Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Detailed Site Investigation

Stage 2 Proposed Redevelopment
Campbelltown Hospital, Campbelltown, NSW

Prepared for
Health Infrastructure NSW

Project 34275.09
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Douglas Partners
Geotechnics / Environment / Groundwater

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

	Signature	Date
Author		2 August 2018
Reviewer		2 August 2018

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Executive Summary

Douglas Partners Pty Ltd (DP) was commissioned by Health Infrastructure (HI) to conduct a Detailed Site Investigation (Contamination) (DSI) for the proposed Stage 2 redevelopment ('the proposed redevelopment') of Campbelltown Hospital, Campbelltown, NSW ('the site'). The location of the proposed redevelopment is shown on Drawing 1 (Appendix A). The investigation was carried out in accordance with DP's proposal MAC170225 dated 24 July 2017 and associated approved variations (contract reference HI17256).

DP understands that the DSI is required to support several development applications (DA) and review of environmental factors (REF) being prepared by HI to be submitted to Campbelltown Council (Council) for the proposed development. A separate DSI report titled *Report on Detailed Site Investigation, Stage 2 Proposed Car Park Facilities, Campbelltown Hospital, Campbelltown, NSW,* dated 1 February 2018 (DP, 2018) has been prepared by DP to support a separate DA for the construction of car parking facilities at the site to be constructed in the eastern portion of the hospital site.

The purpose of this DSI is to assess the potential for soil and groundwater impact at the site and comment on the site's suitability, from a contamination standpoint, for the proposed development (as a hospital).

The scope of works completed by DP included a review of previous contamination investigations, preparation of a preliminary conceptual site model (CSM) for the proposed development, collection and analysis of soil samples for identified contaminants of potential concern, screening soil analytical results against guideline values for a hospital setting and preparation of this report.

The preliminary CSM identified potential sources of contamination at the site were possible filling and use of fertilisers, pesticides and herbicides in garden areas. Soil analytical results were below the laboratory limit of reporting and/or the adopted site assessment criteria in all samples.

DP concludes that the potential for contamination constraints at the site with respect to the proposed redevelopment is generally considered to be low and the site is suitable (from a contamination perspective) for the proposed redevelopment. It was not possible to sample within building footprints during the DSI; DP recommends a building footprint inspection should be carried out after demolition of relevant structures is completed and prior to construction of new structures. DP understands a hazardous material survey (HazMat) has been prepared by others for structures at the site. The recommendations of the HazMat should be adhered to throughout the proposed development works and in particular prior to and during demolition works.

There is the potential that hidden, below ground structures (such as fuel tanks, septic tanks, filled gullies, ACM pipes and ACM fence footings) may be present at the site (such as within current building footprints) including within current building footprints and this should be considered accordingly during bulk earthworks for the proposed development. An Unexpected Finds Protocol will therefore need to be established for use during earthworks during redevelopment, in order to ensure that due process is carried out in the event of a possible contaminated find.

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Stage 2 Proposed Redevelopment
Campbelltown Hospital, Campbelltown, NSW

1. Introduction

Douglas Partners Pty Ltd (DP) was commissioned by Health Infrastructure (HI) to conduct a Detailed Site Investigation (Contamination) (DSI) for the proposed Stage 2 redevelopment of Campbelltown Hospital, Campbelltown, NSW ('the site'). The location of the proposed redevelopment is shown on Drawing 1 (Appendix A). The investigation was carried out in accordance with DP's proposal MAC170225 dated 24 July 2017 and associated approved variations (contract reference HI17256).

DP understands that the DSI is required to support several development applications (DA) and a review of environmental factors (REF) being prepared by HI to be submitted to Campbelltown Council (Council) for the proposed development. A separate DSI report titled *Report on Detailed Site Investigation, Stage 2 Proposed Car Park Facilities, Campbelltown Hospital, Campbelltown, NSW,* dated 1 February 2018 (DP, 2018) has been prepared by DP to support a separate DA for the construction of car parking facilities at the site to be constructed in the eastern portion of the hospital site.

The current DSI was completed in conjunction with geotechnical investigations conducted by DP for the site, and as such select soil samples were collected from soil bores conducted as part of those works. The findings of the geotechnical investigation will be reported under separate cover (Project No. 34275.08).

This report has been prepared with reference to *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011), the *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013 (NEPC, 2013) and NSW State Environmental Planning Policy No 55 – *Remediation of Land* (2014; SEPP 55).

The purpose of this DSI is to assess the potential for soil and groundwater impact at the site and comment on the site's suitability, from a contamination standpoint, for the proposed development (as a hospital).

2. Scope of Works

The scope of works completed by DP was as follows:

- Review of previous contamination investigations conducted by DP for the site (see Section 4) including review of laboratory analytical results against suitable contamination assessment criteria for the proposed development;
- Preparation of a preliminary conceptual site model for the proposed development;

- Collection of soil samples from soil cores/augers was completed as part of the geotechnical investigation works. Soil samples were collected during two separate mobilisations, on 8 March 2018 and between 20 and 21 March 2018, using the following rigs;
  - Bores 101 – 105, 107 and 109 – 115: Comacchio Geo 305 combination 110 mm auger and coring; and
  - Bores 106, 108, 116 and 118: Hanjin D&B8.
- Analysis of select soil samples for identified contaminants of potential concern (COPC) including;
  - Metals (arsenic, cadmium, chromium, copper, manganese, lead, mercury, nickel, zinc);
  - Total recoverable hydrocarbons (TRH);
  - Monocyclic aromatic hydrocarbons (benzene, toluene methylbenzene and xylenes - BTEX)
  - Polycyclic aromatic hydrocarbons (PAH);
  - Total phenols;
  - Organochlorine pesticides (OCP), organophosphorus pesticides (OPP) and polychlorinated biphenyls (PCB); and
  - Asbestos (40 - 50 g soil samples and materials).
- Screening soil analytical results against applicable guideline values for a hospital (see Section 8); and
- Preparation of this report detailing the methodology and results of the DSI and providing comments on the suitability of the site for the proposed land use.

The current scope of work did not include surface water sampling or the drilling and sampling of groundwater monitoring wells to evaluate groundwater quality across the site. The need for any surface water and/or groundwater investigation was to be based on the outcome of the current soil sampling and analytical programme.

3. Site Description

The site is located in the central and western portion of Campbelltown Hospital, on the corner of Therry Road and Appin Road, Campbelltown. The site is identified as part Lot 6, Deposited Plan 1058047 within the local government area of Campbelltown City Council.

The wider Campbelltown Hospital site is irregular shaped and comprises two separate portions (separated by Central Road) with a total area of approximately 21.3 ha. The total area of the proposed development is approximately 1.9 ha.

The site layout and boundaries are shown on Drawing 1, Appendix A.

3.1 Proposed Development

The proposed development comprises the demolition and construction of new hospital facilities shown in purple (new hospital buildings), orange (refurbishment of existing buildings) and yellow (new pedestrian transport corridor). The proposed new car parking facilities (grey) are the subject of a separate DSI (DP, 2018).

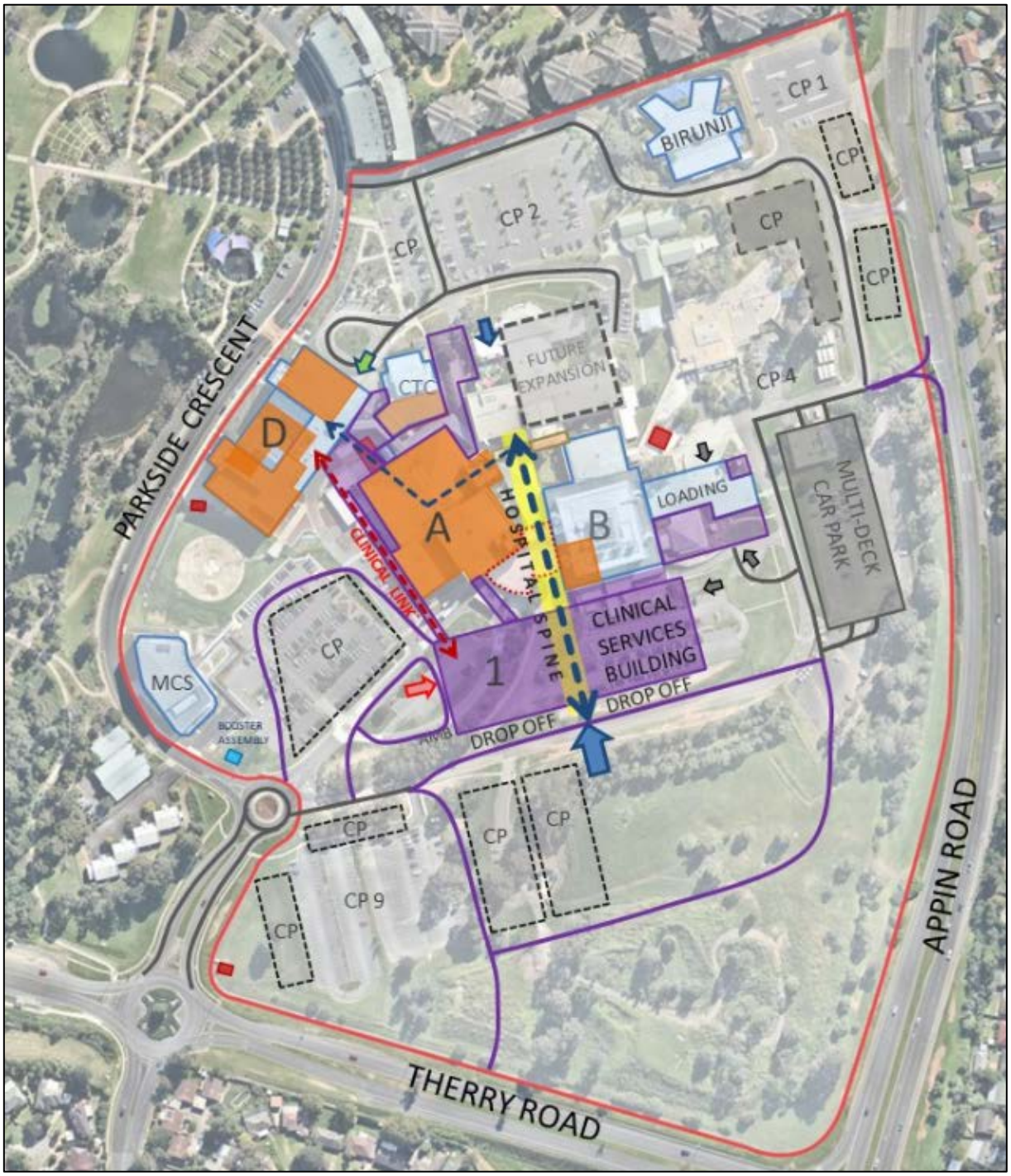


Figure 1: Location of site structures to be demolished and rebuilt (purple) or renovated (orange)

3.2 Soil Landscapes

Reference to the *Soil Conservation Service of NSW (1990) Soil Landscapes of the Wollongong-Port Hacking 1:100,000 Sheet* indicates that the site is underlain by the Blacktown soil landscape (mapping unit bt), characterised by gently undulating rises on Wianamatta Group shales, with local relief to 30 m and slopes usually less than 5%. The landscape is typically represented by broad rounded crests and ridges with gently inclined slopes. Soils range from shallow (<1 m) red-brown podzolic soils -comprising mostly clayey soils on crests and upper slopes - to deep (1.5 m - 3 m) yellow-brown clay soils on lower slopes and areas of poor drainage. These soils are typically moderately reactive with low fertility, poor soil drainage and highly plastic subsoil.

3.3 Geology and Hydrogeology

Reference to the *Geological Survey of New South Wales (1985), Wollongong-Port Hacking 1: 100 000 Geological Sheet 9029-9129* indicates the site is underlain by Ashfield Shale (mapping unit Rwa) of the Wianamatta Group of the Triassic age. This formation typically comprises laminite and dark grey siltstone.

A search of the NSW Office of Water groundwater bore database on 27 July 2017 indicated that here were four registered bores within a distance of approximately 1 km of the site. Three of the bores were located west of the site, and the other was located approximately 0.5 km east. Work summaries from the bore search indicated that the authorised and intended purpose of the bores was for monitoring. Three groundwater bores have previously been installed on the site by DP (DP, 2012 – refer to Section 4 for full reference). The locations of the bores are shown on Drawing 1, Appendix A. The groundwater level (below ground level) at the time of the previous investigation ranged from 1.55 m bgl to 6.14 m bgl.

3.4 Hydrology

Surface water is anticipated to follow the topographical slope, towards tributaries of Birunji Creek, located approximately 100 m west of the site. Fishers Ghost Greek is located approximately 350 m east of the site.

3.5 Site Topography

Overall topographic relief ranges from approximately RL 114 m, relative to the Australian Height Datum (AHD) within the south-eastern portion of the site to the lowest part (approximately 76 RL) within the western portion of the site.

3.6 Acid Sulfate Soil Potential

Reference to the NSW acid sulfate soils (ASS) risk map indicates that the site is located within an area of no known occurrence of ASS.

4. Previous Investigations

The following previous contamination investigations of relevance to this report have been prepared for the Campbelltown Hospital site:

- DP *Report on Preliminary Contamination Assessment, Macarthur Strategy Project, Campbelltown Hospital,* Reference 22884-2 (DP, 1998);
- DP, *Report on Phase 1 Contamination Assessment (P1CA), Campbelltown Hospital Redevelopment, Therry Road, Campbelltown,* Reference 34275.01 (DP, 2011);
- DP letter *Phase 1 Contamination Assessment, Campbelltown Hospital Redevelopment, 34275.01* (DP, 2011a);
- DP, *Report on Phase 2 Contamination Assessment, Proposed Hospital Redevelopment, Campbelltown Hospital, Therry Road, Campbelltown,* Project 34275.02 (DP, 2012 – the P2 CA);
- DP, *Phase 2 Contamination Assessment Summary Report, Stage 1 - Acute Health Services Building, Campbelltown Hospital, Therry Road, Campbelltown,* Project 34275.02 (DP, 2012a); and
- DP *Report on Preliminary Site Investigation, Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW,* Project 34275.09 (DP, 2017 – 'the PSI').

