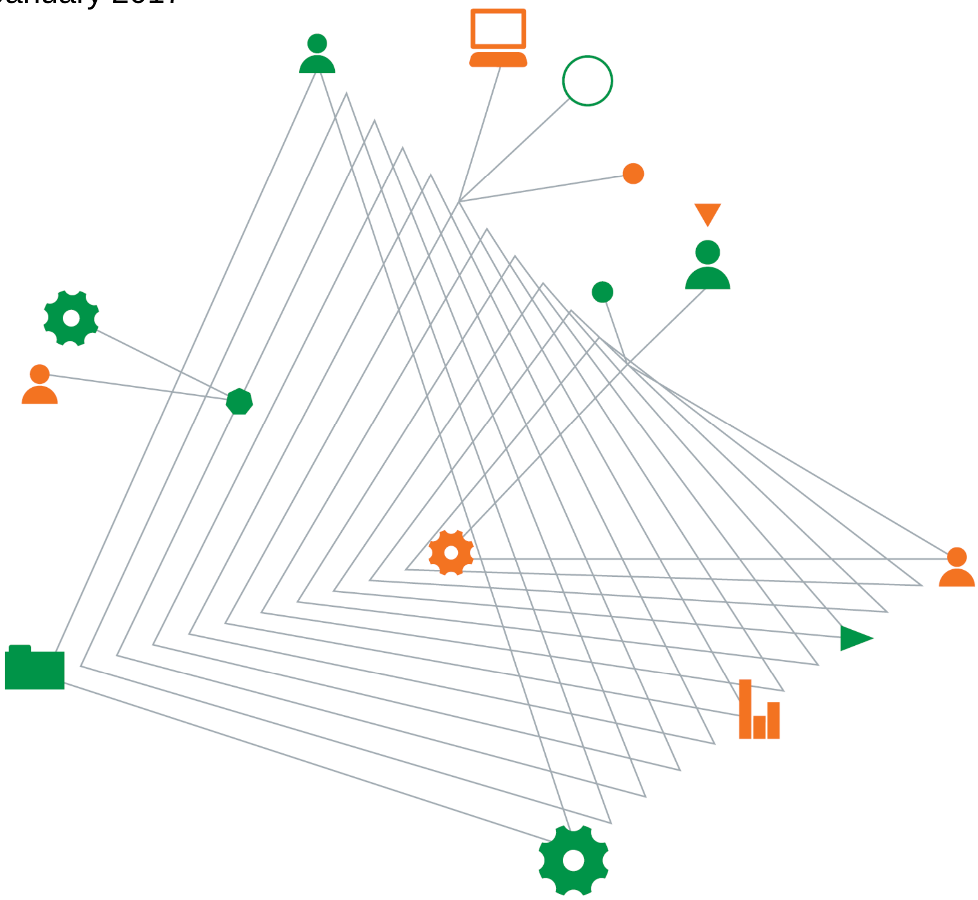
Lend Lease Building Pty Ltd

Contamination Assessment

University of Sydney Health Precinct
Blackburn Building (D06), Dangerous Goods Store (D15) and Proposed Shared Pedestrian & Vehicular Pathway
Camperdown NSW

9 January 2017



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Contamination Assessment

Prepared for
Lend Lease Building Pty Ltd

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Abbreviations

ABC	Ambient Background Concentration
ACL	Added Contaminant Limit
ACM	Asbestos Containing Material
AHD	Australian Height Datum
ALR	ALTRAC Light Rail
AMP	Asbestos Management Plan
ANZECC	Australian and New Zealand Environment and Conservation Council
AQMP	Air Quality Management Plan
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulfate Soil
bgs	below ground surface
BH	Borehole
Bq/gm	Becquerel per gram
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CEC	Cation Exchange Capacity
CoA	Conditions of Approval
COC	Chain of Custody
COPC	Chemical of potential concern
CRC CARE	Cooperative Research Council for Contamination Assessment and Remediation of the Environment
CSELR	CBD and South East Light Rail
CSM	Conceptual Site Model
CT	Contaminant Threshold
DECCW	Department of Environment Climate Change and Water
DO	Dissolved Oxygen
DQI	Data Quality Indicator
DQO	Data Quality Objective
DUAP	Department of Urban Affairs and Planning
EC	Electrical Conductivity
eH	Oxidation/Reduction Potential
EIL	Ecological Investigation Level
EIS	Environmental Impact Statement

ENM	Excavated Natural Material
Envirolab	Envirolab Services Pty Ltd
ESL	Ecological Screening Level
GIL	Groundwater Investigation Level
GME	Groundwater Monitoring Event
HIL	Health-based Investigation Level
HSL	Health-based Screening Level
IP	Interface Probe
KMH	KMH Environmental Pty Ltd
LNAPL	Light Non-aqueous Phase Liquid
LOR	Limit of Reporting
Mbgs	Meters Below Ground Surface
mg/kg	milligrams per kilogram
MW	Monitoring Well
NAPL	Non-aqueous Phase Liquid
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection (Assessment of Site Contamination) Measure
NL	Non Limiting
NSW DEC	New South Wales Department of Environment and Climate Change
NSW EPA	New South Wales Environment Protection Authority
NSW OEH	New South Wales Office of Environment and Heritage
OCP	Organochlorine Pesticide
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PID	Photoionisation Detector
PPE	Personal Protective Equipment
ppm	parts per million
PSH	Phase Separated Hydrocarbon
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
RAP	Remediation Action Plan
RPD	Relative Percent Difference

RWMS	Remediation Work Method Statement
SAQP	Sampling, Analysis and Quality Plan
SCC	Specific Contaminant Concentration
SEPP	State Environmental Planning Policy
SOP	Standard Operating Procedure
SVOC	Semi Volatile Organic Compound
TCLP	Toxicity Characteristics Leaching Procedure
TDS	Total Dissolved Solid
TEQ	Toxicity Equivalence Quotient
TfNSW	Transport for New South Wales
TOC	Top of Casing
TP	Test Pit
TPH	Total Petroleum Hydrocarbon
TRH	Total Recoverable Hydrocarbon
UCL	Upper Confidence Limit
USCS	Unified Soil Classification System
USEPA	United States Environment Protection Agency
VENM	Virgin Excavated Natural Material
VHC	Volatile Halogenated Compounds
VOC	Volatile Organic Compound
WA DoH	Western Australia Department of Health

1. Introduction

1.1. Background

Lend Lease Building Pty Ltd (LLB) commissioned Coffey Services Australia Pty Ltd (Coffey) to undertake a Contamination Assessment of the Stage 1 Blackburn Building Site (hereafter referred to as the 'site') located within the University of Sydney Health Precinct, Camperdown, NSW. The site forms part of the larger Health Precinct development. The contamination investigation was conducted in conjunction with the geotechnical assessment for the site.

The site location is presented as Figure 1.

Coffey understands the proposed development involves the demolition of the Blackburn building and dangerous goods store (D15), and the construction of a new building (to replace the Blackburn building) and a vehicular / shared pathway in the north eastern section of the site. This is further discussed in section 1.4.

This report has been prepared in accordance with Coffey's proposals GEOTLCOV25283AF-AA (dated 30 September 2016) and GEOTLCOV25283AF-AB (dated 6 October 2016).

This documents reports the findings of the contamination assessment for the site. The geotechnical findings have been reported in a separate document (GEOTLCOV25283AF-AD).

1.2. Objectives

The objectives of this Contamination Assessment are to:

- Assess the potential for contamination on site resulting from current and historical land uses;
- Investigate potential surface to subsurface contamination in the context of assessing the suitability of the site for the proposed redevelopment in accordance with State Environmental Planning Policy No. 55 – Remediation of Land (SEPP55); and
- Provide recommendations for further management and/or remediation actions, as required.

1.3. Scope of works

To achieve the project objectives, the following scope of work was carried out:

- Review of the Geotechnical and Contamination Desk Study prepared for the site by Douglas Partners (ref: 84711.00; dated March 2015) to inform the contamination investigation approach;
- Field investigations which included:
  a. Drilling of 6 boreholes to depths between 6.0m and 8.10m bgs and collection of representative soil samples;
  b. Drilling of 8 hand auger boreholes to depths between 0.6m bgs and 1.0m bgs;
  c. Collection of soil samples from each hand auger and boreholes;
  d. Collection of a groundwater sample from the newly installed monitoring well at MW01;
- Laboratory analysis of selected soil and groundwater samples for a suite of chemicals of potential concern (COPC); and

- Preparation of this Contamination Assessment report in general accordance with industry and NSW EPA guidelines, particularly the *Guidelines for Consultants Reporting on Contaminated Sites* (NSW OEH, 2011) and relevant sections of the *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999* (NEPC, amended 2013).

1.4. Proposed Development

Coffey understands the proposed development of the site involves:

- Demolition of the Blackburn Building (D06) and the Dangerous Goods Store (D15);
- Construction of a new building within the Blackburn Building footprint which will be up to 38.3m tall, and comprise a one level basement carpark. Coffey understands the new building will be used for educational purposes (i.e. classrooms and laboratories) for the purpose of medical research. Coffey understands the new building will not be used for student accommodation purposes.
- Construction of a shared pedestrian and vehicular access footpath in the northern and north eastern section of the site (bordering the University No. 1 oval).

Coffey understands the specific designs for the proposed development have not yet been finalised, and as such concept designs have not been made available to Coffey at the time this report was prepared. Coffey understands that surface cover across the site is expected to be hard paved such as building slabs, asphalt and concrete surfacing. Some small areas of landscaping may be retained in the proposed shared vehicular / pedestrian pathway area.

2. Site information

2.1. Site identification

The site location is shown on Figure 1, while the site layout is shown in Figure 2.General information pertaining to the site is summarised in Table 2.1.

Table 2.1: Site Identification

Site Identification:	Part Lot 1 in DP1171804
Site Area:	Approximately 0.6 hectares
Zoning:	SP2 – Infrastructure (Educational Establishment) under the City of Sydney Local Environmental Plan 2012
Current Land use:	The western/south western section of the site currently comprises the Blackburn building (D06), which is used for medical research purposes. A Dangerous Goods store (D15) is located centrally within the site. The remainder of the site is used as an access road and footpath.

2.2. Site description

The site is located within the Health Precinct of the University of Sydney – Camperdown Campus, NSW. The Health Precinct is at the western part of the campus.

At the time of our investigation, the western part of the site was occupied by the 5-storey Blackburn Building (D06), which was established on site in circa 1933. This building has been used for medical research and educational purposes. A partial basement exists within the footprint of the current building which contains a number of classrooms. The ground and upper floors are reportedly used as laboratories, offices, freezers and a pathology museum. An emergency generator exists within the northern courtyard of the Blackburn Building, which has been assumed to contain a small internal tank of diesel fuel. No evidence of staining was noted by Coffey during the site works, or previously within the Geotechnical and Contamination Desk Study report (Douglas Partners, 2015).

The Dangerous Goods Store (D15) is located centrally within the site and comprises a single storey brick building with pitched steel roof. It was not possible for Coffey to access this building during site works. The Geotechnical and Contamination Desk Study reported that this structure stored small quantities of various chemicals and low grade radioactive wastes (Douglas Partners, 2015). A floor drainage grate was observed in the dangerous goods store although no evidence of spillages (i.e. staining on floor, odours etc.) was reported.

Land surrounding these structures comprises small landscaped areas and asphalt surfaced car parks and roads, including Blackburn Circuit.

Key site features are shown on Figure 2.

2.3. Surrounding land use

The site is located in an area occupied by various land uses as follows:

North: Recreational space referred to as University Oval No. 1, and associated grandstand

East: Blackburn Circuit and other University of Sydney Health building (D04 Bosch 1A and Glasshouse). This building is used for lecture theatres and offices. The Glasshouse functions as a greenhouse for growing various plants.

South: D05 Bosch 1B building used for medical research activities with partial basement used for plant storage, and Glasshouse used for growing plants. A diesel generator is situated between Bosch 1B and Glasshouse structures.

West: Royal Prince Alfred Hospital

2.4. Topography and hydrology

Google Earth (2016) indicates that the site lies at elevations that range between 24m and 26m Australian Height Datum (AHD), with site elevations increasing slightly in an easterly direction.

No creeks or rivers surround or dissect the site. It is expected that surface water from site will flow into existing drainage systems along Blackburn Circuit. Surface water runoff may infiltrate small areas of exposed soils where landscaping is present.

The closest permanent waterway to the site is Johnston's Creek which is located approximately 1km to the northwest of the site. Johnston's Creek discharges into Rozelle Bay.

2.5. Geology and soils

2.5.1. Geology

The 1:100,000 Sydney Geological Series Sheet 9130 indicates that the site is underlain by Ashfield Shale, which comprises black to dark grey shale and laminite.

2.5.2. Acid sulfate soils

The 1:25,000 Acid Sulfate Soil Risk Mapping (ASS) (1994-1998) indicates that there is no known occurrence of ASS beneath the site, or within 500m radius of the site.

2.6. Hydrogeology

A search of registered groundwater bores located in the vicinity of the site was undertaken on 6 December 2016 using the NSW Office of Water groundwater map (http://allwaterdata.water.nsw.gov.au/water).

The results of the search indicated that there are 2 registered bores within a 500m radius of the site, as summarised in Table 2.2.

Table 2.2: Registered Groundwater Bores

Bore ID	Final Depth (m bgs)	Authorised Purpose	Standing Water Level (m btoc)	Distance and direction[#]
GW110247	210.0	Domestic	31	330m / SE
GW111408	4.40	Monitoring bore	2.070	430m / N

Notes:
m btoc = meters below top of casing

Regionally, groundwater is expected to flow in a broadly north westerly direction towards Johnston's Creek.

2.7. Summary of site history

The Geotechnical and Contamination Desk Study (Douglas Partners, 2015) provided the following information regarding the historical use of the site:

- The land was dedicated for university purposes in government gazettes dated 1863 and 1855, with aerial photographs identify University buildings to be present since at least 1865. With the current site layout being similar to that in1970. Records suggest that the site was likely to be a farm prior to development of the University,

- The Blackburn Building was established on site in c1933. The layout of the Blackburn Building appears to be similar to its current layout The Bosch 1B Building was also established to the south of the site at this time. Land surrounding the site appeared to be in use as recreational space.

- Further development surrounding the site occurred during the 1940's including the development of the hospital located to the west of the site. Land to the south/southeast remained undeveloped although several zig zag trenches are noted which was suggested to relate to training areas for soldiers participating in World War II.

- By 1970, land surrounding the site had been further developed in a manner that is similar to that observed today. The Dangerous Goods store was constructed some time during the period between 1994 and 2007.

- The site is not listed on the NSW EPA's contaminated land registers or Protection of the Environment Operations (POEO) list. As part of the current assessment Coffey confirmed that the site had not been entered onto these registers maintained by the NSW EPA since the completion of the desk study report (Douglas Partners, 2015).

- A former chemical store was noted within the northern courtyard of the Blackburn Building, where flammable liquids including ethanol were stored.

- Records supplied by WorkCover NSW indicate that the licensable dangerous goods stored on dangerous goods store (D15) included:

    - A Flammable goods store including storage of radioactive waste activity (<100bq/gm) in <20L – 30L containers on shelves. Waste included tritium 3H and 32P waste;

    - Average of 2,200L and maximum of 6,000L of chemicals including ethanol, acetone, hexanes, methanol, xylenes, diethyl ether and formaldehyde;

    - Flammable liquids (Class 3), small amount of toxic chemical (Class 6.1) and corrosive metals (Class 8);

    - Cryigenics specimen storage tank (2,500L – 3,000L);

    - Non-flammable, non-toxic gas 2 used to store gas cylinders including nitrogen, carbon dioxide and carbogen.

    - Storage of small quantities (<20-30L) of various chemicals including benzene, xylene, absolute ethanol AR, mortein plus (pyrethrum and piperonyl butoxide and petroleum distillate), hydrochloric acid, acetone and turpentine.

2.8. Areas of environmental concern

To facilitate the field and laboratory program, areas of environmental concern (AEC) were considered and are summarised in Table 2.3.

Table 2.3: Areas of Environmental Concern and Chemicals of Potential Concern

Item	Mechanism of release	Potential chemicals of concern
Chemical storage within the dangerous goods store (D15) and northern courtyard of Blackburn Building (D06)	Leakage/spillage of chemicals, and infiltration into ground surface.	Heavy metals, TRH, BTEX, PAH, OCP, SVOC, VOC
Trade waste pipelines within the Blackburn Building	Release of trade wastes pipelines of the Blackburn Building from damaged pipes/overflows, and infiltration to surrounding ground	Heavy metals, TRH, BTEX, PAH, OCP, SVOC

Item	Mechanism of release	Potential chemicals of concern
Fuel storage in electrical generators	Leakage/spillage of chemicals, and infiltration into ground surface.	TRH, PAH
Hazardous building materials mostly around the Blackburn Building	Weathering of hazardous building materials from site structures, or poor demolition practices.	Asbestos, lead, arsenic and zinc
Fill of unknown origin across the entire site	Placement of fill of unknown origin, potentially comprising contamination such as ash and asbestos	TRH, BTEX, PAH, heavy metals, OCP, PCB, asbestos

3. Sampling, analysis and quality plan

3.1. Project data quality objectives

As stated in Appendix IV of the Guidelines for the NSW Site Auditor Scheme 2nd ed. (DEC, 2006), the Data Quality Objectives (DQO) process is used to "define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site".

