NT]
Date analysed	-			26/03/2021	2	26/03/2021	26/03/2021		26/03/2021	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	94	[NT]
HCB	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	91	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	89	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	101	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	97	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	99	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	97	[NT]
Endrin	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	86	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	76	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	84	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	105	2	109	101	8	105	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			23/03/2021	2	23/03/2021	23/03/2021		23/03/2021	[NT]
Date analysed	-			26/03/2021	2	26/03/2021	26/03/2021		26/03/2021	[NT]
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	82	[NT]
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	95	[NT]
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	81	[NT]
Malathion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	88	[NT]
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	97	[NT]
Parathion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	88	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-022	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	87	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	105	2	109	101	8	105	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			23/03/2021	2	23/03/2021	23/03/2021		23/03/2021	[NT]
Date analysed	-			26/03/2021	2	26/03/2021	26/03/2021		26/03/2021	[NT]
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	2	<0.1	<0.1	0	90	[NT]
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	105	2	109	101	8	105	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			25/03/2021	2	25/03/2021	25/03/2021		25/03/2021	[NT]
Date analysed	-			25/03/2021	2	25/03/2021	25/03/2021		25/03/2021	[NT]
Arsenic	mg/kg	4	Metals-020	<4	2	<4	5	22	100	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	2	<0.4	<0.4	0	102	[NT]
Chromium	mg/kg	1	Metals-020	<1	2	5	5	0	101	[NT]
Copper	mg/kg	1	Metals-020	<1	2	6	18	100	103	[NT]
Lead	mg/kg	1	Metals-020	<1	2	9	10	11	98	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	2	<0.1	<0.1	0	95	[NT]
Nickel	mg/kg	1	Metals-020	<1	2	4	4	0	102	[NT]
Zinc	mg/kg	1	Metals-020	<1	2	18	28	43	109	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	16	25/03/2021	25/03/2021		[NT]	[NT]
Date analysed	-			[NT]	16	25/03/2021	25/03/2021		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	16	5	5	0	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	16	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	16	7	8	13	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	16	16	14	13	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	16	14	16	13	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	16	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	16	11	9	20	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	16	36	40	11	[NT]	[NT]

QUALITY CONTROL: Misc Soil - Inorg					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			23/03/2021	[NT]	[NT]	[NT]	[NT]	23/03/2021	[NT]
Date analysed	-			23/03/2021	[NT]	[NT]	[NT]	[NT]	23/03/2021	[NT]
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	[NT]	[NT]	[NT]	[NT]	101	[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.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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 (not SPOCAS); 60-140% for organics/SPOCAS (+/-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.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Asbestos: Excessive sample volumes were provided for asbestos analysis.
A portion of the supplied samples were sub-sampled according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire sample.
Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples requested for asbestos testing were sub-sampled from bags provided by the client.

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 264779-2 for Cu & Zn. Therefore a triplicate result has been issued as laboratory sample number 264779-23.

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CHAIN OF CUSTODY DESPATCH SHEET

Project No:	202007.00	**Suburb:**	Bardia	**To:**	Envirolab Services
Project Name:	Contamination PSI	**Order Number**			Ashley St, Chatswood
Project Manager:	Brad Harris	**Sampler:**	AB	**Attn:**	
Emails:	bradley.harris@dougalspartners.com.au Alex.Bayer@douglaspartners.com.au			**Phone:**	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☑			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil W - water)	Container Type (G - glass P - plastic)	Analytes: Heavy Metals	OCP/OPP PCB	TRH and BTEX	PAH	Total Phenols	Asbestos 50g	Hold			Notes/preservation
BH1/0-0.1	1	17/03/21	S	G & P										
BH1/0.2-0.25	2	17/03/21	S	G & P	X	X	X	X		X				Combo 6a
BH2/0-0.1	3	17/03/21	S	G & P	X	X	X	X	X	X				Combo 8a
BH2/0.4-0.6	4	17/03/21	S	G & P										
BH3/0-0.1	5	17/03/21	S	G & P	X					X				
BH3/0.2-0.4	6	17/03/21	S	G & P	X	X	X	X						Combo 6
BH3/0.6-0.8	7	17/03/21	S	G & P										
BH4/0-0.1	8	17/03/21	S	G & P	X	X	X	X		X				Combo 6a
BH4/0.2-0.4	9	17/03/21	S	G & P										
BH5/0-0.1	10	17/03/21	S	G & P	X	X	X	X		X				Combo 6a
BH5/0.3-0.5	11	17/03/21	S	G & P										
BH6/0-0.1	12	17/03/21	S	G & P										
BH6/0.2-0.4	13	17/03/21	S	G & P	X	X	X			X				
BH6/0.6-0.8	14	17/03/21	S	G & P										
BH7/0-0.1	15	17/03/21	S	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: 264179
Date Received: 19.03.2021
Time Received: 17.00
Received By: TS HAW
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Date Received:
Time Received:
Received By:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

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

Lab Report/Reference No:

Metals to Analyse: 8HM unless specified here:

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

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

Signed: **Received by:** ELS SYD **Date & Time:** 19/03/2021 17.00

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 202007.00	**Suburb:** Bardia	**To:** Envirolab Services	
Project Name: Contamination PSI	**Order Number**	Ashley St, Chatswood	
Project Manager: Brad Harris	**Sampler:** AB	**Attn:**	
Emails: bradley.harris@dougalspartners.com.au Alex.Bayer@douglaspartners.com.au		**Phone:**	
Date Required: Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐		**Email:**	
Prior Storage: ☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)		

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Heavy Metals	OCP/OPP PCB	TRH and BTEX	PAH	Total Phenols	Asbestos 50g	Hold			Notes/preservation
BH70.2-0.4	16	17/03/21	S	G & P	X					X				
BH7/0.5-0.7	17	17/03/21	S	G & P	X	X	X	X	X					Combo 8
BH7/0.9-1.0	18	17/03/21	S	G & P										
BH8/0-0.1	19	17/03/21	S	G & P	X	X	X	X						Combo 6
BH8/0.2-0.4	20	17/03/21	S	G & P	X					X				
BH8/0.7-0.9	21	17/03/21	S	G & P										
BD1/210317	22	17/03/21	S	G	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

Lab Report/Reference No:

Metals to Analyse: 8HM unless specified here:

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

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

Signed: **Received by:** **Date & Time:**

Appendix H

Quality Assessment and Quality Control

Appendix H
Quality Assessment and Quality Control

H1.0 Field and Laboratory Data Quality Assurance and Quality Control

The field and laboratory data quality assurance and quality control (QA/QC) procedures and results are summarised in the Table 1. Reference should be made to the field work methodology and the laboratory results/certificates of analysis for further details. The relative percentage difference (RPD) results, along with the other field QC samples are included at the end of this appendix.

Table 1: Field and Laboratory Quality Control

Item	Evaluation / Acceptance Criteria	Compliance
Analytical laboratories used	NATA accreditation	C
Holding times	Various based on type of analysis	C
Intra-laboratory replicates	5% 10% of primary samples; <30% RPD	PC
Laboratory / Reagent Blanks	1 per batch; <PQL	C
Matrix Spikes	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Surrogate Spikes	All organics analysis; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Control Samples	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Standard Operating Procedures (SOP)	Adopting SOP for all aspects of the sampling field work	C

Notes: C = compliance; PC = partial compliance; NC = non-compliance

The RPD results were all within the acceptable range, with the exception of those indicated in Table QA1. The exceedances are not, however, considered to be of concern given that:

- The typically low actual differences in the concentrations of the replicate pair where some RPD exceedances occurred;
- The replicate pair being collected from fill which by its nature is heterogeneous;
- A replicate, rather than homogenised duplicates, was used to minimise risk of volatile loss, hence greater variability can be expected;
- Most of the recorded concentrations being relatively close to the practical quantitation limit (PQL);
- The majority of RPDs within a replicate pair being within the acceptable limits; and
- All other QA/QC parameters met the DQIs.

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

H2.0 Data Quality Indicators

The reliability of field procedures and analytical results was assessed against the following data quality indicators (DQIs) as outlined in NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [the 'NEPM']* (NEPC, 2013):

- 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.

Table 2: Data Quality Indicators

Data Quality Indicator	Method(s) of Achievement
Completeness	Systematic and selected target locations sampled.
	Preparation of borehole/test pit logs, sample location plan and chain of custody 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 chain of custody (CoC) documentation.
	NATA accredited laboratory results certificates provided by the laboratory.
	Satisfactory frequency and results for field and laboratory quality control (QC) samples as discussed in Section 1.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project.
	Experienced sampler used.
	Use of NATA accredited laboratory
	Satisfactory results for field and laboratory QC samples.

Data Quality Indicator	Method(s) of Achievement
Representativeness	Target media sampled.
	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 CoC.
Precision	Field staff followed standard operating procedures.
	Acceptable RPD between original samples and replicates.
	Satisfactory results for all other field and laboratory QC samples.
Accuracy	Field staff followed standard operating procedures.
	Satisfactory results for all field and laboratory QC samples.

Based on the above, it is considered that the DQIs have been complied with.

H3.0 Conclusion

Based on the results of the field QA and field and laboratory QC, and evaluation against the DQIs it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

H4.0 References

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

Table QA1: Relative Percentage Difference Results – Intra-laboratory Replicates

			Metals								TRH						BTEX				PAH				Phenol	OCP											OPP	PCB	Asbestos		
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	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 [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs	Phenol	DDD	DDT+DDE+DDD [c]	DDE	DDT	Aldrin & Dieldrin	Total Chlordane	Endrin	Total Endosulfan	Heptachlor	Hexachlorobenzene	Methoxychlor	Chlorpyriphos	Total PCB	Asbestos ID in soil >0.1g/kg	Trace Analysis	Asbestos (60 g)
Sample ID	Depth	Sample 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	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	-	-	-
BD1/210317	0 m	17/03/2021	8	<0.4	13	19	20	<0.1	14	54	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	-	-	-
BH7	0.2 - 0.4 m	17/03/2021	5	<0.4	7	16	14	<0.1	11	36	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	AD	AD	AD
		Difference	3	0	6	3	6	0	3	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		RPD	**46%**	0%	**60%**	17%	**35%**	0%	24%	**40%**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-