Previous investigation locations are presented on Drawing 1, attached. A review of previous investigations is presented in the PSI and key findings of relevance to this report are summarised below:

- Based on the findings of a site history review and site inspection conducted as part of the P1CA (DP, 2011) the following potential areas of environmental concern (PAEC) of relevance to the site were identified as requiring further investigation:
  - Filling;
  - Demolition and degradation of structures - thought to be minimal based on site history review; and
  - Incinerators and boilers - DP, 2011 noted that it is not known whether or not these existed.

  Three soil bores (bores 38 – 40) were completed as part of the P1CA and observed soil strata comprised filling (roadbase and crushed sandstone – part of road/pavements and reworked natural strata) above natural strata (comprising shaly clay and shale). No laboratory analysis was completed as part of the P1CA.
- The above PAEC were subject to investigation as part of the PSI and subsequently reviewed as part of the P2 CA (DP, 2012) to inform the proposed development of an Acute Health Services Building, a new helipad and new on-grade car parks with associated roads, footpaths and landscaped areas. Three groundwater monitoring bores were drilled and installed at the site as part of the P2 CA (MW104 – 106 – refer to Drawing 1, Appendix A). Observed soil strata comprised filling (roadbase) above natural strata (clay, sandy clay and shale at depth).

Soil samples were collected at depth (natural strata) and analysed for potential contaminants of concern and all results were below the adopted criteria. After installation, the groundwater monitoring bores were purged and sampled and samples analysed for lead, naphthalene, sum of TPH and BTEX and all analytical results were below the laboratory limit of reporting (LOR). Based on the findings of the investigation, DP (2012) concluded that the site was suitable for the proposed development, and no further contamination investigation was considered necessary. With the exception of engineering and maintenance workshops (located outside of the current site boundary and documented in DP, 2018), no further action was considered to be required with regard to AECs;

- Given the time elapsed since the preparation of the PSI (DP, 1998) in particular the amendment to NSW EPA endorsed contamination guidelines National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure* 1999, amended 2013 (NEPC, 2013) DP conducted an updated PSI for the Stage 2 development area (DP, 2017). The scope of work included a site walkover and updated site history search. Key findings of relevance to this report are as follows:
  - The following structures that store or use hazardous chemicals were recorded to be present at the site in the SafeWork NSW search:
    - X-ray department in the main building;
    - Wire cage for gas cylinders located in the main building; and
    - USTs located associated with or near the main building.

    No odours or staining were observed during drilling works completed at the site prior to the PSI.
  - DP recommended a DSI be conducted to confirm the contamination status of the Stage 2 redevelopment area; and
  - The development of an Unexpected Finds Protocol was recommended for use during earthworks and redevelopment of the site, in order to ensure that due process is carried out in the event of a possible unexpected find.

5. 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 (linkages). A preliminary CSM provides a framework to identify potential contamination sources and how potential receptors may be exposed to contamination either in the present or the future (i.e. it enables an assessment of the potential source - pathway - linkages).

5.1 Potential Sources

Based on the review of site history information and the site walkover, the identified potential sources, description of sources and COPC at the site have been summarised in Table 2.

Table 2: Potential Contamination Sources and COPC

Potential Source	Description of Potential Source	Contaminants of Potential Concern
Possible Filling (S1)	The aerial photograph review indicated that several dams had been backfilled over time. Furthermore, during the site walkover, areas of localised fill were observed.	Metals, TRH, BTEX, PAH, OCP, OPP, PCB, phenols, and asbestos
Use of fertilisers, pesticides and herbicides in garden areas (S2)	Some garden maintenance occurs in road verges and garden areas throughout the hospital.	Metals, OCP and OPP

Notes

Metals - comprising arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn);
TRH - Total recoverable hydrocarbons;
BTEX - Benzene, toluene, ethylbenzene and xylene;
PAH - Polycyclic aromatic hydrocarbons;
OCP and OPP - Organochlorine and organophosphorus pesticides;
PCB - Polychlorinated biphenyls;
PFOS – Perfluorooctanesulfonate; and
PFAS – Perfluorooctanoic acid

5.2 Potential Receptors

The following potential human receptors (R) have been identified for the site:

- R1 – Construction and maintenance workers (during site redevelopment);
- R2 – Future site users (visitors / patients / staff) following development of the site; and
- R3 – Land users in adjacent areas.

The following potential ecological receptors (R) have been identified for the site:

- R4 – Local groundwater;
- R5 – Surface water bodies (Birunji Creek); and
- R6 – Terrestrial ecology.

9.3 Potential Pathways

Potential pathways for contamination include the following:

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

9.4 Summary of Potential Complete Pathways

A 'source - pathway - receptor' approach has been used to assess the potential risks of harm being caused to human or ecological receptors from contamination sources on or in the vicinity of the site, via exposure pathways. The possible exposure pathways between the above sources (S1 to S2) and receptors (R1 to R6) are provided in Table 3 below. Assessment of the preliminary CSM was used to determine data gaps and the requirement for sampling and analysis to assess the suitability of the site for the proposed development.

Table 3: Preliminary Conceptual Site Model

Source	Exposure Pathway	Receptor	Requirement for Additional Data and / or Management
S1: Possible Filling S2: Use of fertilisers, pesticides and herbicides	P1 – Ingestion and dermal contact; P2 – Inhalation of fibres and/or dust and/or vapours	R1 - Construction and maintenance workers. R2 – Future site users	An intrusive investigation is required to quantify and assess possible contamination including chemical testing of soil (and groundwater if deemed necessary).
	P2 – Inhalation of fibres and/or dust and/or vapours	R3 – Land users in adjacent areas.	
	P3 – Leaching of contaminants and vertical migration into groundwater.	R4 – Local groundwater.	
	P4 – Surface water run-off. P5 – Lateral migration of groundwater providing baseflow to watercourses.	R5 – Surface water bodies.	
	P6 – Contact with terrestrial ecology.	R6 – Terrestrial ecology.	

6. Fieldwork Methodology

6.1 Sampling Rationale

Field investigations were undertaken during two separate mobilisations, on 8 March 2018 and between 20 and 21 March 2018 by a DP environmental engineer and were undertaken concurrently with the geotechnical investigation (refer to Section 1).

The field investigation was designed with reference to the seven step data quality objective (DQO) process provided in Appendix B, Schedule B2 of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended 2013 (NEPC, 2013). It is noted that the final core locations were decided by the client. The DQO adopted for this DSI is provided in Appendix B1.

A total of 17 bore holes were completed as part of the DSI. Bore holes were generally carried out to refusal, or (in the case of cored boreholes) to provide a specific basement depth with relevant rock information.

The overall objective of the DSI is to assess the potential for soil impact at the site and comment on its suitability, from a contamination standpoint, for the proposed development (hospital). Soil analytical results shall be compared against Site Assessment Criteria (SAC) which are discussed and presented in Appendix B2.

The DSI scope has been devised broadly in accordance with the seven step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of the *National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended 2013* (NEP, 2013). The DQO process is outlined as follows:

6.2 Sampling Density and Test Locations

A total of 17 combined geotechnical and contamination soil cores were conducted as part of the current investigation, of which four (BH109, BH112, BH114 and BH115) were subject to laboratory analysis for COPC (see Section 2). A further six soil cores have been conducted as part of previous investigations and subject to select soil sampling and analysis (refer to Section 4). It was not possible to conduct soil sampling within current building footprints. DP notes that the soil sampling locations were subject to review and approval by HI.

All soil bore logs were reviewed for the presence of possible indicators of contamination (visual and/or olfactory) and select samples were scheduled for laboratory analysis targeting filling, the presence of an unconsolidated ground surface and the location of the proposed development.

Current and historical soil bore locations are shown in Drawing 1, Appendix A.

6.3 Soil Sampling

All sampling depths and type was recorded on DP bore logs, with samples also recorded on chain-of-custody sheets. The general sampling procedure adopted for the collection of environmental samples is summarised below:

- Collect soil samples from the auger returns using disposable sampling equipment (new nitrile glove for each sample);
- Transfer samples into laboratory-prepared glass jars, completely filled so that 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, 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 QA/QC requirements.

Samples designated for analysis were dispatched to Envirolab Services Pty Ltd for analysis of primary samples and intra-laboratory replicates. After backfilling each test bore, the surface was reinstated to its previous level.

7. Results

7.1 Field Results

The log sheets are included in Appendix C and should be read in conjunction with the accompanying standard notes defining classification methods and descriptive terms. The strata observed at the site is broadly summarised as follows:

- TOPSOIL: Topsoil comprising brown silty clay with rootlets was observed in the top 0 - 0.1 m of the soil strata in the western portion of the site (bores 109 to 113) where bores were completed in landscaped areas next to roads and car parks.
- FILLING (ROADBASE): Filling comprising grey crushed sandstone was observed immediately below asphaltic concrete and concrete (where present) in bores conducted across the southern portion of the site, i.e. within the current car park and in the northern access road (bores 101 to 108, 114 and 115). It is noted that no road base or filling was observed beneath concrete within the loading bay (bore 106). The concrete in bore 106 was 0.37 m in thickness.
- FILLING: Filling comprising brown and red silty clay with some siltstone gravel/cobbles (possibly reworked natural) were observed to depths of between 1.8 and 1.9 m below the current ground level in bores 114 and 115 respectively.
- NATURAL: Where observed, natural strata comprised the following (in order).
- SILTY CLAY: Observed at depths of between 0.55 and 4 m bgl in bores 108, 112, 114 and 115.
- ROCK (SILTSTONE): Top of strata observed at depths of between 0.3 and 4 m in all bores.

No free groundwater was observed in the boreholes. It is noted, however, that the bores were immediately backfilled following drilling which precluded longer term monitoring of groundwater levels that might be present. No anthropogenic material was observed in filling at the site. No stockpiles were observed at the site.

7.2 Analytical Results

Select samples were scheduled for analysis for the identified COPC (refer to Section 6). The analytical results are summarised in Appendix D, together with the SAC. The laboratory certificates of analysis are provided in Appendix E. Soil analytical results are summarised below:

- All samples analysed had metals concentrations below the laboratory limit of reporting (LOR) and/or the adopted SAC;
- All samples analysed had PAH and phenols concentrations below the laboratory LOR and the adopted SAC;

- TRH and BTEX was recorded below the laboratory LOR and the adopted SAC in all samples analysed;
- OCP, OPP and PCB analytical results were below the LOR and the SAC in all samples analysed; and
- No asbestos was reported in any of the samples analysed.

7.3 Quality Assurance and Quality Control

The methodology, results and discussion of the field and laboratory QA/QC assessment are provided in Appendix B. Based on the results of the QA/QC assessment the data is considered to be suitable for use in assessing the contamination status of the site.

8. Discussion

The scope of this DSI included a review of previous contamination investigations and soil testing. Soil testing locations were subject to review and approval by HI. As discussed in Section 7.2, it was not possible to conduct soil testing within current building footprints, however given the shallow depth to rock encountered at the site, the risk for filling posing a potential contamination risk to the development to be located beneath current footprints is considered to be low.

The findings of previous contamination investigations indicated that the site has been used as a hospital since the 1970's and prior to this for farming (pastoral) purposes. The site has been subject to various stages of redevelopment since the 1970's and previous investigations have indicated the presence of filling at the site. Soil bores conducted at the site indicated some localised filling commonly associated with the current car park, paving areas and is therefore assumed to be part of the roadbase. No suspected anthropogenic material was observed in any of the soil cores completed at the site.

Soil analytical results identified concentrations of COPC below the LOR, and/or below the SAC.

8.1 Revised CSM

Observed filling at the site comprised roadbase materials and/or reworked natural materials only. All soil analytical results complied with the relevant SAC; as such no source-receptor linkages are present with respect to the development.

9. Conclusions and Recommendations

DP concludes that the potential for contamination constraints at the site with respect to the proposed redevelopment is generally considered to be low and the site is suitable (from a contamination perspective) for the proposed redevelopment. It was not possible to sample within building footprints during the DSI; DP recommends a building footprint inspection should be carried out after demolition of relevant structures is completed and prior to construction of new structures to confirm the contamination status of these currently inaccessible areas.

DP understands a hazardous material survey (HazMat) has been prepared by others for structures at the site. The recommendations of the HazMat should be adhered to throughout the proposed development works and in particular prior to and during demolition works.

9.1 Off-site Disposal

The proposed redevelopment of the site is expected to require 'cut' and as such will likely generate excess surplus material that will require off-site disposal.

Prior to off-site disposal of *any* excavated surplus material generated as part of bulk earthworks, an appropriate waste classification must be conducted by a qualified environmental consultant in accordance with NSW EPA *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW EPA, 2014). Any material transported and/or disposed of off-site must be accompanied by appropriate reporting and material tracking in accordance with the *POEO* Act 1997 and NSW EPA (2014) guidance.

The waste classification may potentially include assessment of suitable natural strata at the site as potential Virgin Excavated Natural Materials (VENM) or Excavated Natural Materials (ENM) as defined in the *Protection of the Environment Operations* (*POEO)* Act 1997. Classified VENM and ENM materials are currently exempted under the *POEO* Act 1997, and as such can potentially be transported for re-use as fill on other sites ('receiver sites'). Some of this surplus material will potentially comprise filling (including portions of the site that were not subject to direct sampling and testing[1]) and as such will require off-site disposal to a suitably licensed landfill facility. Upon request, DP can assist with Waste Classification once the design drawings are available.

9.2 Unexpected Finds

There is the potential that hidden, below ground structures (such as fuel tanks, septic tanks, filled gullies, ACM pipes and incinerator waste) may be present at the site (such as within current building footprints) and this should be considered accordingly during bulk earthworks for the proposed development. An Unexpected Finds Protocol will therefore need to be established for use during earthworks during redevelopment, in order to ensure that due process is carried out in the event of a possible contaminated find. This would also apply to areas of the site that could not be appropriately accessed during testing or the site walkover (such as the engineering / gardeners shed), as discussed in Section 5, if these areas become cleared and/or accessible to the identified human receptors under the proposed development.

[1] Refer to Section 12 for further definition.

10. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Campbelltown Hospital, Campbelltown, NSW in accordance with DP's proposal MAC17225 dated 24 July 2017 and Contract reference HI17256. This report is provided for the exclusive use of Health Infrastructure NSW for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

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

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

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

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/sampling [where appropriate], or to vegetation preventing visual inspection and reasonable access [where appropriate]. 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.