The seven-step DQO process adopted for this assessment is provided below:

Step 1: State the Problem

The objectives are to:

- Assess the potential for contamination on site resulting from current and historical land uses;
- Investigate potential surface to subsurface contamination in the context of assessing the suitability of the site for the proposed redevelopment in accordance with State Environmental Planning Policy No. 55 – Remediation of Land (SEPP55); and
- Provide recommendations for further management and/or remediation actions, as required.

The main problems are:

- How many sampling locations should be drilled / excavated?
- What type of investigation methods should be used?
- Are there access restrictions and / or subsurface conditions present that may affect the location of sampling locations, and the method(s) used for investigation?
- To what depths should sampling locations be extended to for the purpose of this assessment?
- At what depth should soil samples be collected?
- What are the COPCs for both soil and groundwater?

Step 2: Identify the Decision

- What is the level and extent of the contamination present within the subsurface of the site?
- Does this contamination preclude the proposed use of the site for the construction of a new medical research building and a shared pedestrian / vehicular pathway in its current state?

Step 3: Identify Inputs to the Decision

The inputs to assessing the above include:

- Available information that describes the current and historic land uses.
- Results of the field investigations with comparison to the adopted investigation levels; and
- Relevant legislation and regulatory guidelines.

Step 4: Define the Study Boundaries

The lateral boundaries for the proposed Stage 1 Blackburn Building Site (the site) are shown on Figure 2 (attached).

The vertical investigation boundary is limited to the maximum depth of investigation.

Step 5: Develop a Decision Rule

Are all quality assurance / quality control (QA / QC) sample results within recommended control limits (refer to Section 4.1.1)?

- *If Yes*; then data is considered suitable and reliable for the purpose of the assessment.
- *If No*; then data may not be considered suitable and reliable for the purpose of the assessment. In this case:
    - Assess, if identified, any anomalies are due to heterogeneous nature of the sample, reported contaminant concentrations (i.e. close to the laboratory limit of reporting [LOR]), or poor field or laboratory techniques and, based on this, assess the suitability of the results for inclusion in the data set, meeting the project objective.
    - If an anomaly is considered to be a result of laboratory error, request re-analysis of the sample in question by the project laboratory or a secondary laboratory.

For the purposes of this assessment, do the contaminant concentrations exceed relevant criteria and are further remediation actions or management options required to make the proposed alignments, depot and stabling yard suitable for their intended use?

- *If No*; then it may be concluded that the investigation area is suitable for its proposed intended use.

  If Yes; then further statistical analysis is required to assess the significance of the contamination. The statistical parameters of interest are the concentrations of the COPC identified in Table 2.3. The action levels are the Assessment Criteria provided in Section 5.

  The decision statements are:

  - The 95% Upper Confidence Limits (or UCL) concentrations of COPC in the fill materials and natural soils are to be less than the health and ecological based assessment criteria.
  - Where 95% UCL concentration are more than the health based assessment criteria then further assessment and/or management would be required. This could include assessing individual results and/or undertaking a Tier 2 risk assessment.

Health Investigation Levels and Health Screening Levels

- Where data sets are not sufficiently populated to calculate a 95% UCL then individual results are to be less than the health based assessment criteria. Where individual concentrations are more than the health based assessment criteria then further assessment and/or management would be required. This could include assessing individual results and/or undertaking a Tier 2 risk assessment.

- Where the 95% UCL can be calculated the 95% UCLs are to be less than the health based assessment criteria and no individual results in the data set are to be greater than 250% of the assessment criteria; and the standard deviation of the data set is to be within 50% of the assessment criteria.
- Where the 95% UCL is more than the assessment criteria then further assessment and/or management would normally not be required.

Environmental Investigation Levels (EIL) and Ecological Screening Levels (ESL)

- Data is to be compared directly to environmental based assessment criteria. Where individual concentrations are more than the EILs / ESLs, further assessment and/or management would be required.

Step 6: Specify Limits of Decision Errors

There are two types of decision errors:

- Sampling errors, which occur when the samples collected are not representative of the conditions within the investigation area; and
- Measurement errors, which occur during sample collection, handling, preparation, analysis and data reduction.

The null hypothesis for this study is:

1. Contaminant concentrations within the soil and groundwater, as a whole within the investigation area, are less than or comparable with relevant investigation levels.

These errors may lead the decision maker to make the following errors:

- Deciding that the soil and/or groundwater are not contaminated and, therefore, the site is suitable for use for the proposed use when the reverse is true; and
- Deciding that the soils and/or groundwater are contaminated and, therefore, the site is not suitable for use for the proposed commercial/industrial land use when the reverse is true.

An assessment will be made as to the likelihood of a decision error being made based on the results of a QA / QC assessment and the closeness of the data to assessment criteria. Additionally, statistical methods may be utilised, where applicable, such as 95% Upper Confidence Limit (UCL) calculations.

Step 7: Optimise the Design for Obtaining Data

Based on the previous Steps 1 to 6 of the DQO process, the optimal design for obtaining the required data is presented in the following sections.

3.2. Sampling plan

In summary, the field investigations included the following:

- Drilling and sampling a total of six boreholes surrounding the Blackburn Building;
- Drilling and sampling a total of eight hand auger holes (two hand auger holes targeting the dangerous goods store, and 6 hand auger holes systematically placed within the proposed shared pedestrian/vehicular pathway area;
- Collection of one groundwater sample from newly installed groundwater monitoring well BH6.

Given the majority of the site is covered by the Blackburn Building, a systematic sampling pattern could not be established across the entire site. The boreholes were positioned in accessible areas surrounding the Blackburn Building.

Two hand auger holes were placed directly adjacent the D15 dangerous goods store to target possible leakages/spillages of stored chemicals.

A systematic sampling pattern was established in the northern/north-eastern section of the site, where the proposed shared pedestrian/vehicular pathway is proposed. Six hand auger holes were placed in this area.

Newly installed groundwater monitoring well (BH6) was sampled to establish the quality of groundwater beneath the site. BH6 is located in proximity to both the Blackburn building (which houses the diesel generator and former chemical stores), and the dangerous goods store D15.

Approximate borehole, hand auger and groundwater sampling locations are shown on Figure 2.

3.3. Soil sampling methodology

The soil sampling methodology is summarised below in Table 3.1.

Table 3.1: Soil Sampling Methodology

Activity	Details
Soil Sampling	Fieldwork was undertaken as per the following: • Borehole drilling and well installation was completed on 14, 15, 21 and 22 November 2016 • Hand augers and groundwater sampling was completed on the 22 and 24 November 2016 Sample collection was conducted in general accordance with industry's acceptable practices, the amended NEPM (NEPC, 2013), and Australian Standards AS4482.1 and AS4482.2, *Guide To Investigation and Sampling of Sites with Potentially Contaminated Soil (Part 1: Non-volatile and semi-volatile compounds)*. **Boreholes** Boreholes were drilled using a mechanical drill rig equipped with solid flight augers. Samples were collected from decontaminated standard penetration test (SPT) split spoon sampler or directly from the auger where SPT cannot be undertaken due to difficult ground conditions. Boreholes were drilled to depths where the solid auger refused on bedrock (i.e. between 6.0m and 8.1m bgs). Each bore was progressed into bedrock using triple barrel coring techniques to obtain additional geotechnical information. Soil samples were generally collected from each borehole from the near ground surface (0-0.2m), 0.5-0.7m, 1.3-1.5m and approximately each 1m interval, or where evidence of contamination (i.e. odours, staining, etc) was noted. Soil sampling was terminated 0.5m into natural material or solid stem auger refusal (whichever occurred first). **Hand augers**

Activity	Details
	Hand auger holes were drilled using a hand operated auger. Samples were collected directly from the auger bit. Hand auger holes were drilled to depths between 0.6m and 1.0m bgs. Soil samples were generally collected from each hand auger hole from the near ground surface (0-0.2m), 0.5-0.7m, and 0.9-1.0 m and where evidence of contamination (i.e. odours, staining, etc) was noted. Soil sampling was terminated 0.5m into natural material or hand auger refusal (whichever occurred first).
Soil Logging	Soil logging was carried out in general accordance with the Unified Soil Classification System (USCS) by a suitably qualified and experienced Coffey engineer/scientist. Borehole logs are presented in Appendix B.
Soil Screening	At each sampling interval, a portion of each soil sample was placed inside a sealed plastic bag for soil screening in the field for Volatile Organic Compounds (VOCs) using a Photoionisation Detector (PID). The PID was calibrated at the start of each day. Calibration certificates are present in Appendix C. The PID readings, together with other field observations, were used to assess which samples should be analysed for volatile and semi-volatile organic compounds (VOC, SVOC). Field screening results are included on the logs presented in Appendix B.
QA/QC Samples	To measure the accuracy and precision of the data generated by the field and laboratory procedures carried out in this investigation, The following QA/QC samples were collected: • 4 field duplicate soil samples were submitted for analysis which included 3 intra laboratory samples and 1 inter-laboratory samples • 4 trip spike samples submitted for analysis to the primary laboratory • 4 trip blank samples submitted for analysis to the primary laboratory • 4 rinsate samples submitted for analysis to the primary laboratory
Sample Handling and Transportation	Soil samples collected for chemical analysis were immediately placed into laboratory supplied jars, with Teflon lined seals to limit volatile loss and placed into an ice chilled cooler. Soil samples collected for asbestos analysis were placed into ziplock plastic bags and securely sealed. Samples were dispatched to NATA accredited laboratories under chain of custody control.
Decontamination of sampling equipment	All non-disposable sampling equipment was decontaminated with Decon 90 solution in potable water, and rinsed with potable water prior to use and between each sample location.

A total of 14 soil sampling locations have been established within the site as part of this assessment. A combination of targeted and systematic sampling was conducted for this investigation. This approach is consistent with the NSW EPA 1995 Sampling Design Guidelines.

3.4. Groundwater sampling methodology

Groundwater sampling was undertaken in accordance with industry standards and Coffey SOP with the sampling methodology summarised in Table 3.2.

Table 3.2: Groundwater Sampling Methodology

Activity	Detail / Comments
Groundwater sampling	Fieldwork was undertaken as per the following: • Wells installed: BH2, BH4, BH6 • Well installation: 15 November 2016 • Wells sampled: BH6 • Groundwater monitoring event (GME): 22 November 2016 Sample collection was conducted in general accordance with industry's acceptable practices and the amended NEPM (NEPC, 2013).
Well Construction and Development	Three groundwater monitoring wells (BH2, BH4 and BH6) were installed on-site to depths between 12.0m and 10.5m bgs. Monitoring well locations are shown on Figure 2. The monitoring wells were constructed of 50mm diameter screw threaded PVC casing, with a length of machine slotted PVC screen positioned to intercept the groundwater table. To enable the detection of phase separated hydrocarbon (PSH), if any, the well screen was positioned to screen across the water table. The well annulus was backfilled with graded sand from the base of the well to approximately 0.5m above the top of the well screen. Bentonite seal was placed over the sand pack and the remainder of the annulus was grouted to the surface. The well was covered at the surface with a flush-mounted cast iron road box. Well construction details are provided on the logs presented in Appendix B. Following installation, the monitoring wells were developed until at least five well volumes were removed from each monitoring well. Well development records are presented in Appendix D.
Well Gauging	Monitoring wells were gauged using an oil/water interface probe (IP) to assess the depth to groundwater and the presence (and thickness) of PSH, if any.
Well Purging and Sampling	Prior to sampling, the monitoring well was purged using a disposable bailer until three similar groundwater quality readings were obtained, or until the well went dry. Field groundwater quality parameters were recorded between each well volume removed from the well. The water quality meter was calibrated prior to use. Calibration certificates are presented in Appendix C. Monitoring well BH6 was sampled using a disposable bailer.
QA/QC Samples	To measure the accuracy and precision of the data generated by the field and laboratory procedures carried out in this investigation, Coffey collected the following QA/QC samples:

Activity	Detail / Comments
	• one trip spike sample submitted for analysis to the primary laboratory • one trip blank sample submitted for analysis to the primary laboratory
Sample Handling and Transportation	Groundwater samples were immediately placed into laboratory supplied bottles, with Teflon lined seals and placed into an ice chilled cooler. Sample containers for analysis of volatile compounds were filled to eliminate headspace. Samples were dispatched to a NATA accredited laboratory under chain of custody control.

3.5. Laboratory analysis

Laboratory analyses were carried out by Eurofins MGT in Lane Cove, NSW, which is a NATA accredited for the analyses performed. Inter laboratory analysis was undertaken by ALS in Smithfield, NSW, which is a NATA accredited for the analyses performed.

A selection of primary soil and groundwater samples was submitted for laboratory analysis for a suite of COPC as summarised in Table 3.3.

Table 3.3: Summary of Analysis

Contaminant of Potential Concern	No. Primary Soil Samples	No. Primary Groundwater Samples
Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)	27	1
Total recoverable hydrocarbons (TRH)	27	1
Benzene, toluene, ethylbenzene, xylene (BTEX)	27	1
Polycyclic aromatic hydrocarbons (PAH)	27	1
Volatile organic compounds (VOCs)	1	0
Semi volatile organic compunds (SVOC)	3	0
Organochlorine pesticides (OCPs)	14	0
Asbestos (presence / absence)	20	-

4. Quality assurance / quality control

4.1. Data quality indicators for the project

The following QA / QC assessment addresses data completeness, comparability, representativeness, precision and accuracy based on field and laboratory considerations and the processes for assessment of data quality provided in Section 19 (Appendix C) of Schedule B(2) 'Guideline on Site Characterisation' of the amended NEPM (NEPC, 2013).

4.1.1. DQIs for analytical results

Specific data quality indicators (DQIs) indicators for field and laboratory QC samples are shown in Table 4.1.

Table 4.1: Data Quality Indicators for Analytical Results

Type of Quality Control Sample	Control Limit
Duplicate Samples	Relative Percentage Difference (RPD) within 50%
Triplicate Samples	RPD within 50%
Spikes	Recoveries within the following ranges • 70% - 130% for inorganics / metals • 60% - 140% for organics • or as specified in laboratory's quality plan
Blanks	Analytes not detected
Rinsates	Analytes not detected

4.1.2. DQIs for sampling and analysis

DQIs for the project was based on the field and laboratory considerations in the table in Appendix V of NSW DEC (2006). This comprised:

- Completeness – a measure of the amount of useable data (expressed as %) from a data collection activity;
- Comparability – the confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness – the confidence (expressed qualitatively) that data are representative of each media present on the site;
- Precision – a quantitative measure of the variability (or reproducibility) of data; and
- Accuracy – a quantitative measure of the closeness of reported data to the true value.

4.2. Field QA / QC measures

The following QA / QC measures were implemented in carrying out the investigation fieldworks:

- Fieldworks were undertaken by an experienced and appropriately qualified Coffey scientist/engineer.
- Fieldworks were undertaken in general accordance with the guidance presented in relevant industry standards, including the relevant schedules of the amended NEPM (2013) and AS4482.
- Sampling equipment including the PID and water quality meter were calibrated by the equipment supplier prior to use. Calibration certificates are provided in Appendix C.
- Quality control samples were collected and analysed as part of the sampling program. This included intra-laboratory duplicate samples, inter-laboratory duplicate samples, rinsate blank samples, trip spike and trip blank samples. A discussion of these results is provided in the following sections.
- Laboratory analysis for sample BH2_3 was conducted from zip lock bag as the laboratory advised they could not locate a jar for the sample. Although it is envisaged that the zip lock bag should preserve most of the volatiles in the sample, volatile loss cannot be excluded. This sample was taken from natural soil materials at 1.9 mbgs, with the aim of informing of quality of natural material beneath the fill material. Results for volatiles should be analysed with care for this sample, however Coffey believes this will not alter the outcome of the investigation.

4.2.1. Field intra laboratory and inter laboratory samples

Primary, intra laboratory and inter laboratory soil samples collected from the site by are summarised in Table 4.2.

Table 4.2: Soil Duplicate and Triplicate Samples

Primary Sample	Sample Type	Duplicate Sample	Laboratory	Inter laboratory Sample	Laboratory
HA01_0.2-0.3	Soil	Dup01	Envirolab	-	-
BH2-2 0.5	Soil	Dup1	Envirolab	-	-
BH3-4 1.5m	Soil	Dup2	Envirolab	-	-
BH3-4 1.5m	Soil	-	-	TRIP1	ALS

Overall, the number of intra laboratory samples analysed exceeded the minimum rate of 10%. The number of inter laboratory samples collected fell marginally the anticipated rate of 5%.