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

Douglas Partners Pty Ltd

Appendix A

About This Report
Drawing 1

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

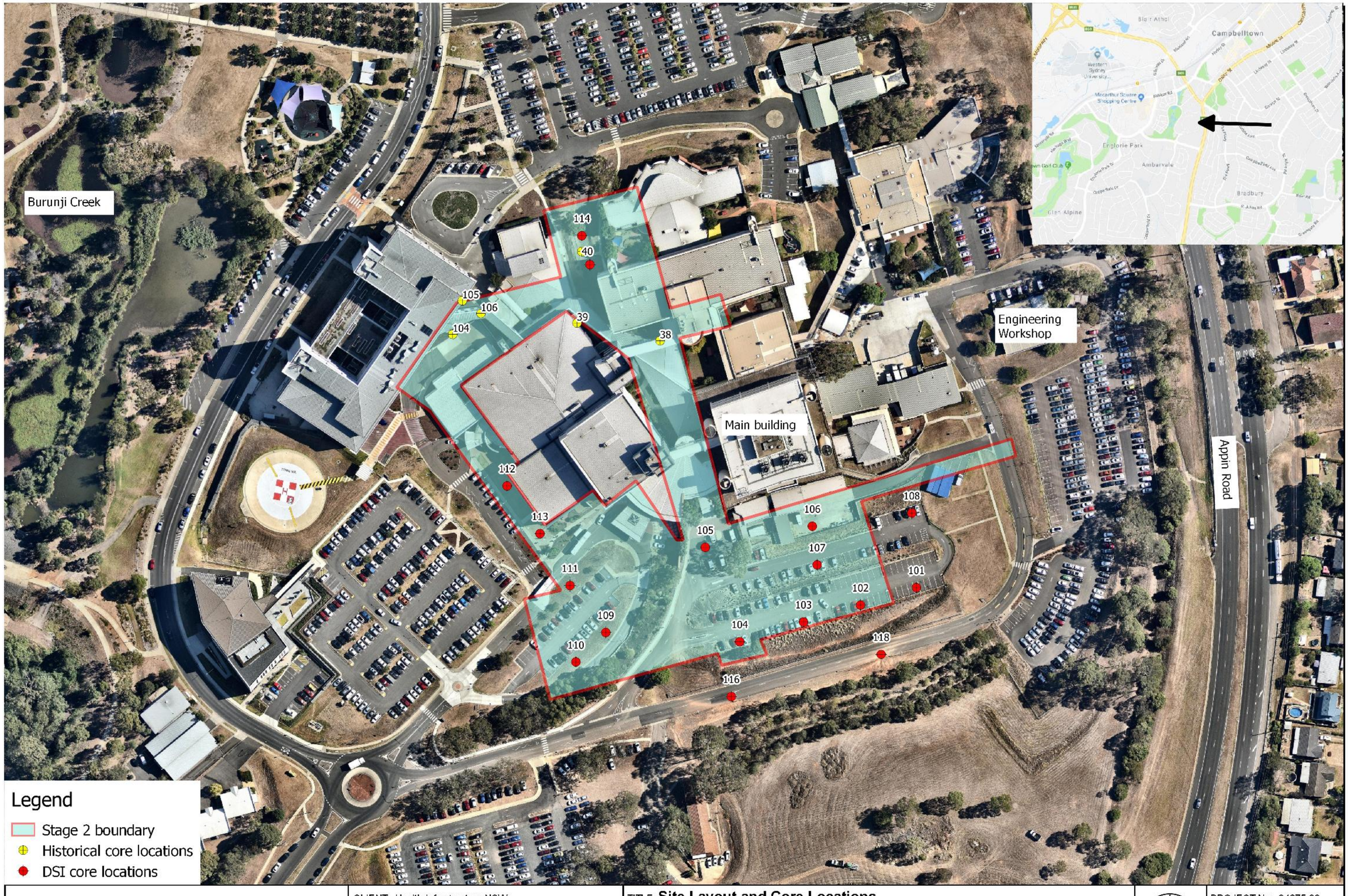
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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

Information for Contractual Purposes

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

Site Inspection

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



Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Health Infrastructure NSW	TITLE: **Site Layout and Core Locations** **Stage 2 Proposed Redevelopment** **Campbelltown Hospital, Campbelltown, NSW**	PROJECT No: 34275.09
	OFFICE: Macarthur / DRAWN BY: EMG		DRAWING No: 1
	SCALE: 1:24,936 / DATE: 9 Apr 2018	N MGA	REVISION: A

Appendix B

Data Quality Objectives and Site Assessment Criteria

Appendix B1: Data Quality Objectives

This 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 the *National Environment Protection (Assessment of Site Contamination) Measure* 1999 as amended 2013 (NEPC, 2013). The DQO process is outlined below:

C1.1 State the Problem

The site is to be redeveloped to upgrade existing hospital facilities and provide additional hospital facilities as part of the Stage 2 redevelopment. At the time of report preparation, the site was occupied by current on-grade parking for the hospital, hospital buildings and existing roads and associated road verge areas.

The "problem" under consideration is the characterisation of the type, extent and nature of contamination that may exist at the site, if any, and the suitability of the site, from a contamination standpoint, for the proposed development.

C1.2 Identify the Decision / Goal of the Study

The available site history indicates the Campbelltown Hospital site has been used as a hospital since the early 1970's. Prior to this the site comprised paddocks as well as a golf club. Localised potential contamination sources have been identified (see Table 1).

The analytical data were compared to relevant site assessment criteria (SAC) (refer to Section 8). The suitability of the site for car parking was based on a comparison of the analytical results for all contaminants of concern to the adopted SAC and, if necessary, compared to the 95% upper confidence limit (UCL) of the mean concentrations.

The following specific decisions were made, as appropriate:

- Do the existing fill materials (if present) and/or natural soils pose a potential risk to identified receptors?
- Is the data sufficient to make a decision regarding the abovementioned risks and the suitability of the site for the proposed development or are additional investigations required?
- Does contamination at the site, if encountered, trigger the Duty to Report requirements under the *Contaminated Land Management* Act 1997 (CLM Act 1997)?
- Are there any off-site migration issues that need to be considered?
- Is the data sufficient to enable the preparation of a Remediation Action Plan (RAP) and/or Environmental Management Plan (EMP) should the data suggest these are required?

C1.3 Identify Information Inputs

The inputs into the decision process were as follows:

- Historical information regarding past land uses and features;
- Site operations and observation details;
- Soil profile information obtained through the intrusive investigation and sampling phase;
- The conceptual site model;
- Chemical test data on analysed soil samples;
- Assessment of test data against applicable SAC; and
- Details of the proposed development.

C1.4 Define the Site Boundaries

The boundary of the assessment comprises the extent of the proposed Stage 2 development area as shown on Drawing 1, Appendix A and to the depth of potential contamination, if present.

C1.5 Develop the Analytical Approach (or decision rule)

The information obtained through this DSI was used to assess the suitability of the site (from a contamination standpoint) for the proposed development. The decision rule in conducting this DSI was as follows:

- Laboratory test results were assessed individually, and/or statistically where appropriate;
- The SAC have been endorsed by the NSW Environment Protection Authority (EPA);
- The soil analytical results provide an indication of the likely potential for contamination at the site;
- Relevant site information, observations and exceedances of the SAC were used to evaluate whether the site is suitable for the proposed development, from a contamination standpoint; and
- Further targeted investigations and / or remediation works will be recommended, if required.

Field and laboratory test results were considered useable for the assessment after evaluation against the following data quality indicators (DQIs):

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

The specific limits (their acceptable range, where applicable) are outlined in the data QA/QC procedures and results (Appendix F).

C1.6 Specify the Performance or Acceptable Criteria

Considering that the future site development will comprise car parking, decision errors for the respective contaminants of concern in fill or soils are:

1. Deciding that the site's fill / soils exceed the SAC when they truly do not; and
2. Deciding that the site's fill / soils are within the SAC when they are truly not.

Decision errors for the DSI were minimised and measured by the following:

- Sample collection and handling techniques were in accordance with DP's *Field Procedures Manual*;
- Samples were prepared and analysed by a NATA accredited laboratory with the acceptance limits for laboratory QA/QC parameters based on the laboratory reported acceptance limits and those stated in NEPC (2013);
- The analyte selection was based on the available site history, past site activities, site features, site walkover observations and the findings of previous investigations. The potential for contaminants other than those to be analysed was considered to be low;
- The SAC adopted were from NSW EPA endorsed guidelines. The SAC have risk probabilities already incorporated; and
- A NATA accredited laboratory using NATA endorsed methods were used to perform laboratory analysis. Where NATA endorsed methods were not used, the reasons are stated. The effect of using non-NATA methods on the decision making process is explained.

C1.7 Optimise the design for obtaining data

Sampling design and procedures that were implemented to optimise data collection for achieving the DQOs included the following;

- A NATA accredited laboratory using NATA endorsed methods was used to perform laboratory analysis whenever possible*;*
- Diffuse sources of contamination, such as the application of pesticides and herbicides, was evaluated under a grid-based soil contamination sampling programme, where possible; and
- Adequately experienced environmental scientists/engineers conducted field work and sample analysis interpretation.

Appendix B2: Site Assessment Criteria

Noting the proposed use of the site as a hospital the most appropriate comparative set of criteria for the site is high density residential criteria,[1]. The relevant Site Assessment Criteria (SAC) have been selected accordingly. Analytical results were assessed (as a Tier 1 assessment) against the SAC comprising the investigation and screening levels of Schedule B1, NEPC (2013). The NEPC guidelines are endorsed by the EPA under the CLM Act 1997. Petroleum based health screening levels for direct contact have been adopted from the CRC CARE (2011) *Technical Report No.10 Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater* as referenced by NEPC (2013).

C2.1 Health Investigation and Screening Levels

The Health Investigation Levels (HILs) and Health Screening Levels (HSLs) are scientifically-based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential risks to human health from chronic exposure to contaminants. HILs are applicable to assessing health risks arising from direct contact (dermal contact and incidental ingestion and inhalation of soil particles) to a range of contaminants. HSLs are used to assess selected petroleum compounds and fractions to assess the risk to human health via inhalation and direct contact with affected soils.

HSLs have been development for a range of petroleum hydrocarbons as either petrol or diesel mixtures, and for different land uses, media, pathways, soil types and depths to contamination. The investigation and screening levels are not intended to be used as clean up levels. They establish concentrations above which further appropriate investigation (e.g. Tier 2) should be undertaken. They are intentionally conservative and are based on a reasonable worst-case scenario for four generic land uses.

Potential exposure pathways considered were:

- Soil vapour intrusion and vapour inhalation (for hydrocarbon contamination) in relation to any structures that will be constructed as part of the memorial park; and
- Direct contact (dermal contact and incidental ingestion and inhalation of soil particles).

Soil types (relevant to HSL only) considered were:

- Clay, given the predominance of silty clay soils at the site (Section 9.1).

Depth to contamination considered was:

- 0 to <1 m for soil HSLs have been adopted as an initial conservative screen; and
- HILs apply generally to the top 3 m of soil.

Relevant land use criteria considered were HIL D / HSL D – commercial/industrial.

[1] As defined in Schedule B7 Table 4 (pp. 20) of NEPC, 2013. Less conservative criteria for the built environment (i.e. commercial/industrial) are not suitable for a site used frequently by more sensitive groups including children and the elderly, such as hospital sites (refer to Section 3.2.5.3; NEPC, 2013).

Only those contaminants common to both Table 1A (1) (NEPC, 2013) and the list of potential contaminants have been included.

The adopted soil HIL and HSL for the potential contaminants of concern are included in Table 1 (Appendix D).

C7.2 Ecological Investigation and Screening Levels

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

The EIL is calculated using the following formula:

EIL = ABC + ACL, where

ABC = Ambient Background Concentration
ACL = Added Contaminant Limit

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

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

The adopted EIL, derived from the Interactive (Excel) Calculation Spreadsheet are provided in Table 1 (Appendix D). The following site specific data and assumptions have been used to determine the EILs:

- A protection level of 80% has been adopted;
- The EILs will apply to the top 2 m of the soil profile;
- Given the potential sources of soil contaminants are from historic use, the contamination is considered as “aged” (>2 years);

- ABCs have been derived using the Interactive (Excel) Calculation Spreadsheet using input parameters of the State of NSW in which the Site is located, and low for traffic volumes. No background concentration is assumed for lead (conservative); and
- Site specific pH and CEC values have been obtained during the car park DSI investigation (DP, 2018) and used as input parameters in the Interactive (Excel) Calculation Spreadsheet. The pH and CEC values for the upper soil layers have an average pH of 9.45 and average CEC of 19.5 $cmol_c/kg$.

C2.3 Management Limits – Petroleum Hydrocarbons

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

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

Management Limits (MLs) to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance where TRH has been recorded. MLs have been derived in NEPC (2013) for the same four petroleum fractions as the HSL (F1 to F4). The adopted Management Limits, from Table 1B (7), Schedule B1 of NEPC (2013) are shown in Table 1 (Appendix D). The following site specific data and assumptions have been used to determine the MLs:

- The MLs will apply to any depth within the soil profile;
- The MLs for residential, parkland and public open space apply; and
- A fine soil texture has been adopted.

C2.4 Asbestos in Soil

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

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

Mining, manufacturing or distribution of asbestos products may result in sites being contaminated by friable asbestos including free fibres. Severe weathering or damage to bonded ACM may also result in the formation of friable asbestos comprising fibrous asbestos (FA) and/or asbestos fines (AF).

Asbestos only poses a risk to human health when asbestos fibres are made airborne and inhaled. If asbestos is bound in a matrix, such as cement or resin, it is not readily made airborne, except through substantial physical damage. Bonded ACM in sound condition represents a low human health risk, whilst both FA and AF materials have the potential to generate or be associated with, free asbestos fibres. Consequently, FA and AF must be carefully managed to prevent the release of asbestos fibres into the air.

A detailed asbestos assessment as outlined in NEPC (2013) was not undertaken as part of the investigation. Asbestos was screened from samples taken for general analysis and assessment of contaminants. The presence or absence of asbestos at a limit of reporting of 0.1 g/kg has been adopted for this assessment as an initial screen.

Appendix C

Bore Hole Logs

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 95.7 mAHD
EASTING: 297663
NORTHING: 6226977
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 34275.08
DATE: 2/3/2018
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
95	0.05	ASPHALTIC CONCRETE										
	0.3	FILLING - grey crushed sandstone (roadbase), moist										
		SILTSTONE - low strength, moderately weathered, grey siltstone							U			
	1								S			14,20/90mm,- refusal
94	2											
93		- becoming extremely low strength, extremely weathered below 2.5m						2.57m: B, h, pl, sm, cly int				PL(A) = 0.34
	3	- becoming medium strength, moderately weathered below 2.6m						2.6m: B, h, pl, sm, cln 2.65m: B, h, pl, sm, cln 2.79m: B, h, pl, sm, cln 2.81m: B, h, sm, cln 2.9m: J, 65°, sv, pl, ro, cln 20mm long 2.92m: J, 65°, sv, pl, ro, cln 20mm long 2.94m: J, 65°, sv, pl, ro, fe stn 30mm long 2.99m: B, h, pl, ro, fe stn 3.05m: B, h, pl, ro, fe stn	C	100	29.5	PL(A) = 0.29
92	4	- 150mm thick low strength, highly weathered band at 3.5m - 30mm thick extremely low strength, extremely weathered band at 4.1m										
		- becoming fresh below 4.4m						3.06m: B, h, pl, sm, cly vn 3.23m: J, 30°, sh, pl, ro, fe stn 20mm long 3.27m: J, v, cu, fe stn 90mm long 3.38m: B, h, pl, sm, fe stn 3.41m: J, v, pl, he, fe stn 30mm 3.45m: J, 60°, sv, sm, fe stn 30mm 3.5m: B, h, pl, ro, cly co 3.61m: B, h, pl, ro, cly co 3.66m: J, 30°, sh, pl, he, fe stn 10mm 3.68m: J, 30°, sh, pl, he, fe stn 10mm	C	100	57.5	PL(A) = 0.36 PL(A) = 0.36 PL(A) = 0.26
91	5	- 40mm thick extremely low strength, extremely weathered band at 4.71m										
90	6											
89		- becoming low strength below 6.5m						3.72m: J, 30°, sh, pl, he, fe stn 10mm 3.75m: J, 30°, sh, pl, he, fe stn 10mm 3.81m: J, 30°, sh, pl, he, fe stn 10mm 3.87m: J, 30°, sh, pl, he, fe stn 10mm 3.91m: B, h, pl, he, fe stn 3.92m: J, 70°, sv, pl, sm, fe stn 20mm long 4.1m: B, h, pl, sm, fe stn	C	100	68.5	PL(A) = 0.19
88	7											
		- becoming fresh below 7.78m										
87	8	- becoming medium strength below 8.5m						4.55m: B, h, pl, sm, cln 4.57m: Bm h, pl, sm, fe stn 4.6m: J, 70°, sv, pl, ro, cln 20mm long 4.62m: J, 70°, sv, pl, ro, cln 120mm long 5.05m: B, h, pl, cly vn 5.08m: B, h, pl, sm, cly co	C	100	99.4	PL(A) = 0.46 PL(A) = 0.35
	9											
86												

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.5m

TYPE OF BORING: 110mm diameter auger to 2.5m, NMLC coring to 20.8m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 95.7 mAHD
EASTING: 297663
NORTHING: 6226977
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 34275.08
DATE: 2/3/2018
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
85		SILTSTONE - medium strength, fresh, grey siltstone *(continued)*						5.1m: J, 70°, sv, pl, sm, cln 20mm long 5.25m: B, h, pl, ro, fe stn 5.52m: J, 60°, sv, pl, sm, cly co 150mm long 5.57m: B, h, pl, sm, cln 5.66m: B, h, pl, sm, cly co 5.75m: fg zone 90mm thick 5.84m: J, v, cu, pl, he 70mm long 5.91m: B, h, pl, sm, cly co	C	100	99.4	PL(A) = 0.59 PL(A) = 2.01
84	11	- becoming high strength below 11.5m										
83	12							6.03m: B, h, pl, sm, cly, un 6.04m: B, h, pl, sm, cly, un 6.16m: J, 65°, sv, pl, ro, fe stn 40mm long 6.2m: B, h, pl, ro, fe stn 6.25m: J, 75°, sv, pl, cln 20mm long 6.4m: J, v, cu, pl, fe stn 110mm long 6.45m: B, h, pl, ro, fe stn 6.51m: B, h, pl, ro, fe stn 6.57m: J, 70°, sv, pl, cly co 30mm long 6.64m: J, v, un, sm, fe stn 70mm long, B, h, pl, ro, fe stn 6.71m: J, 70°, sv, pl, sm, cln 70mm long 6.8m: J, v, st, ro, fe stn 60mm long, B, h, pl, ro, fe stn	C	100	100	PL(A) = 1.1 PL(A) = 0.99 PL(A) = 0.99
82	13	- becoming medium strength below 12.7m										
81	14											
80	15							7.17m: J, 65°, sv, pl, sm, cln 30mm long 7.27m: B, h, pl, sm, cly co 7.32m: J, 60°, sv, pl, sm, cly co 20mm long 7.41m: B, h, pl, sm, cly co 7.43m: J, 20°, sh, pl, sm, cln 20mm long 7.47m: B, h, pl, ro, fe stn 7.48m: B, h, pl, ro, fe stn 7.61m: J, v, st, sm, cln 30mm, B, h, pl, ro, cln 7.67m: J, v, cu, sm, cln 40mm long 7.75m: fg zone 30mm thick 8.38m: B, h, pl, sm cly co 9.05m: B, h, pl, sm, cln	C	100	97.6	PL(A) = 0.55 PL(A) = 0.63 PL(A) = 0.75
79	16											
78	17											
77	18							9.21m: J, 15°, sh, pl, sm, cln 9.47m: fg zone 50mm thick 9.87m: B, h, pl, sm, cly co 10.31m: Cs 10mm thick 11.36m: B, h, pl, sm, cln 12.1m: J, 30°, sh, pl, sm, cln 120mm long 12.87m: J, 70°, sv, pl, sm, cln 40mm thick 13.46m: J, 65°, sv, pl, ro, cln 170mm thick 15.41m: B, h, pl, sm, cln 15.44m: fg zone 30mm	C	100	99.3	PL(A) = 0.66 PL(A) = 0.94
76	19											

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.5m

TYPE OF BORING: 110mm diameter auger to 2.5m, NMLC coring to 20.8m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 95.7 mAHD
EASTING: 297663
NORTHING: 6226977
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 34275.08
DATE: 2/3/2018
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
75		SILTSTONE - medium strength, fresh, grey siltstone *(continued)*						thick	C	100	99.3	PL(A) = 0.73
	20.8	Bore discontinued at 20.8m - limit of investigation						15.91m: B, h, pl, sm, cln 15.93m: B, h, pl, sm, cln 16.6m: J, 65°, sv, pl, sm, cln 80mm long 17.85m: J, 65°, sv, un, sm, cln 70mm long 17.9m: J, v, cu, pl, sm, cln 40mm long 18.49m: J, 30°, sh, pl, sm, cln 29mm long 18.51m: J, 70°, sv, pl, sm, cln 40mm long				
74	21											
	22											
73	23											
72	24											
71	25											
70	26											
69	27											
68	28											
67	29											
66												

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.5m

TYPE OF BORING: 110mm diameter auger to 2.5m, NMLC coring to 20.8m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 94.7 mAHD
EASTING: 297637
NORTHING: 6226970
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 34275.08
DATE: 5/3/2018
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
94	0.05	ASPHALTIC CONCRETE							
	0.3	FILLING - grey crushed sandstone (roadbase), dry							
		SILTSTONE - very low to low strength, moderately to slightly weathered, grey siltstone							
	1			S	1.0 1.14		20/140mm,-,- refusal		
93		- with medium strength bands below 1.5m							
	2								
92	2.5	Bore discontinued at 2.5m - limit of investigation		S	2.5 2.61		20.110mm,-,- refusal		
	3								
91									
	4								
90									
	5								
89									
	6								
88									
	7								
87									
	8								
86									
	9								
85									

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** N/A

TYPE OF BORING: 110mm diameter auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 93.3 mAHD
EASTING: 297613
NORTHING: 6226967
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 34275.08
DATE: 5/3/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	ASPHALTIC CONCRETE										
	0.3	FILLING - grey crushed sandstone (roadbase), moist										
		SILTSTONE - very low to low strength, moderately to slightly weathered, grey siltstone										
93												
	1								S			20/110mm,-,- refusal
92												
	2											
91									S			20/50mm,-,- refusal
	3											
90												
	4											
89		- becoming medium strength, fresh below 4.5m						4.58m: B, h, pl, sm, cln 4.64m: J, 70°, sv, pl, fe, fe stn 60mm long	C	100	90	PL(A) = 0.34 PL(A) = 0.71
	5											
88												
	6							6.65m: B, h, pl, sm, cln				PL(A) = 0.39
87												
	7							7.24m: B, h, pl, sm, cly vn	C	100	98.6	PL(A) = 0.57
86												
	8											PL(A) = 0.47
85								8.66m: B, h, pl, sm, cly co 8.69m: B, h, pl, sm, cly co				
	9							9.31m: J, v, un, sm, clay co 100mm long, B, h, pl, sm, cly co 9.41m: B, h, pl, sm, cly inf 10mm thick	C	100	95.2	PL(A) = 0.34
84												

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 4.2m

TYPE OF BORING: 110mm diameter auger to 4.2m, NMLC coring to 18.8m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 93.3 mAHD
EASTING: 297613
NORTHING: 6226967
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 34275.08
DATE: 5/3/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
83		SILTSTONE - medium strength, fresh, grey siltstone *(continued)*						9.42m: J, v, un, sm, cly co 70mm long 10.23m: B, h, pl, sm, cly co				PL(A) = 1.3
	11	becoming high strength below 10.2m						10.85m: J, 80°, sv, pl, sm, cln 170mm long	C	100	95.2	
82												PL(A) = 1.42
								11.56m: J, v, pl, sm, cln 60mm long				
	12							12.06m: B, h, pl, sm, cln				
81												PL(A) = 1.16
	13								C	100	100	PL(A) = 0.93
80								13.43m: J, v, cu, sm, cln 300mm long				
	14											PL(A) = 1.33
79												
	15											PL(A) = 1.03
78								15.67m: J, 75°, sv, pl, sm, cln 40mm long				
	16								C	100	98.3	PL(A) = 1.4
77												
	17							16.75m: J, 65°, sv, pl, sm, cln 20mm long 16.86m: fg zone 40mm thick 16.93m: J, 60°, sv, pl, sm, cly inf 5mm thick 17m: J, 75°, sv, pl, sm, cln 70mm long				PL(A) = 1.46
76												
	18							17.45m: J, 75°, sv, pl, sm, cln 60mm long				
75									C	100	100	PL(A) = 0.81
	18.8	Bore discontinued at 18.8m - limit of investigation										
	19											
74												

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 4.2m

TYPE OF BORING: 110mm diameter auger to 4.2m, NMLC coring to 18.8m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 92.0 mAHD
EASTING: 297589
NORTHING: 6226956
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 34275.08
DATE: 5/3/2018
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
92	0.05	ASPHALTIC CONCRETE							
	0.4	FILLING - grey crushed sandstone (roadbase), moist							
		SILTSTONE - very low to low strength, moderately to slightly weathered, grey siltstone							
91	1	- with medium strength bands below 1.0m		S	1.0 1.11		20/110mm,-,- refusal		
90	2	2.0 Bore discontinued at 2.0m - limit of investigation							
89	3								
88	4								
87	5								
86	6								
85	7								
84	8								
83	9								

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 4.2m

TYPE OF BORING: 110mm diameter auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 87.4 mAHD
EASTING: 297564
NORTHING: 6226992
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 34275.08
DATE: 9/3/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	ASPHALTIC CONCRETE										
	0.3	FILLING - grey crushed sandstone (roadbase), moist										
87		SILTSTONE - very low to low strength, moderately to slightly weathered, grey siltstone with medium strength bands										
	1	- becoming low strength, slightly weathered with medium strength bands below 0.85m							S			20/130mm,-,- refusal
86												
	2											
85		- becoming medium strength below 2.55m						2.55m: J, 60°, sv, pl, sm, cly co 50mm long				PL(A) = 0.42
	3							2.7m: B, h, pl, sm, cly co 2.8m: B, h, pl, sm, cly co 2.82m: B, h, pl, sm, cly co 2.9m: B, h, pl, ro, fe stn 3.02m: B, h, pl, ro, fe stn 3.07m: B, h, pl, ro, fe stn 3.1m: B, h, pl, ro, fe stn 3.22m: B, h, pl, ro, fe stn 3.36m: B, h, pl, ro, fe stn 3.46m: B, h, pl, sm, cly co	C	100	81.7	PL(A) = 0.42
84		- becoming fresh stained below 3.7m										
	4											
83		- becoming fresh below 4.35m						3.5m: B, h, pl, he, cly co 3.56m: J, 65°, sv, pl, he, cly co 30mm long 3.7m: J, 60°, sv, pl, sm, cly co 20mm long, B, h, pl, sm, cly co 3.81m: B, h, pl, ro, cly co 4.14m: J, 75°, sv, pl, ro, fe stn 80mm long 4.22m: B, h, pl, ro, cly co				PL(A) = 0.67
	5											
82												PL(A) = 0.61
	6							4.41m: B, h, pl, sm, cly co 4.45m: B, h, pl, sm, cly co 4.51m: B, h, pl, sm, cly co 4.55m: B, h, pl, sm, cly co 4.6m: B, h, pl, sm, cly co 4.61m: B, h, pl, sm, cly co	C	100	87	
81												PL(A) = 0.69
	7											
80		- becoming medium to high strength below 7.35m						4.63m: B, h, pl, sm, cly co 4.64m: B, h, pl, sm, cly co 5.29m: B, h, pl, sm, cly co 5.66m: B, h, pl, sm, cly co				PL(A) = 1.2
	8											
79								6.45m: B, h, pl, sm, cly co 6.47m: B, h, pl, sm, cly co 6.53m: B, h, pl, sm, cly co 6.69m: B, h, pl, sm, cly co				PL(A) = 1.04
	9								C	100	89	
78								6.71m: B, h, pl, sm, cly co 7.21m: B, h, pl, sm, cly co				PL(A) = 0.96