RPD results for the above soil samples were calculated as shown in Table 1.

Acceptable RPD results are considered to be less than 50% for soil, with results at the higher range expected for organic analyses. However, no RPD acceptance limit is considered to apply in the following situations where exaggerated RPD results may be expected:

- QC sample pairs where one sample reported a detectable concentration and the alternate sample reported a concentration below the laboratory LOR.
- QC sample pairs where one or more of the primary and/or secondary samples reported contaminant concentration less than, or equal to, ten times the laboratory LOR.

RPD values for primary and duplicate soil samples were reported to be within the acceptable range of 50% for all samples with the exception of the following:

- Arsenic between parent sample BH3_4_1.5m and intra laboratory sample Dup2 and inter laboratory sample Trip 1. The RPD for both duplicate samples was 114%.

Given that this samples comprised gravelly sandy fill material, the RPD anomalies are likely to be attributed to the heterogeneous nature of the soil and the uneven distribution of contaminants within the soil matrix. Coffey considers that the reported outliers are unlikely to affect the overall conclusions of the investigation.

Based on the above, the analytical results are considered acceptable for the purposes of this assessment.

4.2.2. Other field QC samples

Trip spike sample are collected during field sampling to assess loss of volatiles from samples during transit, while trip blanks are collected to assess whether contamination may have been introduced to samples during shipping and field handling activities. Rinsate samples are collected to assess the effectiveness of field decontamination techniques.

Three trip spike samples were submitted for laboratory analysis during the soil sampling program, and one trip spike was submitted for analysis during the groundwater sampling program. All trip spike samples reported recoveries within the acceptable range.

Three trip blank samples were submitted for laboratory analysis during the soil sampling program, and one trip blank was submitted for analysis during the groundwater sampling program. All trip blank samples reported concentrations below the laboratory LOR.

Four rinsate blank samples were submitted for laboratory analysis during the soil sampling program. All rinsate blank samples reported concentrations below the laboratory LOR, with the exception of some minor elevations of heavy metals, and C10-C14. The elevated results may be attributable to minor cross contamination between sampling events following decontamination. The elevated results are considered minor as they were reported slightly above the LOR, and are unlikely to impact on the quality, precision or accuracy of the results.

Tabulated results for the above field QC samples are summarised in Table 2.

4.3. Laboratory QA/QC

In accordance with standard industry practice, the project laboratories performed an internal QA / QC assessment. The assessment is typically described as a multi-level approach whereby standard laboratory control procedures are implemented, including laboratory duplicates, method blanks, matrix spikes and surrogate spikes.

Laboratory QC analytical results are summarised below:

- Laboratory analysis of soil and groundwater samples was undertaken by NATA accredited environmental testing laboratories.

- All soil and groundwater samples were extracted and analysed within recommended holding times, with the exception of the following:

    - TCLP benzo(a)pyrene in sample BH6_1m. The sample was sampled on 14 November 2016, and was analysed for TCLP B(a)P on 6 December 2016. The analysis was requested following receipt of the contaminant concentration to inform on the leachability of B(a)P. This information was used to inform the basis of the preliminary waste classification procedure (along with sample HA07_0.5-0.6, which was within holding times), and as such must be interpreted with care for this process. The holding time breach will not influence the contamination assessment.

- No target analytes were detected in any of the method blanks.
- RPDs for the laboratory duplicate soil and groundwater samples were within the acceptable range for all samples with the exception of the following:
  - Anthracene, Benzo(a)anthracene, Benzo(b&j)fluoranthene, Chrysene, Fluoranthene, Phenanthrene and Pyrene in laboratory report 525093

  It is considered likely that RPD outliers can be attributed to the heterogeneity of the fill material rather than poor laboratory techniques. It should be noted that the RPDs passes Eurofins internal quality control acceptance criteria. Coffey considers that the reported outliers are unlikely to affect the overall conclusions of the investigation.
- Percentage recovery results for laboratory control samples were within the acceptable range for all samples.
- Percentage recovery results for surrogate samples were within the acceptable range for all samples.
- Percentage recovery results for matrix spikes were within the acceptable range for all samples.
- The laboratory internal standards, calibration blanks and mid-range calibration verifications were all within the acceptable range.

4.4. Data quality assessment

Based on an assessment of the field and laboratory QA / QC data, Coffey considers that the data obtained is representative of subsurface conditions at the sampling locations, and the results are acceptable for the purposes of this assessment.

5. Investigation levels

5.1. Soil investigation levels

The soil investigation levels presented in Schedule B1 of the amended NEPM (NEPC, 2013) were adopted for this assessment, supplemented by criteria presented within *Technical Report No. 10: Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater* (CRC Care, Sept 2011), and USEPA Regional Screening Levels (RSLs) (US EPA 2016).

5.1.1. Health-based investigation and screening levels

For assessing contamination levels in soil in urban settings, Schedule B1 in the amended NEPM (NEPC, 2013) presents health based investigation levels (HILs) and health screening levels (HSLs) for different generic land uses (e.g. industrial/commercial, residential, recreational, etc).

Based on information available to describe the proposed development, Coffey considers that the proposed development is consistent with the generic commercial/industrial land use setting (HIL D – Health Investigation Level D – Commercial/Industrial) defined in Schedule B7 of NEPC (2013) given that:

- The primary human receptor within the proposed development will comprise adult tertiary students and employees attending lectures and undertaking laboratory work within the ground floor and basement areas.
- The proposed building will not provide residential accommodation for students or staff.
- The majority of the ground surfaces are expected to be sealed with concrete / pavers, minimising direct contact with underlying soils.
- The shared vehicular / pedestrian pathway will be used as a thoroughfare. Human receptors are unlikely stay on this part of the site for extended periods of time.

Similarly, workers undertaking the proposed site redevelopment activities also fall under this land use setting.

The HILs for heavy metals, PAH and OCP in soils are summarised in Table 5.1.

Table 5.1: Summary of HILs in Soil

Analyte	HILs for Commercial/Industrial (mg/kg)
Arsenic (total)	3,000
Cadmium	900
Chromium (VI)[1]	3,600
Copper	240,000
Lead	1,500
Mercury (inorganic)	730
Nickel	6,000
Zinc	400,000
Carcinogenic PAH as Benzo(a)pyrene TEQ[2]	40
Total PAHs	4,000
Aldrin + Dieldrin	45

Analyte	HILs for Commercial/Industrial (mg/kg)
Chlordane	530
DDT+DDD+DDE	3,600
Endosulfan	2,000
Endrin	100
Heptachlor	50
HCB	80
Methoxchlor	2,500
PCB	7
Other VOCs and SVOC	<LOR

Notes:

[1] Soils were tested for Total Chromium, which comprises both Chromium (III) and Chromium (VI) valence states. The HIL for Chromium (VI) has been adopted as a conservative assessment threshold.

[2] TEQ = Toxicity Equivalence Quotient.

TRH, BTEX and naphthalene concentrations were assessed against the soil HSLs for vapour intrusion from the relevant depth and soil matrix applicable to “Commercial / Industrial” land use (HSL D) from the amended NEPM (NEPC, 2013).

The adopted screening levels were selected in consideration of the dominant soil texture - sandy soils.

The HSLs for TRH, BTEX and naphthalene in soils are summarised in Table 5.2.

Table 5.2: Summary of HSLs in Soils

Chemical	HSL D – Commercial / Industrial (for sandy soils) (mg/kg)			
	0m to <1m	1m to <2m	2m to <4m	4m +
Benzene	3	3	3	3
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	230	NL	NL	NL
Naphthalene	NL	NL	NL	NL
F1 (C_6-C_{10} minus BTEX)	260	370	630	NL
F2 (>C_{10}-C_{16} minus naphthalene)	NL	NL	NL	NL

NL: non-limiting (i.e. contaminant is not considered to pose a risk to human health).

Where SVOCs and VOCs are detected at concentrations above the laboratory LOR, health screening levels from other authoritative sources (e.g. USEPA Region 9) will be used to assess the significance of potential risks.

5.1.2. Ecological investigation & screening levels

The western section of the site where the Blackburn building is located will be excavated to allow for the construction of the new building where soils will be removed for a basement. For this reason, ecological investigation levels (EIL) and ecological screening levels (ESL) are not considered applicable to this area of the site.

The eastern / north eastern section of the site is proposed for a shared vehicular / pedestrian pathway. Although it is perceived that the majority of this area will be contain a sealed surface, there may small areas where landscaping may be established. As such, ecological and screening criteria has been considered for commercial / industrial for this area only. Table 5.3 below provides the adopted EILs and ESLs.

Table 5.3: Summary of EIL and ESL in Soils

Chemical	ESL & EIL D – Commercial / Industrial (mg/kg)
Benzene	75
Toluene	135
Ethylbenzene	165
Xylenes	180
Naphthalene	370
Benzo(a)pyrene	1.4
F1 C6-C10	215
F2 C10-C16	170
F4 C16-C34	1700
F4 C34-C40	3300
Arsenic	160
Chromium	310[3]
Copper	400[2]
Lead	1800
Nickel	55[4]
Zinc	405[1]
DDT	640

Notes:

ESLs for sandy soils have been selected for a conservative approach.

EILs have assumed an aged soil

Background concentrations obtained from “Element concentrations in soils in rural and urbab areas of Australia (1995).

[1]Derived using a conservative CEC of 5 cmol/kg, and a pH of 6.5 (assumed pH derived from groundwater data from site).

[2]Derived using a pH of 6.5 (assumed pH derived from groundwater data from site)

[3]Derived using a conservative clay value of 1%

[4]Derived using a conservative CEC of 5 cmol/kg)

5.1.3. Management limits

In accordance with Section 2.9 of Schedule B(1) of the amended NEPM (NEPC, 2013), consideration of Management Limits will been undertaken to assess whether the reported soil conditions have the potential to pose a potential risk to buried infrastructure, present a fire or explosion risk, or result in the formation of PSH.

The adopted screening levels were selected in consideration of the dominant soil texture – coarse grained sandy soils.

The management limits for soil are summarised in Table 5.4.

Table 5.4: Summary of Management Limits

Chemical	Commercial / Industrial (for coarse grained soils) (mg/kg)
F1: TRH C_6-C_9	700
F2: TRH C_{10}-C_{16}	1,000
F3: TRH >C_{16}-C_{34}	3,500
F4: TRH >C_{34}-C_{40}	10,000

5.1.4. Asbestos

Quantitative testing (present / absent) was undertaken during sampling to assess the presence of asbestos fibres within the subsurface soils.

For the purpose of this assessment, a conservative criterion of "no asbestos fines or asbestos containing materials detected in soils" has been adopted as screening criteria.

5.1.5. Aesthetic criteria

Although no specific numeric aesthetic guideline values are provided, Schedule B1 of the amended NEPM (NEPC, 2013) requires the consideration of aesthetic issues (as a result of contamination) arising from soils within the site. The following assessment criteria were adopted when considering soil aesthetics:

- no persistently malodourous soils, taking into consideration the natural state of the soil at the site;
- no staining or discolouration in soils, taking into consideration the natural state of the soil; and
- no large or frequently occurring anthropogenic materials present (to the extent practicable).

5.2. Groundwater investigation levels

To assess groundwater quality, reference needs to be made to environmental and/or human health threshold levels or acceptance criteria. Groundwater investigation levels (GILs) are selected based on published criteria for beneficial use of groundwater and potential environmental impact

5.2.1. Assessment of environmental values

The amended NEPM (NEPC, 2013) describes the process involved in identifying the likely environmental values that must be considered during groundwater investigations at potentially contaminated sites. Based on this, assessment of relevant environmental values follows the steps below:

- Determine whether the aquifer beneath the site is included in the NSW Office of Water list of major aquifers of drinking water quality;
- Assess the identified uses of groundwater from the aquifer; and
- Use groundwater indicators to assess whether the aquifer is suitable for use as a drinking water source (i.e. based on measured concentrations of total dissolved solids (TDS) within the groundwater).

Based on these steps, Coffey identified the following:

- The groundwater underlying the site is not considered to be part of the NSW Office of Water list of major aquifers of drinking water quality.
- Potential receptors may include Johnston's Creek which are expected to be freshwater environments.
- A review of the NSW Natural Resources Atlas found two registered bores within a 500m radius of the site. One monitoring well (GW110247) was registered for use for domestic purposes. As this well is located 330m up hydraulic gradient from the site, and extracts groundwater from a depth of 210m below the ground surface, drinking water was not considered to be a relevant environmental value.

Based on the above, Coffey considers that potential beneficial uses of groundwater include:

- Protecting freshwater aquatic ecosystems.

5.2.2. Protection of aquatic ecosystems

Chemical concentrations in groundwater are assessed against criteria from the following guidelines:

- ANZECC &ARMCANZ (2000). *National Water Quality Management Strategy. Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*

Assuming slightly to moderately disturbed ecosystems, freshwater criteria for protection of 95% of species were applied, except where contaminants are potentially bioaccumulative in which case the trigger values for protection of 99% of species have been used.

A summary of the adopted GILs is provided in Table 5.5.

Table 5.5: Summary of Groundwater Investigation Levels

Analyte	ANZECC 2000 [1] (µg/L)
Arsenic	13[a]
Cadmium	0.2
Chromium (Total)	1[b]
Copper	1.4
Lead	3.4
Mercury	0.06
Nickel	11
Zinc	8
TRH C_6-C_{10}	20[c]
TRH C_{10}-C_{16}	50[c]
TRH C_{16}-C_{34}	100[c]
TRH C_{34}-C_{40}	100[c]
Benzene	950
Toluene	180
Ethylbenzene	80
Xylene (m & p)	75 [d]
o-Xylene	350
Benzo(a)pyrene	1

Analyte	ANZECC 2000 (1) (µg/L)
Naphthalene	16
Anthracene	1
Phenanthrene	1
Fluoranthene	1

1. Australian and New Zealand Environment and Conservation (2000) National Water Quality Management Strategy – Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Where insufficient data is available to derive a reliable trigger value, low reliability values have been adopted from Section 8.3.7 of ANZECC/ARMCANZ (2000)

(a) The guideline value for arsenic V has been adopted.

(b) GIL for Chromium (VI) adopted for Chromium (Total) as a conservative assessment measure.

(c) In the absence of a nominated guideline value, the laboratory LOR has been taken as the nominal trigger value for the presence of Benzo(a)pyrene, Anthracene, Phenanthrene and TRH compounds in groundwater as will be used as the GIL (NSW DEC, 2007).

(d) GIL for m&p Xylene is based on the m-Xylene, which is the lowest trigger value for the two Xylene isomers.

HSLs are also applied to groundwater for assessing human health risk through the dominant vapour inhalation exposure pathway. Therefore, TRH and BTEX concentrations are assessed against the groundwater HSLs for vapour intrusion from the relevant depth and soil matrix applicable to "Commercial / Industrial" land use (HSL D) from the amended NEPM (NEPC, 2013). However, it is noted that there are limitations with regard to the application of HSLs where the identified contamination has an atypical petroleum composition.

The HSLs for TRH and BTEX in groundwater from the amended NEPM (NEPC, 2013) are summarised in Table 5.6.

Based on the dominant soil texture and the measured standing water level, the HSLs for sandy soils with groundwater between 4m to <8m depth have been adopted. The selection of sandy soils for HSLs was selected as a conservative approach, and allows the addition of backfill sands during development.

Table 5.6: Summary of HSLs in Groundwater

Chemical	HSL D – Commercial / Industrial Land Use (for sandy soils) (mg/L)	HSL D – Commercial / Industrial Land Use (for sandy soils) (mg/L)
	2m to <4m	4m to <8m
Benzene	5	5
Toluene	NL	NL
Ethylbenzene	NL	NL
Xylenes	NL	NL
Naphthalene	NL	NL
C_6-C_{10}	6	6
>C_{10}-C_{16}	NL	NL

NL: non-limiting (i.e. calculated risk level is above the solubility level for this chemical).

Where the depth to groundwater is less than 2m bgs, comparison of the reported TRH and BTEX concentrations against the HSLs in the amended NEPM (NEPC, 2013) is not applicable. Therefore, where elevated concentrations of these contaminants are reported, individual assessment and consideration of the potential risk human health and the environment is required.

6. Field observations and laboratory results

The following provides a summary of the results of the fieldwork and laboratory analysis of soil and groundwater samples collected from the site in November 2016.

6.1. Site specific geology

The inferred subsurface profile encountered on-site is summarised in Table 6.1.