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 4.2m

TYPE OF BORING: 110mm diameter auger to 2.55m, NMLC coring to 12.18m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 87.4 mAHD
EASTING: 297564
NORTHING: 6226992
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 34275.08
DATE: 9/3/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
77		SILTSTONE - medium to high strength, fresh, grey siltstone *(continued)*						7.86m: B, h, pl, sm, cly co 8.43m: B, h, pl, sm, cly co 8.47m: Bedded zone, aug 0.15mm spacing, B, h, pl, sm, cly co 180mm thick	C	100	89	
76	11							9.48m: B, h, pl, sm, cly co 9.65m: B, h, pl, sm, cly co 9.7m: B, h, pl, sm, cly co 9.72m: J, 70°, sv, pl, ro, cln 50mm long, B, h, pl, sm, cly co	C	100	100	PL(A) = 1.33 PL(A) = 0.97 PL(A) = 0.92
	12											
75	12.18	Bore discontinued at 12.18m - limit of investigation										
	13											
74	14											
73	15											
72	16											
71	17											
70	18											
69	19											
68												

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 4.2m

TYPE OF BORING: 110mm diameter auger to 2.55m, NMLC coring to 12.18m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 87.5 mAHD
EASTING: 297613
NORTHING: 6227005
DIP/AZIMUTH: 90°/--

BORE No: 106
PROJECT No: 34275.08
DATE: 20/3/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
87	0.37	CONCRETE										
		SILTSTONE - very low strength, highly weathered, grey siltstone										
86	1	- becoming medium strength, slightly weathered below 1.0m						1m: fg zone 140mm thick 1.28m: J, 60°, sv, pl, ro, fe stn 40mm long 1.46m: B, h, pl, ro, fe stn 1.67m: B, h, pl, ro, fe stn 1.76m: B, h, pl, ro, fe stn 1.91m: B, h, pl, ro, fe stn 2.09m: J, 70°, sv, pl, ro, fe stn 100mm long 2.39m: fg zone 170mm thick	C	100		PL(A) = 0.45
85	2											PL(A) = 0.34
84	2.91 3 3.0 3.3							2.73m: B, h, pl, ro, fe sn 2.79m: B, h, pl, ro, fe sn 2.91m: CORE LOSS: 90mm 3.06m: J, 30°, sh, pl, ro, fe stn 30mm long 3.1m: J, 30°, sh, pl, ro, fe stn 30mm long 3.26m: CORE LOSS: 40mm 3.59m: CORE LOSS: 70mm	C			
	3.66	- becoming fresh below 3.72m										PL(A) = 0.66
83	4											PL(A) = 0.92
82	5											PL(A) = 0.64
81	6	- becoming high strength below 6.3m										PL(A) = 1.34
80	7							7.05m: J, 75°, sv, pl, sm, cln 50mm long 7.31m: J, 85°, sv, pl, sm, cln 290mm long	C	100		PL(A) = 2.41
79	8											PL(A) = 2.06
78	9								C	93		PL(A) = 1.63

RIG: Hanjin DB8 **DRILLER:** Terratest **LOGGED:** IKA/EMG **CASING:** HWT to 1.0m

TYPE OF BORING: 200mm concrete core to 0.37m, 110mm diameter auger to 1.00m, NMLC coring to 13.60m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 87.5 mAHD
EASTING: 297613
NORTHING: 6227005
DIP/AZIMUTH: 90°/--

BORE No: 106
PROJECT No: 34275.08
DATE: 20/3/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
77	11	SILTSTONE - high strength, fresh, grey siltstone *(continued)*						10.47m: J, 70°, sv, pl, sm, cln 40mm long 11m: J, v, pl, sm, cln 100mm long 11.33m: J, v, pl, sm, cln 70mm long 11.6m: J, v, pl, sm cln 150mm long	C	93		PL(A) = 1.76 PL(A) = 1.7
76	12								C	100		PL(A) = 1.75
75	13											
74	13.6	Bore discontinued at 13.6m - limit of investigation										PL(A) = 2.25
73	14											
72	15											
71	16											
70	17											
69	18											
68	19											

RIG: Hanjin DB8 **DRILLER:** Terratest **LOGGED:** IKA/EMG **CASING:** HWT to 1.0m

TYPE OF BORING: 200mm concrete core to 0.37m, 110mm diameter auger to 1.00m, NMLC coring to 13.60m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 91.6 mAHD
EASTING: 297620
NORTHING: 6226987
DIP/AZIMUTH: 90°/--

BORE No: 107
PROJECT No: 34275.08
DATE: 5/3/2018
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
91	0.03	ASPHALTIC CONCRETE							
		CONCRETE							
	0.48	SILTSTONE - very low to low strength, highly to moderately weathered, grey siltstone		D	0.48 0.8				
1	1.0	Bore discontinued at 1.0m - refusal on low to medium strength siltstone		S	1.0 1.15		20/150mm,-,- refusal		
90	2								
89	3								
88	4								
87	5								
86	6								
85	7								
84	8								
83	9								
82									

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** N/A

TYPE OF BORING: 110mm diameter auger to 1.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 92.8 mAHD
EASTING: 297655
NORTHING: 6227010
DIP/AZIMUTH: 90°/--

BORE No: 108
PROJECT No: 34275.08
DATE: 21/3/2018
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
92	0.04	ASPHALTIC CONCRETE							
		CONCRETE							
	0.55	SILTY CLAY - very stiff to hard, grey mottled red and brown silty clay, MC~PL		D	0.55				
					0.9				
	1				1.0				1
				S			pp = 150-300 9,17,17 N = 34		
	1.45	SILTSTONE - very low to low strength, highly to moderately waethered, grey siltstone			1.45				
91	2								2
				S	2.5		10/20mm,-,- refusal		
90	3				2.51				3
	3.1	Bore discontinued at 3.1m - refusal on low to medium strength siltstone							
89	4								4
88	5								5
87	6								6
86	7								7
85	8								8
84	9								9
83									

RIG: Hanjin DB8 **DRILLER:** Terratest **LOGGED:** IKA/EMG **CASING:** N/A

TYPE OF BORING: 110mm diameter auger to 3.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 84.7 mAHD
EASTING: 297519
NORTHING: 6226957
DIP/AZIMUTH: 90°/--

BORE No: 109
PROJECT No: 34275.08
DATE: 6/3/2018
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
84	0.1	FILLING - brown clayey silt with a trace of rootlets, dry (topsoil)							
		SILTSTONE - very low to low strength, moderately to slightly weathered, grey siltstone		B	0.3 0.5				
1				S	1.0 1.06		20/60mm,-,- refusal		
83	2	- with medium strength bands below 2.0m							
	2.5	Bore discontinued at 2.5m - refusal on low to medium strength siltstone							
82	3								
81	4								
80	5								
79	6								
78	7								
77	8								
76	9								
75									

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** N/A

TYPE OF BORING: 110mm diameter auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 85.1 mAHD
EASTING: 297506
NORTHING: 6226943
DIP/AZIMUTH: 90°/--

BORE No: 110
PROJECT No: 34275.08
DATE: 6/3/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
85	0.1	FILLING - brown clayey silt with a trace of rootlets, dry (topsoil)										
		SILTSTONE - very low to low strength, moderately to slightly weathered, grey siltstone										
84	1								S			20/141mm,-,- refusal
83	2	- with medium strength bands below 2.0m										
		- becoming medium strength below 2.55m						2.63m: B, h, pl, sm, cly co 2.67m: B, h, pl, ro, fe stn 2.76m: B, h, pl, sm, cly co 2.8m: J, v, pl, sm, cly vn 40mm long, B, h, pl, sm, cly co 2.84m: B, h, pl, sm, cly co 2.88m: B, h, pl, sm, cly co 2.98m: Cs 30mm thick 3.14m: B, h, pl, sm, cly int 10mm thick 3.15m: J, 60°, sv, pl, sm, fe stn 30mm long 3.53m: J, 30°, sh, pl, sm, cly co 20mm long 3.69m: B, h, pl, sm, cly co 3.91m: J, 30°, sh, pl, sm, cly co 20mm long 3.94m: B, h, pl, sm, cly co 4.06m: B, h, pl, sm, cly, un 4.09m: B, h, pl, sm, cly, un 4.54m: B, h, pl, sm, cly co 6.47m: B, h, pl, sm, cly co 7.19m: B, h, pl, sm, cly co 7.57m: J, v, pl, ro, cln 600mm long B, h, pl, sm, cln 7.83m: B, h, pl, ro, cln 8.21m: J, v, pl, ro, cln 120m long, B, h, pl, ro, cln 8.86m: J, v, st, ro, cln 240mm long, B, h, pl, ro, cln	C	100		PL(A) = 0.36
82	3											
		- becoming slightly weathered below 3.53m										PL(A) = 0.45
81	4	- becoming fresh stained below 4.09m										
									C	100	100	PL(A) = 0.66
80	5											
		- becoming high strength, fresh below 5.3m										PL(A) = 1.42
79	6											
												PL(A) = 1.37
78	7											
									C	100		PL(A) = 1.22
77	8											
												PL(A) = 1.09
76	9	- becoming medium strength below 8.86m										
												PL(A) = 0.92

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.5m

TYPE OF BORING: 110mm diameter auger to 2.55m, NMLC coring to 10.10m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 85.1 mAHD
EASTING: 297506
NORTHING: 6226943
DIP/AZIMUTH: 90°/--

BORE No: 110
PROJECT No: 34275.08
DATE: 6/3/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
75	10.1	SILTSTONE - medium strength, fresh stained, grey siltstone *(continued)*										
		Bore discontinued at 10.1m - limit of investigation										
74	11											
73	12											
72	13											
71	14											
70	15											
69	16											
68	17											
67	18											
66	19											

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.5m

TYPE OF BORING: 110mm diameter auger to 2.55m, NMLC coring to 10.10m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 83.8 mAHD
EASTING: 297504
NORTHING: 6226977
DIP/AZIMUTH: 90°/--

BORE No: 111
PROJECT No: 34275.08
DATE: 7/3/2018
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
83	0.1	FILLING - brown clayey silt with a trace of rootlets, dry (topsoil)							
		SILTSTONE - very low to low strength, highly to moderately weathered, grey siltstone - becoming slightly weathered with medium strength bands below 0.5m		S	1.0 1.11		20/110mm,-,- refusal		
82	2.0	Bore discontinued at 2.0m - refusal on low to medium strength siltstone							
81									
80									
79									
78									
77									
76									
75									
74									

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** N/A

TYPE OF BORING: 110mm diameter auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 83.6 mAHD
EASTING: 297475
NORTHING: 6227022
DIP/AZIMUTH: 90°/--

BORE No: 112
PROJECT No: 34275.08
DATE: 7/3/2018
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
83	0.3	FILLING - brown clayey silt with a trace of rootlets, moist (topsoil)							
		SILTY CLAY - very stiff to hard, red mottled grey silty clay with a trace of ironstone gravel, MC<PL		S	1.0		pp >600 8,11,13 N = 24		
82	2.0	SILTSTONE - very low to low strength, highly to moderately weathered, grey siltstone		S	1.45 2.5		9,16,20/130mm refusal		
81					2.95				
80		- becoming moderately to slightly weathered with medium strength bands below 3.5m							
	4.0	Bore discontinued at 4.0m - refusal on low to medium strength siltstone							
79									
78									
77									
76									
75									
74									

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** N/A

TYPE OF BORING: 110mm diameter auger to 4.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 83.5 mAHD
EASTING: 297488
NORTHING: 6227003
DIP/AZIMUTH: 90°/--

BORE No: 113
PROJECT No: 34275.08
DATE: 7/3/2018
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
83	0.3	FILLING - brown clayey silt, dry (topsoil)										
		SILTSTONE - very low to low strength, highly to moderately weathered, grey siltstone							S			20/130mm,-,- refusal
82	1											
	2											
81									S			20/70mm,-,- refusal
		- becoming low strength, slightly weathered below 2.6m						2.76m: B, h, pl, sm, cly co 2.88m: B, h, pl, sm, cly co 3m: B, h, pl, sm, cly co				PL(A) = 0.3
	3							3.02m: B, h, pl, ro, fe stn 3.03m: B, h, pl, ro, fe stn 3.11m: B, h, pl, ro, fe stn 3.13m: J, 70°, sv, pl, ro, fe stn 150mm long	C	100		PL(A) = 0.48
80		- becoming medium strength, fresh stained below 3.6m										
	4							3.22m: J, 75°, sv, pl, ro, cln 50mm long 3.27m: B, h, pl, sm, ro, cln 3.34m: B, h, pl, ro, cly, un 3.35m: J, 70°, sv, pl, sm, cln 30mm long 3.46m: B, h, pl, sm, cly co				PL(A) = 0.45
79												
	5							3.7m: B, h, pl, sm, cly co 3.85m: J, 70°, sv, pl, sm, cln 50mm long				PL(A) = 0.48
78												
	6							4.16m: B, h, pl, ro, fe stn 4.56m: B, h, pl, ro cln 5.34m: B, h, pl, ro, cln 5.43m: B, h, pl, ro, cln 5.62m: B, h, pl, sm, cly co 5.74m: B, h, pl, sm, cly co	C	100		PL(A) = 0.63
77		- becoming fresh below 6.5m										
	7							6.32m: B, h, pl, ro, cly co 6.39m: B, h, pl, ro, cly co 6.91m: B, h, pl, sm, cly co				PL(A) = 1.36
76												
	8							8.21m: B, h, pl, sm, cly vn 8.39m: J, 60°, sv, st, ro, cln 20mm long 8.54m: B, h, pl, sm, cly co	C	100	100	PL(A) = 0.99
75												
	9											
74	9.0	Bore discontinued at 9.0m - limit of investigation										

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.6m

TYPE OF BORING: 110mm diameter auger to 2.60m, NMLC coring to 9.00m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 81.9 mAHD
EASTING: 297509
NORTHING: 6227139
DIP/AZIMUTH: 90°/--

BORE No: 114
PROJECT No: 34275.08
DATE: 8/3/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
81	0.05	ASPHALTIC CONCRETE										
	0.25	FILLING - grey crushed sandstone (roadbase), dry										
		FILLING - brown and red silty clay with some siltstone cobbles, MC~PL										5,7,7 N = 14
	1								S			
		- with medium strength bands below 1.5m							E			
80	1.8	SILTY CLAY - very stiff to hard, red mottled light brown and grey silty clay with some ironstone gravel, MC<PL										
	2								S			pp >600 9,13,16 N = 29
79	3											
78	4	- becoming grey with extremely low strength, extremely weathered shale bands below 3.7m							S			7,20,20/130mm refusal
	4.0	SILTSTONE - very low to low strength, highly to moderately weathered, grey siltstone with extremely low strength, extremely weathered bands										
77	5	- becoming very low to low strength, moderately weathered with medium strength, slightly weathered bands below 5.0m							S			20/110mmm,-,- refusal
		- becoming low strength, moderately to slightly weathered below 5.6m						5.63m: J, 30°, sh, pl, ro, fe stn 20mm long				PL(A) = 0.18
76	6							5.78m: Cs 20mm thick 5.82m: J, 70°, sv, pl, sm, cly inf 2mm thick 40mm long 5.86m: B, h, pl, ro, fe stn 5.96m: B, h, pl, sm, cly co	C	100		PL(A) = 0.16
75	7	- 200mm thick extremely low strength, extremely weathered band at 6.76m - becoming medium strength, slightly weathered below 6.96m - 50mm thick extremely low strength, extremely weathered band at 7.04m						6m: J, 65°, sv, pl, ro, fe stn 30mm long 6.08m: B, h, pl, ro, fe stn 6.27m: B, h, pl, sm, cly co 6.32m: B, h, pl, ro, fe stn 6.45m: B, h, pl, ro, fe stn 6.56m: Cs 15mm thick 6.71m: B, h, pl, ro, cly co				PL(A) = 0.42
74	8	- becoming fresh stained below 8.0m						6.76m: B, h, pl, sm, cly co 6.88m: fg zone, 50mm thick 6.96m: B, h, pl, sm, fe stn	C	100		PL(A) = 0.51
73	9							7.04m: B, h, pl, sm, fe stn 7.09m: B, h, pl, sm, fe stn 7.13m: J, 60°, sv, pl, ro, fe stn 30mm long 7.42m: B, h, pl, sm, cly co	C	100		PL(A) = 0.32
72												

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 5.5m

TYPE OF BORING: 110mm diameter auger to 5.60m, NMLC coring to 11.85m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

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: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 81.9 mAHD
EASTING: 297509
NORTHING: 6227139
DIP/AZIMUTH: 90°/--

BORE No: 114
PROJECT No: 34275.08
DATE: 8/3/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
71	11	- becoming fresh below 10.0m SILTSTONE - medium strength, fresh, grey siltstone *(continued)*						7.63m: J, 15°, sh, pl, sm, cln 20mm long 7.66m: B, h, pl, sm, cln 7.81m: fg zone 130mm thick 8m: fg zone, 130mm thick 8.16m: J, 80°, sv, pl, sm, cln 60mm long, B, h, pl, sm, cln 8.23m: J, 60°, sv, pl, sm, cln 60mm long 8.28m: B, h, pl, sm, cly co	C	100		PL(A) = 0.56 PL(A) = 0.68
70	11.85 12	Bore discontinued at 11.85m - limit of investigation						8.48m: B, h, pl, sm, cly co 8.56m: J, 60°, sv, pl, sm, cly co 30mm long 8.59m: J, 60°, sv, pl, ro, fe stn 20mm long 8.64m: B, h, pl, sm cly co 8.73m: fg zone, 140mm thick 8.87m: J, v, pl, sm, cln 70mm thick 8.94m: J, v, pl, sm, cln 60mm long, B, h, pl, ro, cly co 9.2m: B, h, pl, ro, fe stn 9.22m: fg zone, 50mm thick 9.37m: B, h, pl, sm, cly co 9.47m: B, h, pl, sm, cly co' 9.53m: B, h, pl, sm, cly co 9.68m: B, h, pl, sm, cly co 9.71m: B, h, pl sm, cly int 5mm thik 9.79m: J, 35°, sh, pl, sm, fe stn 30mm long, B, h, pl, sm, fe stn 9.82m: B, h, pl, sm, fe stn 9.87m: B, h, pl, sm, cly co 9.92m: B, h, pl, sm, cly co 9.95m: B, h, pl, sm, cly co 10.31m: B, h, pl, sm, cly co 10.47m: B, h, pl, sm, cly co 10.8m: B, h, pl, sm, cly co				
69	13											
68	14											
67	15											
66	16											
65	17											
64	18											
63	19											
62												

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 5.5m

TYPE OF BORING: 110mm diameter auger to 5.60m, NMLC coring to 11.85m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 82.3 mAHD
EASTING: 297511
NORTHING: 6227121
DIP/AZIMUTH: 90°/--

BORE No: 115
PROJECT No: 34275.08
DATE: 8/3/2018
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
82	0.05	ASPHALTIC CONCRETE							
	0.3	FILLING - grey crushed sandstone (roadbase), dry							
		FILLING - brown and red silty clay with a trace of siltstone gravel, MC~PL		E	0.5				
81	1			S	1.0 1.45		6,9,14 N = 23		
	1.9	SILTY CLAY - very stiff to hard, red mottled grey silty clay with a trace of ironstone gravel, MC~PL							
80	2	- becoming grey with extremely low strength, extremely weathered bands below 2.3m							
	2.5	SILTSTONE - very low to low strength, highly to moderately weathered, grey siltstone with extremely low strength, extremely weathered bands		S	2.5 2.94		11,16,20/140mm refusal		
79	3								
		- becoming very low to low strength, highly to moderately weathered with medium strength bands below 3.8m		S	4.0 4.11		20/110mm,-,- refusal		
78	4								
	5.0	Bore discontinued at 5.0m - refusal on low to medium strength siltstone							
77	5								
76	6								
75	7								
74	8								
73	9								

RIG: Commacchio Geo 205 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** N/A

TYPE OF BORING: 110mm diameter auger to 5.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 96.1 mAHD
EASTING: 297577
NORTHING: 6226927
DIP/AZIMUTH: 90°/--

BORE No: 116
PROJECT No: 34275.08
DATE: 14/3/2018
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
96	0.05	ASPHALTIC CONCRETE										
	0.3	FILLING - grey crushed sandstone (roadbase), moist										
		SILTSTONE - very low to low strength, highly weathered to moderately weathered, grey siltstone										
95	1								S			20/130mm,-,-refusal
94	2								S			20/130mm,-,-refusal
		- becoming very low strength and highly weathered below 2.63m										
93	3	- becoming low strength and slightly weathered below 2.72m						2.93m: B, h, pl, sm, fe stn 2.95m: B, h, pl, sm, fe stn 3.06m: Cs 20mm thick 3.15m: B, h, pl, sm, cly co 3.23m: J, 70°, sv, pl, fe fe stn 40mm long 3.27m: J, 70°, sv, pl, ro, fe stn 40mm long 3.43m: B, h, pl, ro, fe stn 3.59m: B, h, pl, ro, fe stn 3.6m: B, h, pl, ro, fe stn 3.62m: B, h, pl, sm, cly inf 5mm thick 3.63m: J, 65°, sv, pl, sm, cly co 40mm long 3.84m: B, h, pl, sm, cly co 3.96m: B, h, pl, sm, cly co 3.97m: B, h, pl, sm, cly co 4m: B, h, pl, sm, cly co 4.35m: B, h, pl, ro, fe stn 4.52m: B, h, pl, sm, cly co 4.53m: B, h, pl, sm, cly co 4.61m: B, h, pl, sm, cly co 4.81m: B, h, pl, sm, cly co 4.84m: J, 65°, sv, pl, sm, cly co 40mm long 4.85m: J, 70°, sv, pl, sm, cly co 40mm long 5.08m: J, 65°, sv, cu, he, fe stn 30mm long 5.2m: B, h, pl, sm, cly co 5.61m: B, h, pl, ro, fe stn 6.14m: B, h, pl, sm, cly inf 5mm thick 6.35m: B, h, pl, ro, fe stn 6.36m: J, v, cu, ro, fe stn 690mm long 7.12m: B, h, pl, ro, fe stn 7.41m: J, 30°, sh, pl, he, fe stn 20mm long 7.46m: J, 30°, sh, pl, he, fe st 20mm long	C	100		PL(A) = 0.06 PL(A) = 0.25 PL(A) = 0.17 PL(A) = 0.43 PL(A) = 0.3 PL(A) = 0.21 PL(A) = 0.94 PL(A) = 0.41 PL(A) = 0.54
92	4	- highly weathered band (200mm thick) at 4.25m										
91	5											
90	6											
89	7	- becoming medium strength and fresh stained below 7.29m - becoming fresh below 7.70m							C	100		
88	8											
87	9								C	100		

RIG: Hanjin DB8 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.7m

TYPE OF BORING: 110mm diameter auger to 2.63m, NMLC coring to 22.95m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 96.1 mAHD
EASTING: 297577
NORTHING: 6226927
DIP/AZIMUTH: 90°/--

BORE No: 116
PROJECT No: 34275.08
DATE: 14/3/2018
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
86		SILTSTONE - medium strength, fresh, grey siltstone *(continued)*						7.63m: B, h, pl, sm, cly co 7.85m: B, h, pl, sm, cly co 8.76m: B, h, pl, sm, cly co 9.55m: B, h, pl, sm, cly co 10.1m: B, h, pl, sm, cly co 10.2m: B, h, pl, sm, cly co	C	100		PL(A) = 0.49
85	11							10.56m: J, 30°, sh, pl, sm, cln 20mm long 10.85m: B, h, pl, sm, cly co 10.87m: B, h, pl, sm, cly co				PL(A) = 0.85
84	12											PL(A) = 0.75
		- with high strength bands below 12.50m						12.7m: J, 30°, sh, pl, sm, cln 20mm long 12.98m: J, 30°, sh, pl, sm, cln 20mm long	C	100	100	
83	13											PL(A) = 1.06 PL(A) = 0.55
82	14											
81	15	SILTSTONE - medium strength, fresh, grey siltstone *(continued)*						14.88m: Cs 20mm thick				PL(A) = 1.09
80	16							16.29m: J, 70°, sv, pl, sm, cln 90mm long	C	100		PL(A) = 0.77
79	17											PL(A) = 0.81
78	18											PL(A) = 0.7
									C	100		
77	19											PL(A) = 0.57

RIG: Hanjin DB8 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.7m

TYPE OF BORING: 110mm diameter auger to 2.63m, NMLC coring to 22.95m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 96.1 mAHD
EASTING: 297577
NORTHING: 6226927
DIP/AZIMUTH: 90°/--

BORE No: 116
PROJECT No: 34275.08
DATE: 14/3/2018
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
76		SILTSTONE - medium strength, fresh, grey siltstone *(continued)*						20.06m: B, h, pl, sm, cln 20.07m: B, h, pl, sm, cln				
								20.42m: J, 30°, sh, pl, sm, un, cln 20mm long				PL(A) = 1.02
75	21								C	100		PL(A) = 1.17
74	22											PL(A) = 0.86
								22.34m: B, h, pl, sm, cly co 22.38m: J, 70°, sv, pl, sm, cly co 60mm long 22.47m: B, h, pl, sm, cly inf 10mm thick				
73	23 22.95	Bore discontinued at 22.95m - limit of investigation										PL(A) = 2.06
72	24											
71	25											
70	26											
69	27											
68	28											
67	29											

RIG: Hanjin DB8 **DRILLER:** Terratest **LOGGED:** IKA **CASING:** HWT to 2.7m

TYPE OF BORING: 110mm diameter auger to 2.63m, NMLC coring to 22.95m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Prop Multi-Storey Building
LOCATION: Stage 2 Redevelopment, Campbelltown Hospital, Campbelltown, NSW

SURFACE LEVEL: 100.9 mAHD
EASTING: 297648
NORTHING: 6226948
DIP/AZIMUTH: 90°/--

BORE No: 118
PROJECT No: 34275.08
DATE: 13/3/2018
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
100	0.05	ASPHALTIC CONCRETE							
	0.4	FILLING - brown, crushed sandstone (roadbase), moist							
		SILTSTONE - very low to low strength, highly weathered to moderately weathered grey siltstone		S	1.0 1.2		12,20/50,- refusal		
99	2	- becoming low strength and moderately weathered to slightly weathered, with medium strength bands below 2.0m		S	2.5		18,20/50,- refusal		
	2.7	Bore discontinued at 2.7m - refusal on low to medium strength siltstone			2.7				
98	3								
97	4								
96	5								
95	6								
94	7								
93	8								
92	9								
91									

RIG: Hanjin DB8 **DRILLER:** Terratest **LOGGED:** IKA/EMG **CASING:** N/A

TYPE OF BORING: 110mm diameter auger to 2.63m, NMLC coring to 2.70m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

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Appendix D

Laboratory Results Summary Table

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Table 1 - Summary of Soil Sampling and Chemical Analysis Results (Results in mg/kg - unless specified)