Table 6.1: Subsurface Profile

Unit	Depth to top of Unit (mbgs)	Typical thickness (m)	Description
PAVEMENT	0.0	0.05	Asphalt pavement was observed at the surface of the site in most of the borehole locations
FILL	0.0 - 0.05	0.3 – 2.2	Fill material surrounding the Blackburn Building typically comprised a brown to yellow clayey gravelly sand. The sand and gravels were generally well graded, and the clay was of low plasticity. Fill material in other areas of the site generally comprised a grey to brown silty clay and gravelly sand. The sand was well graded, and the clays were low to medium plasticity. Anthropogenic material including bricks, asphalt, concrete, ash, plastic, brick and wood.
RESIDUAL SOIL	0.75-2.2	2.0 - 5.0	Typically a medium to highly plastic brown to grey clay. The clay is red mottled with ironstone fragments.
BEDROCK	4.0 – 6.6	Undefined	SHALE: Grey to dark grey, extremely weathered to slightly weathered.

Borehole and test pit logs are presented in Appendix B.

Anthropogenic materials including bricks, asphalt, concrete, ash, plastic, brick and wood, were encountered in the fill in several of the test locations. No other evidence of potential subsurface contamination, such as significantly elevated PID readings, visible staining or odours, was noted. No visible signs of asbestos containing materials were observed within any of the sampling locations. No asbestos was detected in any of the soil samples collected from the site.

6.2. Field screening

Soil samples collected during fieldwork were screened in the field using a PID for the presence of ionisable VOCs.

PID readings ranged from 0.6ppm to 24.8ppm which indicate there is a low potential for the presence of significant concentrations of ionisable VOCs within the soil samples collected from the site.

PID results are provided on the borehole logs presented in Appendix B.

6.3. Site specific hydrogeology

Standing water level was recorded in the monitoring well on 22 November 2016. Water level data for the monitoring well is recorded on the field data sheets presented in Appendix D.

Site-specific hydrogeology for the site is summarised in Table 6.2.

Table 6.2: Site Specific Hydrogeology

Item	Description
Standing Water Level	The standing water level of BH6 was 6.400m below top of well casing. Survey data for the wells is not available, therefore the groundwater elevation to AHD has not been provided.
Groundwater flow direction	Based on the hydrology of the surrounding area, groundwater is expected to flow in a north to north easterly direction towards Johnstons Creek.
PSH and sheens	PSH was not encountered during groundwater monitoring and sampling. In addition, no hydrocarbon sheen was observed during purging and sampling.
Odours	No odours was noted within the groundwater well during purging and sampling.

Groundwater quality parameters measured during purging are recorded on the field data sheets presented in Appendix D.

Site-specific groundwater quality (measured post-purge) is summarised in Table 6.3.

Table 6.3: Field Groundwater Quality Parameters (post purge)

Parameter	Reading	Comment
Dissolved Oxygen (DO)	1.51mg/L	Indicative of low to typical oxygen content
Electrical Conductivity (EC)	2430µScm^{-1}	Indicative of freshwater to brackish environments
pH	6.01	Indicative of slightly acidic conditions
Temperature	22.3	-

6.4. Soil and groundwater results

Soil analytical results are summarised in Table 3. Groundwater analytical results are summarised in Table 5. Laboratory certificates and chain of custody records are presented in Appendix E.

6.5. Discussion of Results

6.5.1. Human health

The soil analytical results reported concentrations of the COPC below the adopted health investigation and screening levels with the exception of:

- Carbon tetrachloride (1.8 mg/kg) in sample HA02_0.03-0.05m,
- Chloroform (0.9 mg/kg) in sample HA02_0.03-0.05m,
- Chloromethane (5.7mg/kg) in sample HA02_0.03-0.05m, and
- Bromomethane (0.56mg/kg) in sample HA02_0.03-0.05m.

In the absence of health investigation levels published within the ASC NEPM (NEPC, 2013) for the above VOC, the LOR was adopted as a preliminary screening criteria. The VOC were reported at concentrations below the Regional Screening Levels for Industrial Land as published by the USEPA.

Volatile compounds were not detected in the groundwater sample collected from BH6.

6.5.2. Soil aesthetics and management limits

No staining or discolouration was observed within the subsurface of the site. However minor inclusions of anthropogenic materials, including bricks, asphalt, concrete, ash, plastic, brick and wood were present throughout the fill. Such materials may pose aesthetic impacts in the event that they remain exposed at surface following site development. However, given that fill will either be removed as part of the basement excavation, or remain beneath paved vehicle access road/footpath, these impacts are not considered significant.

All samples reported petroleum hydrocarbon at concentrations below the adopted Management Limits.

6.5.3. Environment

The soil analytical results reported concentrations of the COPC below the ecological investigation and screening levels for Commercial / Industrial land use, with the exception of the following:

- Benzo(a)pyrene in samples HA06_0-0.2 (2.1 mg/kg), HA07_0.1-0.2 (1.2 mg/kg), HA07_0.5-0.6 (2.5 mg/kg) and HA08_0.1-0.2 (1 mg/kg), which exceeds the ESL criteria of 1.4 mg/kg.

With the exception of HA07_0.5-0.6, these samples were collected from near surface (0-0.2m bgs). Observations made during the field investigation reveal the presence of asphalt within the fill sampled at these locations, which is assessed to be the likely source of Benzo(a)pyrene. Asphalt is generally not considered to be bioavailable to plants. In consideration that landscaping introduced as part of the proposed development would normally be established within soils imported to site, it is considered unlikely that the plants would come into contact with the fill materials in this area.

6.5.4. Groundwater results

The groundwater analytical results reported concentrations of the COPC below the adopted groundwater investigation levels with the exception of the following:

- Zinc with a concentration of 0.082 mg/L

These concentrations are considered representative of background levels, rather than a result of site activities. In addition, the nearest downgradient receptor from the site is Johnston's creek, which is approximately 1km away. The zinc concentration reported from the site would be expected to naturally attenuate before reaching Johnston's creek.

6.6. Data gaps & uncertainties

It is noted that the investigations completed to date have established sampling locations within accessible areas of the site only, with sampling locations positioned in areas to avoid below ground infrastructure such as trade waste pipes. Investigations were not conducted within the footprints of existing buildings. Whilst these investigations have not identified widespread contamination, however given that buildings cover approximately 50% of the total site area, some uncertainty remains with regard to the following potential sources of contamination, including:

- Below ground services carrying trade wastes discharged from laboratories and drains from the Dangerous Goods store. Leakages from these services over time can result in localised soil impacts along service corridors, which may not have been detected in the investigation boreholes established within the site.

- In consideration of the age of the Blackburn Building, the existing building fabric and below ground services may contain hazardous building products, including asbestos. Weathering and/or localised damage can result in the deposition of these hazardous materials in shallow fill surrounding the façade of each structure which may not have been detected by the investigation completed. .

It is considered appropriate that these areas of uncertainty regarding the presence of potentially unidentified contamination between investigations positions are considered within the conceptual site model developed for the site.

7. Conceptual site model

7.1. Overview

The NEPM (NEPC, 2013) defines a conceptual site model (CSM) as a representation of site related information regarding contamination sources, receptor and exposure pathways between those sources and receptors.

7.2. Areas of Environmental Concern / Sources of Contamination

The following AEC and potential sources of contamination have been identified:

- Chemical storage within the dangerous goods store (D15)
- Fuel storage in electrical generators
- Trade wastes within pipelines within/surrounding the Blackburn Building
- Hazardous building materials
- Fill materials

7.3. Plausible pollutant linkages

The key environmental pathways and exposure routes by which contaminants identified at the site may reach environmental and human receptors are assessed to include:

- Ingestion of soil
- Dermal contact with soil
- Inhalation of dusts, vapours and fibres
- Infiltration and leaching from unsaturated soils to shallow groundwater
- Vertical and lateral contaminant migration through the saturated zone
- Contaminant migration along preferential flow pathways (e.g. drainage systems, historic service conduits/corridors, building foundations etc.)
- Surface runoff / overland flow including storm water flowing along drainage at the site.
- Plant uptake

7.4. Receptors

7.4.1. Ecological Receptors

The following ecological receptors are identified in relation to the site:

- Landscaping within the site, and introduced as part of the proposed development
- Groundwater present beneath the site.
- Aquatic ecosystems within surface water bodies located off site; namely Johnston's Creek located approximately 1km from the site.

7.4.2. Human Receptors

The following current or future human receptors are identified:

- Current and future students and university staff occupying the site.
- Site visitors who attend site for short periods on an intermittent basis.
- Ground workers (site redevelopment and future maintenance events involving subsurface excavation works).
- Users of adjoining land, including construction workers, students and staff.
- Trespassers

7.5. Source – Pathway – Receptor Relationships

The following paragraphs discuss the plausible pollutant linkages between the contamination sources and receptors identified in relation to the site. The following symbols were used to describe nature of the pollutant linkage:

P = plausible complete pathways

p = partially complete pathway depending on site conditions/exposure scenario

n = pathway not complete

Table 8.1: Conceptual Site Model and Plausible Pollutant Linkages

Receptor	Contaminated Media	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Inhalation & Ingestion	Dermal Contact	Infiltration/ Leaching &	Lateral groundwater migration	Plant Uptake	Discussion of Potential Exposure Scenarios & Risks
Current and Future Students and University Staff On Site	Soil and groundwater	n	n	n	n	N/A	N/A	N/A	Students and university staff within the site may be exposed to contaminated fill materials via direct exposure routes (i.e. dermal contact, inhalation and ingestion pathways) where fill material is exposed at surface. Exposure via direct exposure pathways is assessed to be currently limited due to the presence of hard ground surfacing (i.e. concrete and bitumen cover etc.) across the majority of the site. Shallow fill is exposed in small landscaped areas within the site although exposure potential is considered to be low. It is understood that the basement will remove fill within the western portion of the site, further limiting the potential for future students/staff to be exposed to impacted fill post development. Volatile organic compounds were not reported at concentrations that are considered to pose a risk to current/future site users via the vapour inhalation pathway. It is understood that the basement would be constructed to a depth that would restrict groundwater ingress. Future site users may be exposed to groundwater that seeps into the basement however given the groundwater quality recorded within the site, and likely incidental nature of exposure (i.e. infrequent and short in duration), it is assessed that potential risks associated with this exposure route are not significant.
Site Visitors & Trespassers	Soil and groundwater	n	n	p	p	N/A	N/A	N/A	Site visitors and trespassers within the site have a similar exposure scenario to students and staff within the site, where the primary exposure pathways include inhalation/ingestion of soil and dermal contact of soils exposed at surface, albeit the exposure duration and frequency would be significantly lower relative to students and staff who spend a greater proportion of time on site.

Receptor	Contaminated Media	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Inhalation & Ingestion	Dermal Contact	Infiltration/ Leaching &	Lateral groundwater migration	Plant Uptake	Discussion of Potential Exposure Scenarios & Risks
									Similarly, it is considered unlikely that these receptors would be exposed to groundwater from the site at frequencies which would pose a significant health risk.
Ground Workers	Soil and groundwater	n	n	p	p	N/A	N/A	N/A	Workers carrying out excavations within the site as part of the proposed development and a future maintenance event may be exposed to contaminated fill materials via inhalation/ingestion pathways, and dermal contact with soil and groundwater.
Users of adjoining land	Soil	n	n	p	n	N/A	N/A	N/A	Users of adjoining land may be exposed to contamination within the site via the inhalation of dusts deriving from the site during site development or future maintenance events.
Landscaping	Soil	N/A	N/A	N/A	N/A	N/A	N/A	p	Benzo(a)pyrene was detected in a number of fill samples submitted for analysis at concentrations exceeding the ecological investigation level. These occurrences coincided with asphalt which was assessed to be the likely source of Benzo(a)pyrene. As asphalt is generally not considered to be bioavailable to plants., it is assessed that the risk to existing or proposed landscaping is low. Landscaping introduced as part of the proposed development would also normally be established within soils imported to site, which is likely to further reduce the risks. It is assessed that landscaping is unlikely to be in direct contact with groundwater beneath the site.

Receptor	Contaminated Media	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Inhalation & Ingestion	Dermal Contact	Infiltration/ Leaching &	Lateral groundwater migration	Plant Uptake	Discussion of Potential Exposure Scenarios & Risks
Groundwater	Soil	N/A	N/A	N/A	N/A	p	n	N/A	The groundwater sample collected from monitoring well BH6 installed within the site did not exhibit visible or olfactory evidence that significant groundwater contamination exists. Analysis of groundwater samples collected from the site did not report concentrations of COPC above the assessment criteria, with the exception of zinc, which was considered to be attributable to diffuse sources from the surrounding urban environment, rather than a specific source encountered within the site. Based on the above, it is assessed soil materials within the site do not pose significant to groundwater quality beneath the site, or aquatic ecosystems present within surface water bodies located off site.
Surface Water	Soil & groundwater	N/A	N/A	N/A	N/A	n	n	N/A	The reported concentrations of zinc in groundwater sample collected from BH6 is expected to naturally attenuate before reaching Johnston's creek.

8. Preliminary Waste Classification

Coffey followed the six step process detailed in Part 1 of the NSW EPA (2014a) guidelines for assessing the preliminary waste classification of the soil materials beneath the site.

The preliminary waste classification results are presented in Table 4 attached at the rear of the text. Laboratory reports and chain of custody documentation are provided in Appendix C.

According to the waste classification procedure:

- Step 1: The material assessed is not a 'special waste'.
- Step 2: The material assessed is not a 'liquid waste'.
- Step 3: The material assessed is not 'pre-classified'.
- Step 4: The material assessed does not appear to possess hazardous characteristics.
- Step 5: The material has been assessed by chemical analyses, as presented in Table 4.

Various soil samples exceeded the CT1 criteria for Lead, Nickel and Benzo(a)pyrene.

Subsequent TCLP test was undertaken to determine the leachability status of these chemicals. TCLP analysis was undertaken on a select number of soil samples which reported the highest concentrations of Lead, Nickel and Benzo(a)pyrene. The soil and soil leachate analysis was reported below the SCC1 and TCLP1 criteria.

- Step 6: The material is composed predominantly of soil and rock materials. NSW EPA (2014) notes that materials that are non-putrescible (for the purpose of waste classification) include soils, timber, garden trimmings, agricultural, forestry and crop materials, and natural fibrous organic and vegetative materials. Based on observations by Coffey, the material is considered to be non-putrescible.

On the above basis of the above steps, the soil materials beneath the site are preliminarily classified as ***General Solid Waste (non-putrecisble).*** Given that the assessment was conducted in situ using samples collected from an augured borehole, it is recommended that this classification is reconfirmed prior to the excavation of the proposed basement.

9. Conclusion

In conclusion, the findings of this investigation has not identified contamination within soil or groundwater at the site that exceeds the adopted health or ecological investigation levels. Therefore, based on the findings of this investigation Coffey concludes that the site is suitable for the proposed development subject to the implementation of the Unexpected Finds Protocol (ref: GEOTLCOV25283AF-L01, dated 9 January 2017) as part of the construction process. The Unexpected Finds Protocol includes procedures for identifying and managing risks and protecting human health and environment should unexpected contamination or hazardous materials (e.g. asbestos containing materials) are discovered during excavation at the site.

Given that soil or groundwater contamination has not been identified exceeding the adopted health or ecological investigation levels, a Remedial Action Plan (RAP) is not considered necessary at present.

Available soil data indicates that the fill material on the site would classify as General Solid Waste in accordance with the Waste Classification Guidelines (DECCW; 2009). Coffey recommends that the waste classification of fill materials be confirmed by observation of the appearance of fill materials during excavation for basement construction.

10. Limitations

The findings contained in this report are the result of discrete/specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site at the time the investigations were carried out. It is the nature of contaminated land investigations that the degree of variability in site conditions cannot be known completely and no sampling and analysis program can eliminate all uncertainty concerning the condition of the site. Professional judgement must be exercised in the collection and interpretation of the data. The possibility that other, as yet unidentified, contamination is present at the site cannot be precluded.

Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points. This report does not address issues relating to geotechnical or potentially hazardous building materials or services, which may be present on the site

12. References

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USEPA (May 2016) Regional Screening Levels (Available: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016)

Important information about your **Coffey** Environmental Report

Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

Tables

Field Duplicates (SOIL)
Filter: ALL

			SDG **Field ID** **Sampled Date**	17-Nov-16 BH2_2_0.5 15/11/2016	17-Nov-16 DUP1 15/11/2016	**RPD**	24-Nov-16 BH3_4_1.5m 21/11/2016	24-Nov-16 DUP2 21/11/2016	**RPD**	24-Nov-16 HA01_0.2-0.3 24/11/2016	24-Nov-16 DUP01 24/11/2016	**RPD**	24-Nov-16 BH3_4_1.5m 21/11/2016	ALSE-Sydney 28-Nov-16 TRIP 1 21/11/2016	**RPD**
Chem_Group	**ChemName**	**Units**	**EQL**												
BTEX	Benzene	mg/kg	0.1 (Primary): 0.2 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.2	0
	Ethylbenzene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0
	Toluene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0
	Xylene (m & p)	mg/kg	0.2 (Primary): 0.5 (Interlab)	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.5	0
	Xylene (o)	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.5	0
	Xylene Total	mg/kg	0.3 (Primary): 0.5 (Interlab)	<0.3	<0.3	0	<0.3	<0.3	0	<0.3	<0.3	0	<0.3	<0.5	0
	C6-C10 less BTEX (F1)	mg/kg	20 (Primary): 10 (Interlab)	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<10.0	0
Metals	Arsenic	mg/kg	2 (Primary): 5 (Interlab)	<2.0	2.2	10	**40.0**	**11.0**	**114**	<2.0	<2.0	0	**40.0**	**11.0**	**114**
	Cadmium	mg/kg	0.4 (Primary): 1 (Interlab)	<0.4	<0.4	0	<0.4	<0.4	0	<0.4	<0.4	0	<0.4	<1.0	0
	Chromium	mg/kg	5 (Primary): 2 (Interlab)	<5.0	9.5	62	20.0	19.0	5	17.0	17.0	0	20.0	30.0	40
	Copper	mg/kg	5	7.8	10.0	25	13.0	6.8	63	82.0	76.0	8	13.0	6.0	74
	Lead	mg/kg	5	20.0	26.0	26	30.0	27.0	11	17.0	27.0	45	30.0	20.0	40
	Mercury	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	Nickel	mg/kg	5 (Primary): 2 (Interlab)	<5.0	<5.0	0	6.2	<5.0	21	70.0	62.0	12	6.2	<2.0	102
	Zinc	mg/kg	5	<5.0	5.4	8	21.0	10.0	71	52.0	57.0	9	21.0	<5.0	123
OCP	4,4-DDE	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	a-BHC	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Aldrin	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	b-BHC	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Chlordane	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0				<0.1		
	d-BHC	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	DDD	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	DDT	mg/kg	0.05 (Primary): 0.2 (Interlab)	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.2	0
	Dieldrin	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Endosulfan I	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Endosulfan II	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Endosulfan sulphate	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Endrin	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Endrin aldehyde	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Endrin ketone	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	g-BHC (Lindane)	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Heptachlor	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Heptachlor epoxide	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Hexachlorobenzene	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0				<0.05	<0.05	0
	Methoxychlor	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0				<0.2	<0.2	0
	Toxaphene	mg/kg	1	<1.0	<1.0	0	<1.0	<1.0	0				<1.0		
PAH	Acenaphthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0				<0.5	<0.5	0
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Anthracene	mg/kg	0.5	<0.5	<0.5	0	0.6	<0.5	18				0.6	<0.5	18
	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	0	0.6	<0.5	18				0.6	<0.5	18
	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	2.9	141	<0.5	<0.5	0
	Benzo(a)pyrene TEQ (lower bound) *	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	3.9	155	<0.5	<0.5	0
	Benzo(a)pyrene TEQ (medium bound) *	mg/kg	0.5	0.6	0.6	0	0.7	0.6	15				0.7	0.6	15
	Benzo(a)pyrene TEQ (upper bound) *	mg/kg	0.5	1.2	1.2	0	1.2	1.2	0	1.2	4.4	114	1.2	1.2	0
	Benzo(g,h,i)perylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	1.4	95	<0.5	<0.5	0
	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0				<0.5	<0.5	0
	Chrysene	mg/kg	0.5	<0.5	<0.5	0	0.6	<0.5	18				0.6	<0.5	18
	Benzo[b+j]fluoranthene	mg/kg	0.5	<0.5	<0.5	0	0.6	<0.5	18				0.6	<0.5	18
	Dibenz(a,h)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0				<0.5	<0.5	0
	Fluoranthene	mg/kg	0.5	<0.5	<0.5	0	1.9	<0.5	117	<0.5	7.6	175	1.9	<0.5	117
	Fluorene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0				<0.5	<0.5	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0				<0.5	<0.5	0
	Naphthalene	mg/kg	0.5 (Primary): 1 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0				<0.5	<0.5	0
	Naphthalene	mg/kg	0.5 (Primary): 1 (Interlab)	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	0	2.1	<0.5	123				2.1	<0.5	123
	Pyrene	mg/kg	0.5	<0.5	<0.5	0	1.5	<0.5	100				1.5	<0.5	100
	Total PAHs	mg/kg	0.5	<0.5	<0.5	0	7.9	<0.5	176	<0.5	37.7	195	**7.9**	**<0.5**	**176**
TPH	F2-NAPHTHALENE	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0
	C6 - C9	mg/kg	20 (Primary): 10 (Interlab)	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<10.0	0
	C10 - C14	mg/kg	20 (Primary): 50 (Interlab)	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<50.0	0
	C15 - C28	mg/kg	50 (Primary): 100 (Interlab)	<50.0	<50.0	0	80.0	<50.0	46	<50.0	190.0	117	80.0	<100.0	0
	C29 - C36	mg/kg	50 (Primary): 100 (Interlab)	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	100.0	67	<50.0	<100.0	0
	C10 - C36 (Sum of total)	mg/kg	50	<50.0	<50.0	0	80.0	<50.0	46	<50.0	290.0	141	80.0	<50.0	46
	C10-C16	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0
	C16-C34	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0	<100.0	240.0	82	<100.0	<100.0	0
	C34-C40	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0	<100.0	<100.0	0	<100.0	<100.0	0
	C6 - C10	mg/kg	20 (Primary): 10 (Interlab)	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<10.0	0

*RPDs have only been considered where a concentration is greater than 0 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 200 (0-10 x EQL); 50 (10-20 x EQL); 30 (> 20 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Field Blanks (WATER)
Filter: ALL

			SDG	17-Nov-16	17-Nov-16	24-Nov-16	24-Nov-16	17-Nov-16	17-Nov-16	24-Nov-16	24-Nov-16	17-Nov-16	17-Nov-16	24-Nov-16
			Field ID	RB1 DAY1	RB1 DAY2	DAY3	RINSATE	TB	TB	TB	TB	TS	TS	TS
			Sampled_Date	14/11/2016	15/11/2016	21/11/2016	22/11/2016	14/11/2016	15/11/2016	22/11/2016	22/11/2016	14/11/2016	15/11/2016	22/11/2016
			Sample Type	Rinsate	Rinsate	Rinsate	Rinsate	Trip_B	Trip_B	Trip_B	Trip_B	Trip_S	Trip_S	Trip_S
Chem_Group	**ChemName**	**Units**	**EQL**											
BTEX	Benzene	µg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	88%	97%	107%
	Ethylbenzene	µg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	83%	93%	99%
	Toluene	µg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	89%	99%	104%
	Xylene (m & p)	µg/l	2	<2	<2	<2	<2	<2	<2	<2	<2	81%	90%	98%
	Xylene (o)	µg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	84%	95%	103%
	Xylene Total	µg/l	3	<3	<3	<3	<3	<3	<3	<3	<3	82%	92%	99%
	C6-C10 less BTEX (F1)	mg/l	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	85%	95%	90%
Metals	Arsenic	mg/l	0.001	**0.001**	<0.001	<0.001	<0.001	-	-	-	-	-	-	-
	Cadmium	mg/l	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-
	Chromium	mg/l	0.001	**0.004**	**0.001**	**0.032**	**0.002**	-	-	-	-	-	-	-
	Copper	mg/l	0.001	**0.025**	**0.003**	**0.01**	<0.001	-	-	-	-	-	-	-
	Lead	mg/l	0.001	**0.023**	**0.002**	**0.005**	<0.001	-	-	-	-	-	-	-
	Mercury	mg/l	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	-	-	-	-
	Nickel	mg/l	0.001	**0.02**	**0.002**	**0.017**	**0.001**	-	-	-	-	-	-	-
	Zinc	mg/l	0.005	**0.06**	**0.009**	**0.014**	<0.005	-	-	-	-	-	-	-
OCP	4,4-DDE	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	a-BHC	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Aldrin	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	b-BHC	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Chlordane	µg/l	1	<1	<1	-	-	-	-	-	-	-	-	-
	d-BHC	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	DDD	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	DDT	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Dieldrin	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Endosulfan I	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Endosulfan II	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Endosulfan sulphate	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Endrin	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Endrin aldehyde	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Endrin ketone	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	g-BHC (Lindane)	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Heptachlor	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Heptachlor epoxide	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Hexachlorobenzene	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Methoxychlor	µg/l	0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
	Toxaphene	mg/l	0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-
PAH	Acenaphthene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Acenaphthylene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Anthracene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Benzo(a)anthracene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Benzo(a)pyrene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Benzo(g,h,i)perylene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Benzo(k)fluoranthene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Chrysene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Benzo[b+j]fluoranthene	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-
	Dibenz(a,h)anthracene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Fluoranthene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Fluorene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Indeno(1,2,3-c,d)pyrene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Naphthalene	µg/l	1	<10	<10	<10	<10	<10	<10	<10	<10			
	Phenanthrene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Pyrene	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
	Total PAHs	µg/l	1	<1	<1	<1	<1	-	-	-	-	-	-	-
TPH	F2-NAPHTHALENE	mg/l	0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-
	C6 - C9	µg/l	20	<20	<20	<20	<20	<20	<20	<20	<20			
	C10 - C14	µg/l	50	**110**	**90**	<50	<50	-	-	-	-	-	-	-
	C15 - C28	µg/l	100	<100	<100	<100	<100	-	-	-	-	-	-	-
	C29 - C36	µg/l	100	<100	<100	<100	<100	-	-	-	-	-	-	-
	C10 - C36 (Sum of total)	µg/l	100	**110**	<100	<100	<100	-	-	-	-	-	-	-
	C10-C16	mg/l	0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-
	C16-C34	mg/l	0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
	C34-C40	mg/l	0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
	C6 - C10	mg/l	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			

					Asbestos	Amino Aliphatics, Aromatics & Anilines	BTEX							Chlorinated Hydrocarbons			Explosives			Halogenated Benzenes					Herbicides	
					Asbestos	Amino Aliphatics, Aromatics & Anilines	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 less BTEX (F1)	Benzyl chloride	Hexachlorocyclopentadiene	Hexachloroethane	2,4-Dinitrotoluene	2,6-dinitrotoluene	Nitrobenzene	1,2,3,4-tetrachlorobenzene	1,2,3,5-Tetrachlorobenzene	1,2,4,5-tetrachlorobenzene	1,3,5-Trichlorobenzene	Pentachlorobenzene	Pronamide	Trifluralin
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL						0.5	0.1	0.1	0.1	0.2	0.1	0.3	20	0.5	1	0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 0 to <1m, Sand							3					230	260													
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 1m to <2m, Sand							3						370													
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 2m to <4m, Sand							3						630													
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 4m+, Sand							3																			
NEPM 2013 HILs Commercial/industrial D Soil					No Detect																					
NEPM 2013 Mgmt Limits Commercial and industrial, Coarse Soil																										
NEPM 2013 EIL Commercial and Industrial (aged)																										
NEPM 2013 ESL Commercial and Industrial, Coarse Soil							75	165	135			180														
US EPA Region Screening Levels - Industrial Soil, May, 2016																										
US EPA Region Screening Levels - Resiential Soil, May, 2016																										
Field_ID	**Depth (m)**	**Location**	**Sampled_Date**	**Matrix**																						
BH1_1_0-0.2m	0-0.2	Blackburn Building	21/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH1_2_0.5m	0.5		21/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2_1_0-0.2	0-0.2		15/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2_2_0.5	0.5		15/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2_3	1.9		15/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH3_2_0.5m	0.5		21/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH3_3_1m	1		21/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH3_4_1.5m	1.5		21/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH4_1_0.0-0.2m	0-0.2		15/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH4_2_0.5m	0.5		15/11/2016	SOIL	Not detected	<LOR	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<0.5	<1	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH5_2_0.5m	0.5		22/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH6_0.5	0.5		14/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH6_1m	1		14/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	0.3	<0.1	0.5	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
BH6_2m	2		14/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.2-0.3	0.2-0.3	Dangerous Goods Store D15	24/11/2016	SOIL	Not detected	<LOR	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<0.5	<1	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA02_0.03-0.05	0.03-0.05		24/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA03_0.03-0.05	0.03-0.05	Proposed shared vehicular / pedestrian pathway	22/11/2016	SOIL	Not detected	<LOR	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<0.5	<1	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA03_0.4-0.5	0.4-0.5		22/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA04_0.0-0.05	0-0.05		22/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA04_0.5-0.6	0.5-0.6		22/11/2016	SOIL	Not detected	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA04_0.9-1.0	0.9-1.0		22/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA05_0.0-0.2	0-0.2		22/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA06_0.0-0.2	0-0.2		22/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA06_0.9-1.0	0.9-1.0		22/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA07_0.1-0.2	0.1-0.2		24/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA07_0.5-0.6	0.5-0.6		24/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA08_0.1-0.2	0.1-0.2		24/11/2016	SOIL	Not detected	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-
HA08_0.5-0.6	0.5-0.6		24/11/2016	SOIL	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-	-	-

					Metals								Nitroaromatics			OCP
					Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	2-Picoline	4-aminobiphenyl	Pentachloronitrobenzene	OCPs
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					2	0.4	5	5	5	0.1	5	5	0.5	0.5	0.5	0.05
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 0 to <1m, Sand																
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 1m to <2m, Sand																
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 2m to <4m, Sand																
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 4m+, Sand																
NEPM 2013 HILs Commercial/industrial D Soil					3000	900		240000	1500	730	6000	400000				
NEPM 2013 Mgmt Limits Commercial and industrial, Coarse Soil																
NEPM 2013 EIL Commercial and Industrial (aged)					160		310	400	1800		55	405				640
NEPM 2013 ESL Commercial and Industrial, Coarse Soil																
US EPA Region Screening Levels - Industrial Soil, May, 2016																
US EPA Region Screening Levels - Resiential Soil, May, 2016																
Field_ID	**Depth (m)**	**Location**	**Sampled_Date**	**Matrix**												
BH1_1_0-0.2m	0-0.2	Blackburn Building	21/11/2016	SOIL	<2	<0.4	8.5	33	29	0.1	11	47	-	-	-	<LOR
BH1_2_0.5m	0.5		21/11/2016	SOIL	<2	<0.4	17	11	29	<0.1	5.1	28	-	-	-	-
BH2_1_0-0.2	0-0.2		15/11/2016	SOIL	<2	<0.4	8.7	13	30	<0.1	<5	12	-	-	-	<LOR
BH2_2_0.5	0.5		15/11/2016	SOIL	<2	<0.4	<5	7.8	20	<0.1	<5	<5	-	-	-	<LOR
BH2_3	1.9		15/11/2016	SOIL	<2	<0.4	15	20	41	<0.1	7.8	22	-	-	-	<LOR
BH3_2_0.5m	0.5		21/11/2016	SOIL	54	<0.4	18	9.7	32	<0.1	7.9	21	-	-	-	<LOR
BH3_3_1m	1		21/11/2016	SOIL	<2	<0.4	18	14	22	<0.1	<5	11	-	-	-	-
BH3_4_1.5m	1.5		21/11/2016	SOIL	40	<0.4	20	13	30	<0.1	6.2	21	-	-	-	<LOR
BH4_1_0.0-0.2m	0-0.2		15/11/2016	SOIL	<2	<0.4	8.6	68	27	<0.1	56	63	-	-	-	<LOR
BH4_2_0.5m	0.5		15/11/2016	SOIL	3.2	<0.4	<5	11	21	<0.1	<5	5.6	<0.5	<0.5	<0.5	<LOR
BH5_2_0.5m	0.5		22/11/2016	SOIL	<2	<0.4	19	48	21	<0.1	51	37	-	-	-	-
BH6_0.5	0.5		14/11/2016	SOIL	6	<0.4	25	37	26	<0.1	20	31	-	-	-	<LOR
BH6_1m	1		14/11/2016	SOIL	4.9	<0.4	18	34	27	<0.1	24	30	-	-	-	<LOR
BH6_2m	2		14/11/2016	SOIL	11	<0.4	30	12	19	<0.1	8.7	13	-	-	-	<LOR
HA01_0.2-0.3	0.2-0.3	Dangerous Goods Store D15	24/11/2016	SOIL	<2	<0.4	17	82	17	<0.1	70	52	<0.5	<0.5	<0.5	<LOR
HA02_0.03-0.05	0.03-0.05		24/11/2016	SOIL	<2	<0.4	17	76	17	<0.1	64	55	-	-	-	-
HA03_0.03-0.05	0.03-0.05	Proposed shared vehicular / pedestrian pathway	22/11/2016	SOIL	4.5	<0.4	10	76	160	<0.1	7.6	54	<0.5	<0.5	<0.5	<LOR
HA03_0.4-0.5	0.4-0.5		22/11/2016	SOIL	7.5	<0.4	29	<5	29	<0.1	6.7	19	-	-	-	-
HA04_0.0-0.05	0-0.05		22/11/2016	SOIL	7.4	<0.4	7.8	17	110	0.2	<5	68	-	-	-	-
HA04_0.5-0.6	0.5-0.6		22/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
HA04_0.9-1.0	0.9-1.0		22/11/2016	SOIL	11	<0.4	39	<5	42	0.1	5.9	39	-	-	-	-
HA05_0.0-0.2	0-0.2		22/11/2016	SOIL	6.5	<0.4	13	18	55	<0.1	6.8	58	-	-	-	-
HA06_0.0-0.2	0-0.2		22/11/2016	SOIL	13	<0.4	15	130	510	0.3	7.3	180	-	-	-	-
HA06_0.9-1.0	0.9-1.0		22/11/2016	SOIL	6	<0.4	18	14	29	<0.1	5.4	15	-	-	-	-
HA07_0.1-0.2	0.1-0.2		24/11/2016	SOIL	6.7	0.7	25	58	180	0.3	15	400	-	-	-	-
HA07_0.5-0.6	0.5-0.6		24/11/2016	SOIL	12	<0.4	19	240	350	0.2	5.7	160	-	-	-	-
HA08_0.1-0.2	0.1-0.2		24/11/2016	SOIL	5.6	<0.4	28	43	140	0.2	18	170	-	-	-	<LOR
HA08_0.5-0.6	0.5-0.6		24/11/2016	SOIL	2.9	<0.4	8	17	64	0.1	<5	50	-	-	-	-