Sample Location	Sample Depth (m)	Sampling Date	Heavy Metals								PAH					TRH				BTEX				OCPs, OPPs & PCBs										
			As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	B(a)P TEQ	B(a)P	Total PAH	Naphthalene	Phenols	C6-C10 less BTEX [F1]	>C10-C16 (less Naphthalene) [F2]	>C16-C34	>C34-C40	Benzene	Toluene	Ethylbenzene	Total Xylenes	Aldrin + dieldrin	Chlordane	DDT + DDE + DDD	Endosulfan	Endrin	Heptachlor	HCB	Methoxychlor	OPP (Chlorpyrifos)	PCBs	Asbestos
Practical Quantitation Limit			4	0.4	1	1	1	0.1	1	1	0.5	0.05	0.1	1	5	25	50	100	100	0.2	0.5	1	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Assessment Criteria																																		
NEPC (2013) HIL / HSL			**500**	**150**	**500**	**30000**	**1200**	**30**	**1200**	**60000**	**4**	**400**	**400**	**5**	**50000**	**50**	**280**	**ND**	**ND**	**0.7**	**480**	**NL**	**110**	**10**	**100**	**700**	**460**	**20**	**10**	**20**	**550**	**400**	**2**	**ND**
NEPC (2013) EIL / ESL			**100**	**ND**	**410**	**230**	**1100**	**ND**	**270**	**760**	**ND**	**0.7**	**ND**	**170**	**ND**	**180**	**120**	**1300**	**5600**	**65**	**105**	**125**	**45**	**ND**	**ND**	**180**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
NEPC (2013) Management Limits			**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**800**	**1000**	**3500**	**10000**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Analytical Results of Test Pit Samples																																		
BH115	0.5-1.0	08/03/18	5	<0.4	10	36	24	<0.1	10	43	<0.5	<0.05	<0.05	<PQL	<5	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<PQL	<PQL	<0.1	<PQL	<PQL	<PQL	<0.1	<0.1	<0.1	<0.1	ND
BH114	1.5-1.8	08/03/18	5	<0.4	14	33	22	<0.1	13	43	<0.5	<0.05	<0.05	<PQL	<5	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<PQL	<PQL	<0.1	<PQL	<PQL	<PQL	<0.1	<0.1	<0.1	<0.1	ND
BH109	0-0.1	20/03/2018	6	<0.4	11	10	14	<0.1	3	21	<0.5	<0.05	<0.05	<PQL	<5	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<PQL	<PQL	<0.1	<PQL	<PQL	<PQL	<0.1	<0.1	<0.1	<0.1	ND
BH112	0-0.1	21/03/2018	8	<0.4	11	10	13	<0.1	6	18	<0.5	<0.05	<0.05	<PQL	<5	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<PQL	<PQL	<0.1	<PQL	<PQL	<PQL	<0.1	<0.1	<0.1	<0.1	ND

Appendix E

Laboratory Analytical Reports and Chain-of-Custody Documentation

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CERTIFICATE OF ANALYSIS 188036

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Emily McGinty
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**34275.08, Stage 2 Redevel. Campbelltown Hospital**
Number of Samples	2 Soil
Date samples received	26/03/2018
Date completed instructions received	26/03/2018

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	04/04/2018
Date of Issue	03/04/2018

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

Results Approved By
Dragana Tomas, Senior Chemist
Leon Ow, Chemist
Lucy Zhu, Asbsestos Analyst
Priya Samarawickrama, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

Moisture			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date prepared	-	27/03/2018	27/03/2018
Date analysed	-	28/03/2018	28/03/2018
Moisture	%	10	13

vTRH(C6-C10)/BTEXN in Soil			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date extracted	-	27/03/2018	27/03/2018
Date analysed	-	28/03/2018	28/03/2018
TRH C_6 - C_9	mg/kg	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25
Benzene	mg/kg	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1
m+p-xylene	mg/kg	<2	<2
o-Xylene	mg/kg	<1	<1
naphthalene	mg/kg	<1	<1
Total +ve Xylenes	mg/kg	<1	<1
Surrogate aaa-Trifluorotoluene	%	80	72

svTRH (C10-C40) in Soil			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date extracted	-	27/03/2018	27/03/2018
Date analysed	-	27/03/2018	27/03/2018
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	84	82

PAHs in Soil			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date extracted	-	27/03/2018	27/03/2018
Date analysed	-	27/03/2018	27/03/2018
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	%	109	108

Organochlorine Pesticides in soil			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date extracted	-	27/03/2018	27/03/2018
Date analysed	-	27/03/2018	27/03/2018
HCB	mg/kg	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1
Surrogate TCMX	%	85	97

Organophosphorus Pesticides			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date extracted	-	27/03/2018	27/03/2018
Date analysed	-	27/03/2018	27/03/2018
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1
Surrogate TCMX	%	85	97

PCBs in Soil			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date extracted	-	27/03/2018	27/03/2018
Date analysed	-	27/03/2018	27/03/2018
Aroclor 1016	mg/kg	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1
Surrogate TCLMX	%	85	97

Misc Soil - Inorg			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date prepared	-	27/03/2018	27/03/2018
Date analysed	-	27/03/2018	27/03/2018
Total Phenolics (as Phenol)	mg/kg	<5	<5

Acid Extractable metals in soil			
Our Reference		188036-1	188036-2
Your Reference	UNITS	BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date prepared	-	27/03/2018	27/03/2018
Date analysed	-	27/03/2018	27/03/2018
Arsenic	mg/kg	6	8
Cadmium	mg/kg	<0.4	<0.4
Chromium	mg/kg	11	11
Copper	mg/kg	10	10
Lead	mg/kg	14	13
Mercury	mg/kg	<0.1	<0.1
Nickel	mg/kg	3	6
Zinc	mg/kg	21	18

Asbestos ID - soils			
Our Reference	UNITS	188036-1	188036-2
Your Reference		BH109	BH112
Depth		0-0.1	0-0.1
Date Sampled		20/03/2018	21/03/2018
Type of sample		Soil	Soil
Date analysed	-	03/04/2018	03/04/2018
Sample mass tested	g	Approx. 20g	Approx. 25g
Sample Description	-	Brown fine-grained soil	Brown fine-grained soil
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
Trace Analysis	-	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-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.

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

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Date analysed	-			28/03/2018	1	28/03/2018	28/03/2018		28/03/2018	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	103	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	103	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	113	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	110	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	103	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	94	[NT]
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	97	[NT]
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	70	1	80	71	12	72	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Date analysed	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	107	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	98	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	92	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	107	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	98	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	92	[NT]
Surrogate o-Terphenyl	%		Org-003	85	1	84	84	0	92	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Date analysed	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	97	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	105	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	122	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	100	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	104	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	81	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	1	<0.05	<0.05	0	93	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	124	1	109	112	3	106	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Date analysed	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
HCB	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	93	[NT]
gamma-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	82	[NT]
Heptachlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	81	[NT]
delta-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	74	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	78	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	88	[NT]
Dieldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	95	[NT]
Endrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	88	[NT]
pp-DDD	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	73	[NT]
Endosulfan II	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	80	[NT]
Methoxychlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	100	1	85	85	0	99	[NT]

QUALITY CONTROL: Organophosphorus Pesticides						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Date analysed	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	82	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	82	[NT]
Dimethoate	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	86	[NT]
Fenitrothion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	90	[NT]
Malathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	72	[NT]
Parathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	89	[NT]
Ronnel	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	89	[NT]
Surrogate TCMX	%		Org-008	100	1	85	85	0	84	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Date analysed	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	100	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	100	1	85	85	0	84	[NT]

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			27/03/2018	[NT]	[NT]	[NT]	[NT]	27/03/2018	[NT]
Date analysed	-			27/03/2018	[NT]	[NT]	[NT]	[NT]	27/03/2018	[NT]
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	[NT]	[NT]	[NT]	[NT]	106	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Date analysed	-			27/03/2018	1	27/03/2018	27/03/2018		27/03/2018	[NT]
Arsenic	mg/kg	4	Metals-020	<4	1	6	<4	40	110	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	102	[NT]
Chromium	mg/kg	1	Metals-020	<1	1	11	10	10	109	[NT]
Copper	mg/kg	1	Metals-020	<1	1	10	9	11	113	[NT]
Lead	mg/kg	1	Metals-020	<1	1	14	13	7	109	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	120	[NT]
Nickel	mg/kg	1	Metals-020	<1	1	3	4	29	105	[NT]
Zinc	mg/kg	1	Metals-020	<1	1	21	21	0	104	[NT]

Result Definitions

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

Quality Control Definitions

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples 188036-1 & 2 were sub-sampled from bags provided by the client.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	34275.08	**Suburb:**	Campbelltown	**To:**	Envirolab Services
Project Name:	Stage 2 Redevelopment Campbelltown Hospital	**Order Number**	1		12 Ashley Street, Chatswood NSW 2067
Project Manager:	EMG	**Sampler:**	IKA	**Attn:**	Tania Notaras
Emails:	Emily.McGinty@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☑			**Email:**	tnotaras@envirolabservices.com.au
Prior Storage:	☑ Esky ☑ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☑	(If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	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 500 ml	Combo 8A	Hold		Notes/preservation
BH109/0-0.1	1	20/03/18	S	G & P							X			
BH112/0-0.1	2	21/03/18	S	G & P							X			
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: 188036
Date Received: 26.3.2018
Time Received: 11.20
Received by: PL
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None 18.1

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

Metals to Analyse: 8HM unless specified here:

Lab Report/Reference No:

Total number of samples in container: 4 **Relinquished by:** IKA **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address** 18 Waler Cresent, Smeaton Grange 2567 NSW **Phone:** (02)46470075 **Fax:** (02)46461886

Signed: J. Hill **Received by:** Ray **Date & Time:** 26.3.2018 11.20

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Emily McGinty

Sample Login Details

Your reference	34275.08, Stage 2 Redevel. Campbelltown Hospital
Envirolab Reference	188036
Date Sample Received	26/03/2018
Date Instructions Received	26/03/2018
Date Results Expected to be Reported	04/04/2018

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	2 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	18.1
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticidesin soil	Organophosphorus Pesticides	PCBsin Soil	Total Phenolics (as Phenol)	Acid Extractable metalsin soil	Asbestos ID - soils
BH109-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓
BH112-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓

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

Additional Info

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

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Emily McGinty

Sample Login Details

Your reference	34275.09, Campbelltown Hospital
Envirolab Reference	187353
Date Sample Received	15/03/2018
Date Instructions Received	15/03/2018
Date Results Expected to be Reported	22/03/2018

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	2 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	31.7
Cooling Method	None
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticidesin soil	Organophosphorus Pesticides	PCBsin Soil	Acid Extractable metalsin soil	Total Phenolics (as Phenol)	Asbestos ID - soils
BH115-0.5-1.0	✓	✓	✓	✓	✓	✓	✓	✓	✓
BH114-1.5-1.8	✓	✓	✓	✓	✓	✓	✓	✓	✓

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

Additional Info

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

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	Campbelltown Hospital			**To:**	Envirolab Services
Project No:	34275.09	**Sampler:**	Isaac Arancibia		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	EMG	**Mob. Phone:**	N/A	**Attn:**	Tania Notaras
Email:	emily.mcginty@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	standard turnaround			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8a									Notes/preservation
BH115/0.5-1.0	1	08/03/18	S	BOTH	X									
BH114/1.5-1.8	2	08/03/18	S	BOTH	X									

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

Job No: 187353
Date Received: 15/3/18
Time Received: 18:30
Received by: MT
Temp: Cool/Ambient 31.7
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No:	187353.		
Send Results to:	Douglas Partners Pty Ltd	**Address:** 18 Waler Crescent Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	IKA	**Transported to laboratory by:**	
Signed:	**Date & Time:** 15/03/2018	**Received by:** MT ELS	15/3/18 18:30.

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 187353

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Emily McGinty
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**34275.09, Campbelltown Hospital**
Number of Samples	2 Soil
Date samples received	15/03/2018
Date completed instructions received	15/03/2018

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	22/03/2018
Date of Issue	22/03/2018

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

Results Approved By
Dragana Tomas, Senior Chemist
Jeremy Faircloth, Organics Supervisor
Long Pham, Team Leader, Metals
Lucy Zhu, Asbsestos Analyst
Nick Sarlamis, Inorganics Supervisor

Authorised By

David Springer, General Manager

vTRH(C6-C10)/BTEXN in Soil			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date extracted	-	16/03/2018	16/03/2018
Date analysed	-	16/03/2018	16/03/2018
TRH C_6 - C_9	mg/kg	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25
Benzene	mg/kg	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1
m+p-xylene	mg/kg	<2	<2
o-Xylene	mg/kg	<1	<1
naphthalene	mg/kg	<1	<1
Total +ve Xylenes	mg/kg	<1	<1
Surrogate aaa-Trifluorotoluene	%	103	103

svTRH (C10-C40) in Soil			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date extracted	-	16/03/2018	16/03/2018
Date analysed	-	17/03/2018	17/03/2018
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	85	83

PAHs in Soil			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date extracted	-	16/03/2018	16/03/2018
Date analysed	-	16/03/2018	16/03/2018
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	%	99	101

Organochlorine Pesticides in soil			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date extracted	-	16/03/2018	16/03/2018
Date analysed	-	16/03/2018	16/03/2018
HCB	mg/kg	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1
Surrogate TCMX	%	98	95

Organophosphorus Pesticides			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date extracted	-	16/03/2018	16/03/2018
Date analysed	-	16/03/2018	16/03/2018
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1
Surrogate TCMX	%	98	95

PCBs in Soil			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date extracted	-	16/03/2018	16/03/2018
Date analysed	-	16/03/2018	16/03/2018
Aroclor 1016	mg/kg	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1
Surrogate TCLMX	%	98	95

Acid Extractable metals in soil			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date prepared	-	16/03/2018	16/03/2018
Date analysed	-	16/03/2018	16/03/2018
Arsenic	mg/kg	5	5
Cadmium	mg/kg	<0.4	<0.4
Chromium	mg/kg	10	14
Copper	mg/kg	36	33
Lead	mg/kg	24	22
Mercury	mg/kg	<0.1	<0.1
Nickel	mg/kg	10	13
Zinc	mg/kg	43	43

Misc Soil - Inorg			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date prepared	-	16/03/2018	16/03/2018
Date analysed	-	16/03/2018	16/03/2018
Total Phenolics (as Phenol)	mg/kg	<5	<5

Moisture			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date prepared	-	16/03/2018	16/03/2018
Date analysed	-	19/03/2018	19/03/2018
Moisture	%	9.5	9.0

Asbestos ID - soils			
Our Reference		187353-1	187353-2
Your Reference	UNITS	BH115	BH114
Depth		0.5-1.0	1.5-1.8
Date Sampled		08/03/18	08/03/18
Type of sample		Soil	Soil
Date analysed	-	22/03/2018	22/03/2018
Sample mass tested	g	Approx. 45g	Approx. 40g
Sample Description	-	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
Trace Analysis	-	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-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.