	PAH																									
	1-Chloronaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(a)pyrene TEQ (lower bound) *	Benzo(a)pyrene TEQ (medium bound) *	Benzo(a)pyrene TEQ (upper bound) *	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Benzo(b+j)fluoranthene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Total PAHs	2-chloronaphthalene	2-methylnaphthalene
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	MG/KG	MG/KG	MG/KG	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 0 to <1m, Sand																									
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 1m to <2m, Sand																									
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 2m to <4m, Sand																									
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 4m+, Sand																									
NEPM 2013 HILs Commercial/industrial D Soil											40												4000		
NEPM 2013 Mgmt Limits Commercial and industrial, Coarse Soil																									
NEPM 2013 EIL Commercial and Industrial (aged)								1.4												370					
NEPM 2013 ESL Commercial and Industrial, Coarse Soil																									
US EPA Region Screening Levels - Industrial Soil, May, 2016																									
US EPA Region Screening Levels - Resiential Soil, May, 2016																									
Field_ID																									
BH1_1_0-0.2m	-	-	-	<0.5	<0.5	<0.5	<0.5	1.3	1.7	2	2.3	1.7	0.9	0.5	1.7	<0.5	0.6	<0.5	1.2	<0.5	<0.5	0.7	8.6	-	-
BH1_2_0.5m	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
BH2_1_0-0.2	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
BH2_2_0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
BH2_3	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
BH3_2_0.5m	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
BH3_3_1m	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
BH3_4_1.5m	-	-	-	<0.5	<0.5	0.6	0.6	<0.5	<0.5	0.7	1.2	<0.5	<0.5	0.6	0.6	<0.5	1.9	<0.5	<0.5	<0.5	2.1	1.5	7.9	-	-
BH4_1_0.0-0.2m	-	-	-	0.5	<0.5	0.7	1.3	1.3	1.8	2	2.3	1.1	1	1	1.2	<0.5	4.1	<0.5	0.8	<0.5	3.5	3.3	19.8	-	-
BH4_2_0.5m	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH5_2_0.5m	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
BH6_0.5	-	-	-	<0.5	<0.5	0.6	2	1.8	2.4	2.7	2.9	1	1.1	1.4	2.1	<0.5	4	<0.5	0.8	<0.5	1.9	3.7	20.4	-	-
BH6_1m	-	-	-	<0.5	0.8	1.2	3.1	2.6	3.5	3.7	4	1.4	1.5	2.1	2.5	<0.5	6.6	<0.5	1.1	<0.5	4.1	5.9	32.9	-	-
BH6_2m	-	-	-	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	0.7	1.2	<0.5	<0.5	<0.5	0.5	<0.5	1.2	<0.5	<0.5	<0.5	0.8	1.1	4.2	-	-
HA01_0.2-0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA02_0.03-0.05	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
HA03_0.03-0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA03_0.4-0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
HA04_0.0-0.05	-	-	-	<0.5	<0.5	<0.5	0.9	1	1.3	1.6	1.8	0.6	0.6	0.9	1.1	<0.5	1.9	<0.5	<0.5	<0.5	1.3	1.9	10.2	-	-
HA04_0.5-0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA04_0.9-1.0	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
HA05_0.0-0.2	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.6	1.2	-	-
HA06_0.0-0.2	-	-	-	<0.5	0.5	0.7	2.2	2.1	2.9	3.2	3.4	1.3	1.7	1.9	2.9	<0.5	4.6	<0.5	1.1	<0.5	2.5	4.5	26	-	-
HA06_0.9-1.0	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
HA07_0.1-0.2	-	-	-	<0.5	0.7	0.6	1.2	1.2	1.6	1.9	2.1	0.7	1	1.1	1.4	<0.5	2.8	<0.5	0.6	<0.5	2.6	2.4	16.3	-	-
HA07_0.5-0.6	-	-	-	<0.5	0.7	0.9	2.3	2.5	3.4	3.6	3.9	1.4	1.7	2.2	3.1	<0.5	4.9	<0.5	1.2	<0.5	3.2	4.7	28.8	-	-
HA08_0.1-0.2	-	-	-	<0.5	<0.5	<0.5	0.9	1	1.4	1.7	1.9	0.9	0.8	1	1.8	<0.5	2	<0.5	0.7	<0.5	0.9	2.1	12.1	-	-
HA08_0.5-0.6	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	1.2	<0.5	<0.5	<0.5	0.8	<0.5	1	<0.5	<0.5	<0.5	0.6	1	3.4	-	-

						Phenol	Phthalates and SVOCs	TPH										VHC						VOCs				
					Acetophenone	Phenols	Phthalates and SVOCs	F2-NAPHTHALENE	C6 - C9	C10 - C14	C15 - C28	C29 - C36	C10 - C36 (Sum of total)	C10-C16	C16-C34	C34-C40	C6 - C10	1,2,3-trichlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	Hexachlorobutadiene	Carbon Tetrachloride	Chloroform	Chloromethane	Bromomethane	Other VOCs
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					0.5	0.5	0.5	50	20	20	50	50	50	50	100	100	20	0.5	0.5	0.5	0.5	0.5	0.5	0.05	0.5	0.05	0.05	-
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 0 to <1m, Sand																												
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 1m to <2m, Sand																												
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 2m to <4m, Sand																												
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 4m+, Sand																												
NEPM 2013 HILs Commercial/industrial D Soil																												
NEPM 2013 Mgmt Limits Commercial and industrial, Coarse Soil														1000	3500	10000	700											
NEPM 2013 EIL Commercial and Industrial (aged)														170	1700	3300	215											
NEPM 2013 ESL Commercial and Industrial, Coarse Soil																												
US EPA Region Screening Levels - Industrial Soil, May, 2016																								2.9	1.4	46	30	
US EPA Region Screening Levels - Resiential Soil, May, 2016																								0.65	0.32	11	6.8	
Field_ID	**Depth (m)**	**Location**	**Sampled_Date**	**Matrix**																								
BH1_1_0-0.2m	0-0.2	Blackburn Building	21/11/2016	SOIL	-	-	-	<50	<20	<20	340	450	790	<50	610	340	<20	-	-	-	-	-	-	-	-	-	-	-
BH1_2_0.5m	0.5		21/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH2_1_0-0.2	0-0.2		15/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH2_2_0.5	0.5		15/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH2_3	1.9		15/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH3_2_0.5m	0.5		21/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH3_3_1m	1		21/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH3_4_1.5m	1.5		21/11/2016	SOIL	-	-	-	<50	<20	<20	80	<50	80	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH4_1_0.0-0.2m	0-0.2		15/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH4_2_0.5m	0.5		15/11/2016	SOIL	<0.5	<LOR	<LOR	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-
BH5_2_0.5m	0.5		22/11/2016	SOIL	-	-	-	<50	<20	<20	54	<50	54	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH6_0.5	0.5		14/11/2016	SOIL	-	-	-	<50	<20	<20	73	56	129	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH6_1m	1		14/11/2016	SOIL	-	-	-	<50	<20	<20	100	55	155	<50	120	<100	<20	-	-	-	-	-	-	-	-	-	-	-
BH6_2m	2		14/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
HA01_0.2-0.3	0.2-0.3	Dangerous Goods Store D15	24/11/2016	SOIL	<0.5	<LOR	<LOR	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-
HA02_0.03-0.05	0.03-0.05		24/11/2016	SOIL	-	-	-	<50	<20	<20	61	<50	61	<50	<100	<100	<20	-	-	-	-	-	-	1.8	0.9	5.7	0.56	<LOR
HA03_0.03-0.05	0.03-0.05	Proposed shared vehicular / pedestrian pathway	22/11/2016	SOIL	<0.5	<LOR	<LOR	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-
HA03_0.4-0.5	0.4-0.5		22/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
HA04_0.0-0.05	0-0.05		22/11/2016	SOIL	-	-	-	<50	<20	<20	69	55	124	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
HA04_0.5-0.6	0.5-0.6		22/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA04_0.9-1.0	0.9-1.0		22/11/2016	SOIL	-	-	-	<50	<20	<20	77	<50	77	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
HA05_0.0-0.2	0-0.2		22/11/2016	SOIL	-	-	-	<50	<20	<20	230	170	400	<50	290	<100	<20	-	-	-	-	-	-	-	-	-	-	-
HA06_0.0-0.2	0-0.2		22/11/2016	SOIL	-	-	-	59	<20	<20	200	220	420	59	320	140	<20	-	-	-	-	-	-	-	-	-	-	-
HA06_0.9-1.0	0.9-1.0		22/11/2016	SOIL	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-
HA07_0.1-0.2	0.1-0.2		24/11/2016	SOIL	-	-	-	82	<20	<20	230	260	490	82	370	180	<20	-	-	-	-	-	-	-	-	-	-	-
HA07_0.5-0.6	0.5-0.6		24/11/2016	SOIL	-	-	-	<50	<20	<20	86	<50	86	<50	120	<100	<20	-	-	-	-	-	-	-	-	-	-	-
HA08_0.1-0.2	0.1-0.2		24/11/2016	SOIL	-	-	-	<50	<20	<20	60	99	159	<50	130	<100	<20	-	-	-	-	-	-	-	-	-	-	-
HA08_0.5-0.6	0.5-0.6		24/11/2016	SOIL	-	-	-	<50	<20	<20	<50	66	66	<50	<100	<100	<20	-	-	-	-	-	-	-	-	-	-	-

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A TETRA TECH COMPANY

			Amino Aliphatics		Amino Aromatics			Anilines		BTEX							Chlorinated Hydrocarbons			Explosives			Halogenated Benzenes				
			N-nitrosodi-n-butylamine	N-nitrosodi-n-propylamine	1-naphthylamine	2-naphthylamine	Diphenylamine	2-nitroaniline	Aniline	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 less BTEX (F1)	Benzyl chloride	Hexachlorocyclopentadiene	Hexachloroethane	2,4-Dinitrotoluene	2,6-dinitrotoluene	Nitrobenzene	1,2,3,4-tetrachlorobenzene	1,2,3,5-Tetrachlorobenzene	1,2,4,5-tetrachlorobenzene	1,3,5-Trichlorobenzene	Pentachlorobenzene
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.5	0.5	0.5	0.5	0.5	1	0.5	0.1	0.1	0.1	0.2	0.1	0.3	20	0.5	1	0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5
CT1 NSW 2014 General Solid Waste (No Leaching)										10	600	288			1000					2.6		40	10				
TCLP NSW 2014 General Soild Waste Leachable Concentration																											
CT2 NSW 2014 Restricted Solid Waste (No Leaching)										40	2400	1152			4000					10.4		160	40				
TCLP NSW 2014 Restricted Soild Waste Leachable Concentration																											
SCC1 NSW 2014 General Solid Waste (leached)										18	1080	518			1800					4.68		72	18				
SCC2 NSW 2014 Restricted Solid Waste (leached)										72	4320	2073			7200					18.7		288	72				
Field_ID	**Sampled_Date**	**Matrix**																									
BH1_1_0-0.2m	21/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH1_2_0.5m	21/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH2_1_0-0.2	15/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH2_2_0.5	15/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH2_3	15/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH2_5	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2_6	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH3_2_0.5m	21/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH3_3_1m	21/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH3_4_1.5m	21/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH4_1_0.0-0.2m	15/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH4_2_0.5m	15/11/2016	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<0.5	<1	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH4_4	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH5_2_0.5m	22/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH6_0.5	14/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH6_1m	14/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	0.3	<0.1	0.5	<20	-	-	-	-	-	-	-	-	-	-	-
BH6_2m	14/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
BH6_5	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.2-0.3	24/11/2016	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<0.5	<1	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA02_0.03-0.05	24/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA03_0.03-0.05	22/11/2016	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<0.5	<1	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA03_0.4-0.5	22/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA04_0.0-0.05	22/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA04_0.9-1.0	22/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA05_0.0-0.2	22/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA06_0.0-0.2	22/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA06_0.9-1.0	22/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA07_0.1-0.2	24/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA07_0.5-0.6	24/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA08_0.1-0.2	24/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-
HA08_0.5-0.6	24/11/2016	SOIL	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	-	-	-	-	-	-	-	-	-	-	-

			Herbicides		Metals										Nitroaromatics			OCP
			Pronamide	Trifluralin	Arsenic	Cadmium	Chromium	Copper	Lead	Lead TCLP	Mercury	Nickel	Nickel TCLP	Zinc	2-Picoline	4-aminobiphenyl	Pentachloronitrobenzene	OCPs
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.5	0.5	2	0.4	5	5	5	0.01	0.1	5	0.05	5	0.5	0.5	0.5	0.05
CT1 NSW 2014 General Solid Waste (No Leaching)					100	20	100		100		4	40						
TCLP NSW 2014 General Soild Waste Leachable Concentration										5			2					
CT2 NSW 2014 Restricted Solid Waste (No Leaching)					400	80	400		400		16	160						
TCLP NSW 2014 Restricted Soild Waste Leachable Concentration										20			8					
SCC1 NSW 2014 General Solid Waste (leached)					500	100	1900		1500		50	1050						
SCC2 NSW 2014 Restricted Solid Waste (leached)					2000	400	7600		6000		200	4200						
Field_ID	Sampled_Date	Matrix																
BH1_1_0-0.2m	21/11/2016	SOIL	-	-	<2	<0.4	8.5	33	29	-	0.1	11	-	47	-	-	-	<LOR
BH1_2_0.5m	21/11/2016	SOIL	-	-	<2	<0.4	17	11	29	-	<0.1	5.1	-	28	-	-	-	-
BH2_1_0-0.2	15/11/2016	SOIL	-	-	<2	<0.4	8.7	13	30	-	<0.1	<5	-	12	-	-	-	<LOR
BH2_2_0.5	15/11/2016	SOIL	-	-	<2	<0.4	<5	7.8	20	-	<0.1	<5	-	<5	-	-	-	<LOR
BH2_3	15/11/2016	SOIL	-	-	<2	<0.4	15	20	41	-	<0.1	7.8	-	22	-	-	-	<LOR
BH2_5	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2_6	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH3_2_0.5m	21/11/2016	SOIL	-	-	54	<0.4	18	9.7	32	-	<0.1	7.9	-	21	-	-	-	<LOR
BH3_3_1m	21/11/2016	SOIL	-	-	<2	<0.4	18	14	22	-	<0.1	<5	-	11	-	-	-	-
BH3_4_1.5m	21/11/2016	SOIL	-	-	40	<0.4	20	13	30	-	<0.1	6.2	-	21	-	-	-	<LOR
BH4_1_0.0-0.2m	15/11/2016	SOIL	-	-	<2	<0.4	8.6	68	27	-	<0.1	56	-	63	-	-	-	<LOR
BH4_2_0.5m	15/11/2016	SOIL	<0.5	<0.5	3.2	<0.4	<5	11	21	-	<0.1	<5	-	5.6	<0.5	<0.5	<0.5	<LOR
BH4_4	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH5_2_0.5m	22/11/2016	SOIL	-	-	<2	<0.4	19	48	21	-	<0.1	51	-	37	-	-	-	-
BH6_0.5	14/11/2016	SOIL	-	-	6	<0.4	25	37	26	-	<0.1	20	-	31	-	-	-	<LOR
BH6_1m	14/11/2016	SOIL	-	-	4.9	<0.4	18	34	27	-	<0.1	24	-	30	-	-	-	<LOR
BH6_2m	14/11/2016	SOIL	-	-	11	<0.4	30	12	19	-	<0.1	8.7	-	13	-	-	-	<LOR
BH6_5	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.2-0.3	24/11/2016	SOIL	<0.5	<0.5	<2	<0.4	17	82	17	-	<0.1	70	0.07	52	<0.5	<0.5	<0.5	<LOR
HA02_0.03-0.05	24/11/2016	SOIL	-	-	<2	<0.4	17	76	17	-	<0.1	64	-	55	-	-	-	-
HA03_0.03-0.05	22/11/2016	SOIL	<0.5	<0.5	4.5	<0.4	10	76	160	-	<0.1	7.6	-	54	<0.5	<0.5	<0.5	<LOR
HA03_0.4-0.5	22/11/2016	SOIL	-	-	7.5	<0.4	29	<5	29	-	<0.1	6.7	-	19	-	-	-	-
HA04_0.0-0.05	22/11/2016	SOIL	-	-	7.4	<0.4	7.8	17	110	-	0.2	<5	-	68	-	-	-	-
HA04_0.9-1.0	22/11/2016	SOIL	-	-	11	<0.4	39	<5	42	-	0.1	5.9	-	39	-	-	-	-
HA05_0.0-0.2	22/11/2016	SOIL	-	-	6.5	<0.4	13	18	55	-	<0.1	6.8	-	58	-	-	-	-
HA06_0.0-0.2	22/11/2016	SOIL	-	-	13	<0.4	15	130	510	0.23	0.3	7.3	-	180	-	-	-	-
HA06_0.9-1.0	22/11/2016	SOIL	-	-	6	<0.4	18	14	29	-	<0.1	5.4	-	15	-	-	-	-
HA07_0.1-0.2	24/11/2016	SOIL	-	-	6.7	0.7	25	58	180	-	0.3	15	-	400	-	-	-	-
HA07_0.5-0.6	24/11/2016	SOIL	-	-	12	<0.4	19	240	350	0.09	0.2	5.7	-	160	-	-	-	-
HA08_0.1-0.2	24/11/2016	SOIL	-	-	5.6	<0.4	28	43	140	-	0.2	18	-	170	-	-	-	<LOR
HA08_0.5-0.6	24/11/2016	SOIL	-	-	2.9	<0.4	8	17	64	-	0.1	<5	-	50	-	-	-	-

	PAH																						
	1-Chloronaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(a)pyrene TCLP	Benzo(a)pyrene TEQ (lower bound) *	Benzo(a)pyrene TEQ (medium bound) *	Benzo(a)pyrene TEQ (upper bound) *	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Benzo(b+j)fluoranthene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	MG/KG	MG/KG	MG/KG	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.001	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
CT1 NSW 2014 General Solid Waste (No Leaching)								0.8															
TCLP NSW 2014 General Soild Waste Leachable Concentration									0.04														
CT2 NSW 2014 Restricted Solid Waste (No Leaching)								3.2															
TCLP NSW 2014 Restricted Soild Waste Leachable Concentration									0.16														
SCC1 NSW 2014 General Solid Waste (leached)								10															
SCC2 NSW 2014 Restricted Solid Waste (leached)								23															
Field_ID																							
BH1_1_0-0.2m	-	-	-	<0.5	<0.5	<0.5	<0.5	1.3	-	1.7	2	2.3	1.7	0.9	0.5	1.7	<0.5	0.6	<0.5	1.2	<0.5	<0.5	0.7
BH1_2_0.5m	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH2_1_0-0.2	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH2_2_0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH2_3	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH2_5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2_6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH3_2_0.5m	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH3_3_1m	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH3_4_1.5m	-	-	-	<0.5	<0.5	0.6	0.6	<0.5	-	<0.5	0.7	1.2	<0.5	<0.5	0.6	0.6	<0.5	1.9	<0.5	<0.5	<0.5	2.1	1.5
BH4_1_0.0-0.2m	-	-	-	0.5	<0.5	0.7	1.3	1.3	-	1.8	2	2.3	1.1	1	1	1.2	<0.5	4.1	<0.5	0.8	<0.5	3.5	3.3
BH4_2_0.5m	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH4_4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH5_2_0.5m	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH6_0.5	-	-	-	<0.5	<0.5	0.6	2	1.8	-	2.4	2.7	2.9	1	1.1	1.4	2.1	<0.5	4	<0.5	0.8	<0.5	1.9	3.7
BH6_1m	-	-	-	<0.5	0.8	1.2	3.1	2.6	<0.001	3.5	3.7	4	1.4	1.5	2.1	2.5	<0.5	6.6	<0.5	1.1	<0.5	4.1	5.9
BH6_2m	-	-	-	<0.5	<0.5	<0.5	0.6	<0.5	-	<0.5	0.7	1.2	<0.5	<0.5	<0.5	0.5	<0.5	1.2	<0.5	<0.5	<0.5	0.8	1.1
BH6_5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.2-0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA02_0.03-0.05	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA03_0.03-0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA03_0.4-0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA04_0.0-0.05	-	-	-	<0.5	<0.5	<0.5	0.9	1	-	1.3	1.6	1.8	0.6	0.6	0.9	1.1	<0.5	1.9	<0.5	<0.5	<0.5	1.3	1.9
HA04_0.9-1.0	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA05_0.0-0.2	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.6
HA06_0.0-0.2	-	-	-	<0.5	0.5	0.7	2.2	2.1	-	2.9	3.2	3.4	1.3	1.7	1.9	2.9	<0.5	4.6	<0.5	1.1	<0.5	2.5	4.5
HA06_0.9-1.0	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
HA07_0.1-0.2	-	-	-	<0.5	0.7	0.6	1.2	1.2	-	1.6	1.9	2.1	0.7	1	1.1	1.4	<0.5	2.8	<0.5	0.6	<0.5	2.6	2.4
HA07_0.5-0.6	-	-	-	<0.5	0.7	0.9	2.3	2.5	<0.001	3.4	3.6	3.9	1.4	1.7	2.2	3.1	<0.5	4.9	<0.5	1.2	<0.5	3.2	4.7
HA08_0.1-0.2	-	-	-	<0.5	<0.5	<0.5	0.9	1	-	1.4	1.7	1.9	0.9	0.8	1	1.8	<0.5	2	<0.5	0.7	<0.5	0.9	2.1
HA08_0.5-0.6	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.7	1.2	<0.5	<0.5	<0.5	0.8	<0.5	1	<0.5	<0.5	<0.5	0.6	1

				PAH/Phenols			Phenol	Phthalates	SVOCs	TPH										VHC
			Total PAHs	2-chloronaphthalene	2-methylnaphthalene	Acetophenone	Phenols	Phthalates	SVOCs	F2-NAPHTHALENE	C6 - C9	C10 - C14	C15 - C28	C29 - C36	C10 - C36 (Sum of total)	C10-C16	C16-C34	C34-C40	C6 - C10	VHCs
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.5	0.5	0.5	0.5	0.5	0.5	0.5	50	20	20	50	50	50	50	100	100	20	0.5
CT1 NSW 2014 General Solid Waste (No Leaching)			200								650				10000					
TCLP NSW 2014 General Soild Waste Leachable Concentration																				
CT2 NSW 2014 Restricted Solid Waste (No Leaching)			800								2600				40000					
TCLP NSW 2014 Restricted Soild Waste Leachable Concentration																				
SCC1 NSW 2014 General Solid Waste (leached)			200								650				10000					
SCC2 NSW 2014 Restricted Solid Waste (leached)			800								2600				40000					
Field_ID	**Sampled_Date**	**Matrix**																		
BH1_1_0-0.2m	21/11/2016	SOIL	8.6	-	-	-	-	-	-	<50	<20	<20	340	450	790	<50	610	340	<20	-
BH1_2_0.5m	21/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
BH2_1_0-0.2	15/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
BH2_2_0.5	15/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
BH2_3	15/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
BH2_5	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2_6	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH3_2_0.5m	21/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
BH3_3_1m	21/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
BH3_4_1.5m	21/11/2016	SOIL	7.9	-	-	-	-	-	-	<50	<20	<20	80	<50	80	<50	<100	<100	<20	-
BH4_1_0.0-0.2m	15/11/2016	SOIL	19.8	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
BH4_2_0.5m	15/11/2016	SOIL	<0.5	<0.5	<0.5	<0.5	<LOR	<LOR	<LOR	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	<LOR
BH4_4	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH5_2_0.5m	22/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	54	<50	54	<50	<100	<100	<20	-
BH6_0.5	14/11/2016	SOIL	20.4	-	-	-	-	-	-	<50	<20	<20	73	56	129	<50	<100	<100	<20	-
BH6_1m	14/11/2016	SOIL	32.9	-	-	-	-	-	-	<50	<20	<20	100	55	155	<50	120	<100	<20	-
BH6_2m	14/11/2016	SOIL	4.2	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
BH6_5	15/11/2016	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA01_0.2-0.3	24/11/2016	SOIL	<0.5	<0.5	<0.5	<0.5	<LOR	<LOR	<LOR	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	<LOR
HA02_0.03-0.05	24/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	61	<50	61	<50	<100	<100	<20	-
HA03_0.03-0.05	22/11/2016	SOIL	<0.5	<0.5	<0.5	<0.5	<LOR	<LOR	<LOR	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	<LOR
HA03_0.4-0.5	22/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
HA04_0.0-0.05	22/11/2016	SOIL	10.2	-	-	-	-	-	-	<50	<20	<20	69	55	124	<50	<100	<100	<20	-
HA04_0.9-1.0	22/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	77	<50	77	<50	<100	<100	<20	-
HA05_0.0-0.2	22/11/2016	SOIL	1.2	-	-	-	-	-	-	<50	<20	<20	230	170	400	<50	290	<100	<20	-
HA06_0.0-0.2	22/11/2016	SOIL	26	-	-	-	-	-	-	59	<20	<20	200	220	420	59	320	140	<20	-
HA06_0.9-1.0	22/11/2016	SOIL	<0.5	-	-	-	-	-	-	<50	<20	<20	<50	<50	<50	<50	<100	<100	<20	-
HA07_0.1-0.2	24/11/2016	SOIL	16.3	-	-	-	-	-	-	82	<20	<20	230	260	490	82	370	180	<20	-
HA07_0.5-0.6	24/11/2016	SOIL	28.8	-	-	-	-	-	-	<50	<20	<20	86	<50	86	<50	120	<100	<20	-
HA08_0.1-0.2	24/11/2016	SOIL	12.1	-	-	-	-	-	-	<50	<20	<20	60	99	159	<50	130	<100	<20	-
HA08_0.5-0.6	24/11/2016	SOIL	3.4	-	-	-	-	-	-	<50	<20	<20	<50	66	66	<50	<100	<100	<20	-

Table 5: Groundwater Analytical Results
Blackburn Building Site

BTEX

	Sampled	Matrix	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 less BTEX (F1)
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
EQL			1	1	1	2	1	3	0.02
ANZECC 2000 Freshwater 95%			950	80	180	75	350		
NEPM 2013 Commercial/industrial GW HSL D Vapour Intrusion, 2m to <4m, Sand			5000						6
NEPM 2013 Commercial/industrial GW HSL D Vapour Intrusion, 4m to <8m, Sand			5000						6
Field_ID	**Sampled**	**Matrix**							
MW01	22/11/2016	WATER	<1	<1	<1	<2	<1	<3	<0.02

Metals

	Arsenic (Filtered)	Cadmium (Filtered)	Chromium (Filtered)	Copper (Filtered)	Lead (Filtered)	Mercury (Filtered)	Nickel (Filtered)	Zinc (Filtered)
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL	0.001	0.0002	0.001	0.001	0.001	0.0001	0.001	0.005
ANZECC 2000 Freshwater 95%	0.013	0.0002	0.001	0.0014	0.0034	0.0006	0.011	0.008
NEPM 2013 Commercial/industrial GW HSL D Vapour Intrusion, 2m to <4m, Sand								
NEPM 2013 Commercial/industrial GW HSL D Vapour Intrusion, 4m to <8m, Sand								
MW01	0.003	<0.0002	<0.001	<0.001	<0.001	<0.0001	0.009	0.082

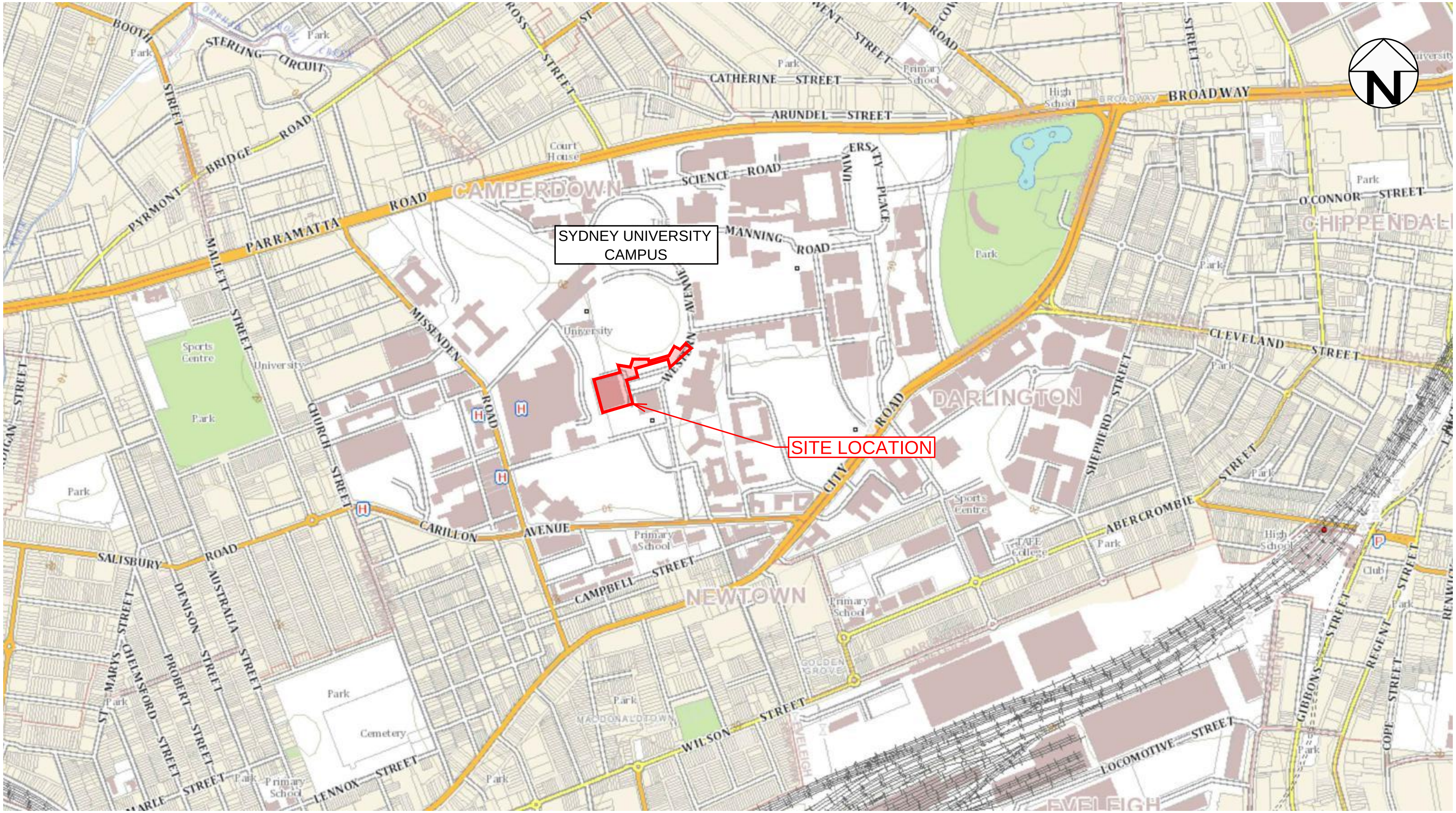
PAH

	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Benzo[b+j]fluoranthene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Total PAHs
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	1	1	1	1	1	1	1	1	0.001	1	1	1	1	1	1	1	1
ANZECC 2000 Freshwater 95%			1		1									16	1		
NEPM 2013 Commercial/industrial GW HSL D Vapour Intrusion, 2m to <4m, Sand																	
NEPM 2013 Commercial/industrial GW HSL D Vapour Intrusion, 4m to <8m, Sand																	
MW01	<1	<1	<1	<1	<1	<1	<1	<1	<0.001	<1	<1	<1	<1	<1	<1	<1	<1

TPH

	F2-NAPHTHALENE	C6 - C9	C10 - C14	C15 - C28	C29 - C36	C10 - C36 (Sum of total)	C10-C16	C16-C34	C34-C40	C6 - C10
	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
EQL	0.05	20	50	100	100	100	0.05	0.1	0.1	0.02
ANZECC 2000 Freshwater 95%							0.05	0.1	0.1	0.02
NEPM 2013 Commercial/industrial GW HSL D Vapour Intrusion, 2m to <4m, Sand										
NEPM 2013 Commercial/industrial GW HSL D Vapour Intrusion, 4m to <8m, Sand										
MW01	<0.05	<20	<50	<100	<100	<100	<0.05	<0.1	<0.1	<0.02