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

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Date analysed	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	90	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	90	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	80	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	88	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	95	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	101	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Date analysed	-			17/03/2018	[NT]	[NT]	[NT]	[NT]	17/03/2018	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	110	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	97	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	110	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	97	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
Surrogate o-Terphenyl	%		Org-003	88	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: PAHs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Date analysed	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	[NT]	[NT]	107	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	100	[NT]	[NT]	[NT]	[NT]	118	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Date analysed	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
HCB	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
gamma-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Heptachlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
delta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	112	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	116	[NT]
Dieldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	124	[NT]
Endrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	105	[NT]
pp-DDD	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Endosulfan II	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	120	[NT]
Methoxychlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-005	109	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: Organophosphorus Pesticides					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Date analysed	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Dimethoate	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Fenitrothion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Malathion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Parathion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Ronnel	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate TCMX	%		Org-008	109	[NT]	[NT]	[NT]	[NT]	104	[NT]

QUALITY CONTROL: PCBs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Date analysed	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCLMX	%		Org-006	109	[NT]	[NT]	[NT]	[NT]	104	[NT]

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	[NT]
Date prepared	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Date analysed	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	104	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	96	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date prepared	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[NT]
Date analysed	-			16/03/2018	[NT]	[NT]	[NT]	[NT]	16/03/2018	[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.

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples 187353-1 & 2 were sub-sampled from bags provided by the client.

Appendix F

QA/QC

Appendix B - DATA QUALITY ASSESSMENT

Q1. Data Quality Indicators

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

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

The DQIs were assessed as outlined in the following table.

DQI	Considerations with reference to NEPC (2013) Schedule B2	Comment
Completeness		
Field Considerations	Critical locations sampled	A total of 17 combined geotechnical and contamination soil cores were conducted as part of the current investigation, of which four were subject to laboratory analysis for COPC (see Section 2). All soil bore logs were reviewed for the presence of possible indicators of contamination (visual and/or olfactory) and select samples were scheduled for laboratory analysis targeting filling, the presence of an unconsolidated ground surface and the location of the proposed car parking areas. Analysis of soil bores conducted within the access roads were not carried out as no filling was observed in the soil cores completed here, and potential contaminant pathways associated with the roads are minimal. Current and historical soil bore locations are shown in Drawing 2, Appendix A.
	Samples collected (from grid and at depth)	Soil samples were collected and analysed targeting shallow soils and/or suspected filling.
	Standard operating procedures (SOPs) appropriate and complied with	Field staff followed SOPs, as discussed further in Report Section 7
	Experienced sampler	Experienced DP environmental scientists led the field team and were given guidance from the project manager.
	Documentation correct	The DP environmental scientist completed a safe work method statement (SWMS), chain of custody, and test pit logs. The project manager reviewed the documentation.

DQI	Considerations with reference to NEPC (2013) Schedule B2	Comment
Laboratory Considerations	Critical samples analysed according to the proposal	Samples were analysed per proposal MAC17225. Samples of media initially considered to be potentially impacted by COPC were analysed.
	Analytes analysed according to the proposal	The analytes were selected on the basis of the COPC as outlined in the proposal, and the CSM.
	Appropriate methods and PQLs / LOR	NATA approved methods were adopted by the selected analytical laboratory. Limits of reporting (LORs) and practical quantitation limits (PQLs) in accordance with the method have been used by the contract laboratory.
	Sample documentation complete	Chain-of-custody (CoC) maintained and appended to the Certificates of Analysis. Certificates of Analysis complete and appended to the report.
	Sample holding times complied with	All samples were analysed within the holding times, as discussed in Section Q3.3.
Comparability		
Field Considerations	Same SOPs used on each occasion	Field staff followed the same SOPs for each day of sampling as defined in the proposal.
	Same types of samples collected	At all soil core locations, soil samples were collected from the soil core arisings. Samples were placed in laboratory supplied jars.
Laboratory Considerations	Sample analytical methods used	The laboratory used is accredited by NATA for the analyses undertaken. Laboratory analytical methods were the same for each sample, for the same analyte, in the same laboratory, and are as stated on the Certificates of Analysis.
	Sample PQLs / LORs	PQL or LOR set by the laboratory are generally below the adopted SAC.
	Same laboratories	Envirolab Services Pty Ltd was used for sample analysis. The reliability of the data provided by the laboratory is discussed in Section Q3.
	Same units	Laboratory results are expressed in consistent units for each media / analyte.
Representativeness		
Field Considerations	Appropriate media sampled according to the proposal	Appropriate media were sampled with reference to the proposal and the CSM. This included media considered to be potentially impacted by the COPC such as topsoil and fill.
	Media identified in the proposal sampled	Media identified as requiring investigation in the proposal were sampled.
Laboratory Considerations	Samples analysed according to the proposal	Samples were analysed according to the proposal and the CSM, and as stipulated in the COC.

DQI	Considerations with reference to NEPC (2013) Schedule B2	Comment
Precision		
Field Considerations	SOPs appropriate and complied with	Field staff followed SOPs as defined in the proposal. SOPs specific for contamination investigation purposes.
Laboratory Considerations	Analysis of laboratory duplicates	Refer to Section Q3.5. The majority of duplicate results were within the laboratory acceptance standards. The relevance of those outside the standards are discussed in the same section.
	Field duplicates	Two field samples were sub-sampled for QAQC purposes as part of the car park investigation report (DP, 2018). No field duplicate samples were collected as part of this investigation.
Accuracy (bias)		
Field Considerations	SOPs appropriate and complied with	Field staff followed SOPs as defined in the proposal. SOPs specific for contamination investigation purposes.
	Analysis of reagent blanks	Refer to Section Q3.6. The reagent blank samples were generally within laboratory acceptance standards. The implications of those outside the standards are discussed in Section Q3.10
	Analysis of matrix spikes	Refer to Section Q3.7. The matrix spike samples were generally within laboratory acceptance standards. The implications of those outside the standards are discussed in Section Q3.10.
	Analysis of surrogate spikes	Refer to Section Q3.8. The surrogate spike samples were generally within laboratory acceptance standards. The implications of those outside the standards are discussed in Section Q3.10.
	Analysis of laboratory control samples	Refer to Section Q3.9. The LCS were generally within laboratory acceptance standards. The implications of those outside the standards are discussed in Section Q3.10.

Q2. FIELD QUALITY ASSURANCE AND QUALITY CONTROL

The field QC procedures for sampling as prescribed in the DP *Field Procedures Manual* were followed at all times during the investigation.

Q2.1 Sampling Team and Weather Conditions

Field sampling was undertaken by a DP environmental engineer. Fieldwork was undertaken during two separate mobilisations, on 8 March 2018 and between 20 and 21 March 2018. The DP environmental engineer was instructed by the Project Manager regarding the sampling methods to be adopted.

Climatic or weather conditions are not considered to have impeded or significantly impacted the investigation.

Q2.2 Sample Collection

Samples were collected from the core arisings, at regular intervals or where a change in soil stratification was observed. Further details of the excavation and sampling methodology are presented in Report Section 7.

Q2.3 Logs and Field Sheets

Logs for each soil sampling location were recorded in the field. The individual samples were recorded on the field logs along with the sample identity, depth, replicate sample locations, and observations. Logs are presented in Appendix D.

Q2.4 Chain-of-Custody

Chain of custody information was recorded on the Chain-of-Custody (COC) sheets which accompanied samples to the analytical laboratory. Signed copies of COCs are presented in Appendix E.

The COC documented*, inter alia*, the analytical laboratory, dispatch courier, DP dispatcher, date, sample identifications, sample type and analysis to be performed on each sample.

Q2.5 Field Replicates

Replicate samples were collected in the field as a measure of accuracy, precision and repeatability of the results. Replicate samples were collected as part of the car park investigation (DP, 2018) and are included in this section.

Field replicate samples for soil were collected from the same location and an identical depth to the primary sample. Equal portions of the subject material were placed into the primary and replicate sampling jars and sealed. The sample was not homogenised so as to minimise the possible loss of volatiles. Replicate samples were labelled with a DP identification number, recorded on DP's field logs, so as to conceal their relationship to their primary sample from the analytical laboratory.

The difference between the primary and the field replicate analytical results is calculated as a relative percentage difference (RPD - %) between the two concentrations. Concentrations equal to or less than 40 % are generally considered to be suitable for soils from a QAQC perspective. The calculated RPD are presented in Tables Q1 and Q2 on the following page. All calculated RPD are within the acceptable range.

Table E1: Relative Percentage Difference Results – Intra-laboratory Replicates

Sample Reference	Depth (m bgl)	Date	Heavy Metals								PAH						TRH			
			As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	B(a)P TEQ	B(a)P	Total PAH	Naphthalene	Phenols	C6-C10 less BTEX [F1]	>C10-C16 (less Naphthalene) [F2]	>C16-C34	>C34-C40
4A	0 - 0.2	11/12/2017	4	0.4	10	34	21	0.1	7	77	0.5	0.05	0.05	PQL	5	25	50	240	140
DUPA	0 - 0.2	11/12/2017	4	0.4	8	28	18	0.1	6	65	0.5	0.06	0.06	PQL	5	25	50	240	130
RPD			0	0	25	21	17	0	17	18	0	17	17	-	0	0	0	0	8

Table E1: Relative Percentage Difference Results – Intra-laboratory Replicates

Sample Reference	Depth (m bgl)	Date	BTEX				OCPs, OPPs & PCBs										Asbestos
			Benzene	Toluene	Ethylbenzene	Total Xylenes	Aldrin + dieldrin	Chlordane	DDT + DDE + DDD	Endosulfan	Endrin	Heptachlor	HCB	Methoxychlor	OPP (Chlorpyrifos)	PCBs	
4A	0 - 0.2	11/12/2017	0.2	0.5	1	1	PQL	PQL	0.1	PQL	PQL	PQL	0.1	0.1	0.1	0.1	ND
DUPA	0 - 0.2	11/12/2017	0.2	0.5	1	1	PQL	PQL	0.1	PQL	PQL	PQL	0.1	0.1	0.1	0.1	ND
RPD			0	0	0	0	-	-	0	-	-	-	0	0	0	0	-

Q3. LABORATORY QUALITY ASSURANCE AND QUALITY CONTROL

Q3.1 Chain-of-Custody

Chain-of-custody procedures are discussed in Section Q2.4.

Q3.2 Analytical Laboratories

Samples were submitted to the following laboratory for analysis:

- Envirolab Services Pty Ltd (ELS)

The laboratory is NATA accredited for the analysis undertaken. ELS's accreditation number is 2901 and it is accredited for compliance with ISO/IEC 17025.

Q3.3 Holding Times

A review of the laboratory certificates of analysis and chain-of-custody documentation indicated that holding times were met.

Q3.4 Analytical Methods

The laboratory analytical methods are provided on the laboratory certificates of analysis in Appendix H, along with the PQL/LOR.

It is noted, however, that some of the test methods (i.e. 500 ml asbestos analysis) adopted are not NATA accredited. Where no NATA accredited method exists standard international analytical methods were adopted.

Q3.5 Laboratory Replicate Results

Laboratory replicates are additional portions of a sample which are analysed in the same manner as the other samples. Laboratory replicate samples were generally analysed at a rate of 1 for every 10 samples in a batch. The laboratory acceptance criteria for replicate samples is as follows:

Table H4: Laboratory Replicate Acceptance Criteria

Laboratory	PQL / LOR Range	Acceptance Criteria
ELS	<5 x PQL	Any RPD
	>5 x PQL	0 – 50%

The laboratory QC for laboratory replicate results, were generally within the acceptance criteria.

Q3.6 Laboratory Blank (Reagent Blank) Results

The laboratory blank, sometimes referred to as the method blank or reagent blank is the sample prepared and analysed at the beginning of every analytical run, following calibration of the analytical apparatus. This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc., it can be determined by processing solvents and reagents in the same manner as for samples. Laboratory blanks are generally analysed at a frequency of 1 in 20, with a minimum of one per batch.

All results should be less than the method PQL or LOR. The report results for the method blanks were within the acceptance criteria.

Q3.7 Matrix Spike

The matrix spike is a sample replicate prepared by adding a known amount of analyte prior to analysis, and then treated exactly the same as all other samples. The recovery result indicates the proportion of the known concentration of the analyte that is detected during analysis. The laboratory acceptance criteria for matrix spike recoveries is as follows:

Table H5: Laboratory Matrix Spike Acceptance Criteria

Laboratory	Analyte(s)	Accepted Recoveries
ELS	Inorganics / metals	70 – 130%
	organics	60 – 140%
	SVOC and speciated phenols	10 – 140%

The laboratory QC for matrix spikes were within the acceptance criteria.

Q3.8 Surrogate Spike

The surrogate spike sample is prepared by adding a known amount of surrogate, which behaves similarly to the analyte, prior to analysis of each sample. The recovery result indicates the proportion of the known concentration of the surrogate that is detected during analysis. The laboratory acceptance criteria for surrogate spike recoveries is as follows:

Table H6: Laboratory Surrogate Spike Acceptance Criteria

Laboratory	Analyte(s)	Accepted Recoveries
ELS	Inorganics/metals	70 – 130%
	organics	60 – 140%
	SVOC and speciated phenols	10 – 140%

The laboratory QC for surrogate spikes were within the acceptance.

Q3.9 Reference/Laboratory Control Sample (LCS)

This sample comprises spiking either a standard reference material or a control matrix (such as a blank of sand or water) with a known concentration of specific analytes. The LCS is then analysed and results compared against each other to determine how the laboratory has performed with regard to sample preparation and analytical procedure. LCSs are generally analysed at a frequency of 1 in 20, with a minimum of one analysed per batch.

The laboratory acceptance criteria for LCS recoveries is as follows:

Table H7: Laboratory LCS Acceptance Criteria

Laboratory	Analyte(s)	Accepted Recoveries
ELS	Inorganics/metals	70 – 130%
	organics	60 – 140%
	SVOC and speciated phenols	10 – 140%

The laboratory QC for LCSs were within the acceptance criteria.

Q3.10 Laboratory Comments

The laboratory QC for laboratory replicate results, reagent blanks, matrix spikes, surrogate spikes and LCS results are reported in the laboratory certificate of analysis.

The laboratory quality control samples were within the laboratory acceptance criteria. It is considered that an acceptable level of laboratory precision and accuracy was achieved and that surrogate spikes, LCS, laboratory duplicate results, laboratory blanks and matrix spike results were of an acceptable level overall. On the basis of this assessment, the laboratory data set is considered to have complied with the DQIs.

Q4. QA/QC DATA EVALUATION

An evaluation of field and laboratory QA/QC information against the stated DQOs has been undertaken. Overall, the SOPs were generally complied with in the field, and the laboratory quality control samples were generally within the laboratory acceptance criteria. No QC non-conformances were observed. On this basis, it is considered that an acceptable level of laboratory precision and consistency was achieved and that the laboratory data sets are reliable and useable for this assessment.