Figures



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client:	LEND LEASE BUILDING PTY LTD
project:	USYD HEALTH PRECINCT UNIVERSITY OF SYDNEY - CAMPERDOWN CAMPUS CAMPERDOWN, NSW
title:	SITE LOCATION
project no:	GEOTLCOV25283AF-AE
figure no:	FIGURE 1
rev:	A

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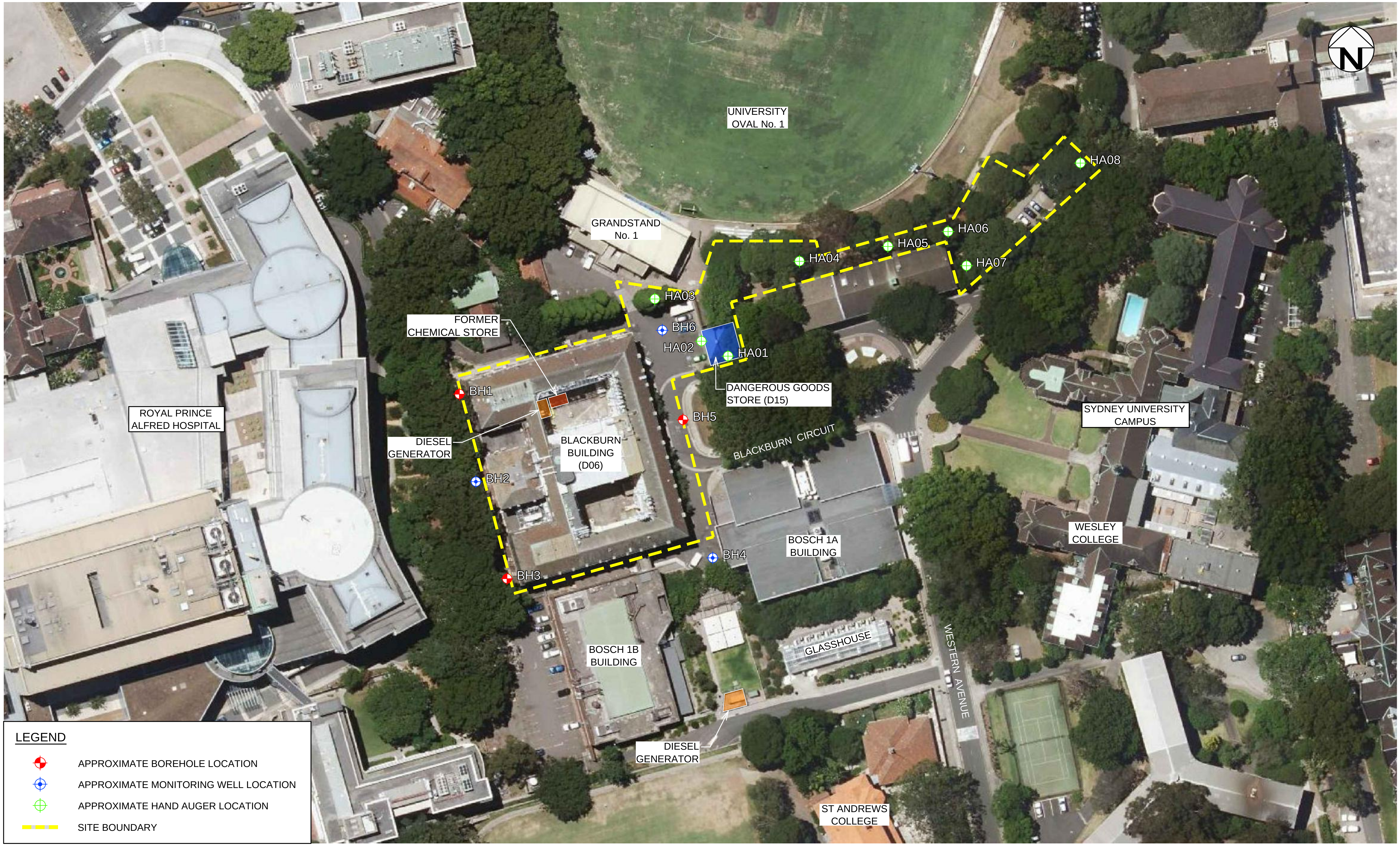

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project: USYD HEALTH PRECINCT
UNIVERSITY OF SYDNEY - CAMPERDOWN CAMPUS
CAMPERDOWN, NSW

title: SITE LAYOUT AND INVESTIGATION PLAN

project no: GEOTLCOV25283AF-AE figure no: FIGURE 2 rev: A

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Appendix A - Douglas Partners (2015) Preliminary Contamination Assessment

Douglas Partners
Geotechnics | Environment | Groundwater

Report on
Geotechnical and Contamination Desktop Study

Proposed Health Precinct Development
Western Avenue, University of Sydney

Prepared for
Campus Infrastructure Services

Project 84711.00
March 2015

Integrated Practical Solutions

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

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

	Signature	Date
Author		3 March 2015
Reviewer	BMcPherson	3 March 2015

NCS INTERNATIONAL
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Report on Geotechnical and Contamination Desktop Study
Proposed Health Precinct Development
Western Avenue, University of Sydney

1. Introduction

This report by Douglas Partners Pty Ltd (DP) presents the results of a geotechnical and contamination desktop study of available information for the proposed health precinct development on Western Avenue, University of Sydney. The desktop study was commissioned by Ms Liz Partridge of Campus Infrastructure Services and was undertaken in accordance with DP's fee proposal SYD141561 dated 21 January 2015.

The proposed development site currently contains the Blackburn, Bosch 1A, Bosch 1B, Bosch Glasshouse, Victor Coppleson and Queen Elizabeth II buildings. The development will be staged over two or more periods and may include the construction of buildings up to eight or nine storeys high overlying up to three or four basement levels.

The objectives of the desktop study were to identify potential geotechnical and contamination issues related to the proposed development, and provide preliminary comments on these issues as well as advice regarding further investigation, which will be required for detailed design and planning purposes.

The desktop study comprised a review of results from previous investigations carried out on nearby sites by DP and by other consultants, as well as a site walkover inspection and review of selected site history information. Details of previous investigations, together with observations made during the site inspection, preliminary comments on geotechnical and contamination issues and recommendations for further investigation are provided herein.

2. Site Description and Current Land Use

The site is irregular in shape and covers an area of approximately 1.5 hectares (refer to Drawing No. 1 in Appendix B). It is bounded by University Oval No. 1 and the Royal Prince Alfred Hospital chapel to the north, residential colleges to the south and east, and Royal Prince Alfred Hospital to the west. Ground surface levels at the site generally fall to the north west at an average overall slope of about four degrees.

The existing buildings on site at the time of the inspection comprised:

- Blackburn (D06) – A five-storey brick building dating from circa 1933 (with a number of subsequent additions and renovations) used for medical research, with a one level partial basement containing a number of small classrooms. Set on a rectangular footprint, it has two large central courtyards surrounded by a mixture of laboratories, a cryogenics laboratory, freezers (-80 degrees), offices and also a pathology museum.

- Bosch 1A (D04) – A two-storey brick building, dating from circa 1965, containing four lecture theatres.
- Bosch 1B (D05) – A three-storey brick building dating from circa 1968, used for medical research, with a one level partial basement used as a plant room. A newer extension on the ground floor is clad in brick tiles.
- Bosch Glasshouse (D16) – A one-storey steel structure dating from circa 2009 containing a number of separate rooms for growing various plant species.
- Queen Elizabeth II (QEII) (D02) – A two-storey brick building dating from circa 1958 with one partial basement level, located immediately adjacent to the Victor Coppleson building. The above ground floors are used for office space and the basement for storage space.
- Victor Coppleson (D02) – A two-storey brick building (dating from circa 1977) used for office space, with one partial basement level used partly for offices and partly for chemical storage. Built as the Research Institute for Mothers and Children.
- Dangerous goods store (D15) – A one-storey brick building with a pitched steel roof located about 20 m west of the Victor Coppleson building (refer to Section 6.3 for further information).

The buildings on site are separated mostly by asphalt pavements, notably Blackburn Circuit which loops around the northern half of the site, and Cadigal Lane along the southern boundary of the site. There are also grassed areas with trees, as well as a courtyard with undercover seating to the east of the Bosch 1B building.

3. Regional Geology and Soils

3.1 Regional Geology

Reference to the Sydney 1:100,000 Geology Sheet indicates that the site is underlain by Ashfield Shale, typically comprising black to dark grey shale and laminite. An extract from the geology map is shown in Figure 1.

Figure 1: Extract from Sydney 1:100,000 Geology Sheet

3.2 Regional Soil Landscapes

Reference to the Sydney 1:100,000 Soils Landscape Sheet indicates that bedrock at the site is overlain by residual soils of the Blacktown group. These typically comprise shallow to moderately deep, moderately reactive clay soils. An extract from the soils landscape sheet is shown in Figure 2.

Figure 2: Extract from Sydney 1:100,000 Soils Landscape Sheet

3.3 Acid Sulphate Soils

Data supplied by the NSW Department of Environment and Climate Change based on published 1:25,000 Acid Sulfate Soil Risk Mapping, 1994 - 1998, identifies the site as being located in an area with no known occurrence of acid sulphate soils (ASS).

Based on this mapping, the site elevation and materials encountered in nearby boreholes (refer to Section 5) the risk of ASS occurring at the site is considered to be low. No further assessment is considered necessary.

4. Site Inspection

A site inspection was conducted on 10 February 2015 by a geotechnical engineer and environmental scientist, accompanied by University of Sydney personnel, with a follow up inspection of the Bosch 1B plant room undertaken by the environmental scientist on 19 February 2015. The inspection included a walkover of external and some internal areas of the site, noting features such land usage, building usage, variations in site levels, chemicals stored on site and other aspects of potential relevance to the subsurface conditions on site. Observations made during the site inspection are detailed below.

4.1 General Observations

Appendix C provides various site photographs. The main general observations made on site were as follows:

- The existing ground surface falls to the north west at approximately four degrees, and there are numerous block retaining walls and vegetated batter slopes across the site to accommodate changes in levels around the existing buildings.
- Ground surface levels are lowest along an approximate north-south alignment through the Blackburn and Bosch 1B Buildings, rising again to the western and northern boundaries of the site.
- There is a disused underground tunnel which runs from the Blackburn building, crossing the northern boundary of the site and terminating underneath the neighbouring Royal Prince Alfred Hospital chapel (photograph of entrance provided in Appendix C).

4.2 Geotechnical Observations

The main geotechnical observations made on site were as follows:

- All of the existing structures on site appear to be in generally good condition given their apparent age. There were, however, some cracks observed on the exterior brick walls of the Royal Prince Alfred Hospital chapel beyond the northern boundary of the site, suggesting possible differential settlement of footings underneath the building.
- The asphalt pavement of Cadigal Lane appears to be asphaltic concrete and mostly in good condition. However, Blackburn Circuit is a spray seal asphalt which has been patched up in

numerous locations, suggestive of previous damage/wear to the pavement, and there are large numbers of interconnecting cracks (known as 'crocodile cracking') present in localised areas of the pavement.

- There is a large gap between the brick work framing the front stairs outside the Victor Coppleson building and the surrounding concrete pavement. This appears to be due to settlement of the concrete pavement, which may be the result of a poorly compacted subgrade under the pavement and/or movement of the partial basement wall of the Victor Coppleson building.

4.3 Contamination Observations

The following observations are considered pertinent to the potential for contamination at the site (also refer to photographs in Appendix C):

- Various Dangerous Goods stores were observed during the site inspection, these are described in more detail in Section 6.3. A floor drainage grate was observed in the D15 dangerous goods store. No staining was observed on the concrete floor slab.
- Above ground backup generators of the type generally containing an internal diesel tank, one observed in the Blackburn Building northern courtyard and one observed at the south of the grassed area in between the Bosch 1B and the Bosch Glasshouse buildings.
- A pipe observed in the Blackburn Building appears to have a black colour from the liquid/ sediments in the liquid being transported. This is considered to be a possible waste pipe.
- The northern courtyard of the Blackburn Building was observed to have a natural gas store and pipeline, to have previously contained a gas cylinder store, and to have numerous pipes visible leading from various levels to above the roof. It is understood that as well as "normal" service pipes (water etc) the observed pipes included steam pipes from various autoclaves in the building.
- The northern courtyard of the Blackburn Building was also observed to contain two sheds which may previously have been used for chemical storage, with signage "Flammable Liquid". One shed was not accessible, but is understood not to currently contain chemicals. The other shed was observed to contain a few containers, with labels "ethanol 100%" (one 20 L container) and "emulsifier-safe" (two 5 L containers).
- The southern courtyard was not accessible, with an inspection through a window indicating the courtyard was generally empty apart from one shed. It is understood that this courtyard is not currently safe to enter and is not used.
- The basement of the QEII Building also appeared to have an area which was previously used for a workshop including a drill and lathe.
- A substation is present in the Bosch 1A Building. The substation was not entered but is understood to be a main substation for this area of campus.
- A plant room is present in the basement level of the Bosch 1B Building. The plant room contained air compressors, boilers, water chillers, motors, air plenums and switchboards. The plant appeared to be run on electricity or mains natural gas. Two small (15 L) containers of "Hydro 4845", a water corrosion and scale preventative, were observed on the concrete floor.

5. Review of Previous Reports

5.1 Reviewed Reports

DP has previously undertaken a large number of investigations within and around the site area, and has reviewed the results of these investigations as well as investigations carried out by other consultants.

Investigations carried out by DP were reported as follows:

- *Report on Geotechnical Investigation, Centenary Institute of Cancer Medicine and Cell Biology – University of Sydney*. DP report 8158 dated November 1983. (DP, 1983)
- *Report on Geotechnical Investigation, Centenary Institute of Cancer and Cell Biology – Royal Prince Alfred Hospital, Camperdown*. DP report 12093 dated April 1989. (DP, 1989)
- *Report on Groundwater Study, Physics Building – Camperdown Campus, University of Sydney*. DP report 24150 dated February 1997. (DP, 1997)
- *Report on Geotechnical Investigation, Proposed Redevelopment, Eastern Precinct – Royal Prince Alfred Hospital, Missenden Road, Camperdown*. DP report 27456 dated October 1998. (DP, 1998)
- *Report on Geotechnical Investigation, Proposed Echtec Building – Sydney University, Camperdown*. DP report 35807A dated July 2003. (DP, 2003a)
- *Report on Preliminary Contamination Assessment, Cadigal Lane, University of Sydney, Camperdown*. DP report 35807B dated August 2003. (DP, 2003b)
- *Report on Preliminary Geotechnical Investigation, Arc Development – University of Sydney*. DP report 44914A dated August 2007. (DP, 2007)
- *Report on Geotechnical Investigation, Proposed Arc Development – University of Sydney.* DP report 44914.02 dated April 2010. (DP, 2010)
- *Investigation Summary Report, Sewer Pipe Relining – Lambie Dew Drive, Camperdown.* DP report 72205 dated February 2011. (DP, 2011)

Investigations carried out by other consultants were reported as follows:

- *Geotechnical Investigation, Proposed Greenhouse – University of Sydney, Western Avenue, Camperdown Campus*. GeoEnviro Consultancy Pty Ltd, September 2008. (GEC, 2008)
- *Geotechnical Investigation for Proposed AIN Building – University of Sydney, Camperdown*. Jeffery and Katauskas Pty Ltd report 24782S1rpt dated April 2011. (J&K, 2011a)
- *Stage 1 and Preliminary Stage 2 Environmental Site Assessment for Proposed AIN Building – University of Sydney, Camperdown*. Environmental Investigation Services report E24782Krpt dated May 2011. (EIS, 2011)
- *Geotechnical Investigation for Proposed St Paul's College Buildings – St Paul's College, University of Sydney, Camperdown.* Jeffery and Katauskas Pty Ltd report 24782S2rpt dated May 2011. (J&K, 2011b)

- *Addendum Letter – Additional Waste Classification Assessment, Proposed AIN Building, University of Sydney, Camperdown*. Environmental Investigation Services report E24782Klet dated January 2013. (EIS, 2013a)
- *Preliminary Screening for Asbestos in Soil, Proposed AIN Building, University of Sydney, Camperdown*. Environmental Investigation Services report E24782Klet5 dated July 2013. (EIS, 2013b)
- *Geotechnical Investigation for Proposed Stage 1 Masterplan Development Application at St Andrew's College, CNR Carillon Ave and Missenden Rd, Camperdown NSW*. Jeffery and Katauskas Pty Ltd report 26578PrptRev2 dated October 2013. (J&K, 2013)
- *Stage 1 Environmental Site Assessment for Proposed University Development at St Andrew's College, Sydney University, Camperdown*. Environmental Investigation Services report E26568KrptRev1 dated November 2013. (EIS, 2013c)

5.2 Subsurface Conditions

The geotechnical investigations listed in Section 5.1 comprised a total of 66 boreholes which were drilled to between 1.0 m and 20.5 m depth, as well as nine cone penetration tests (CPTs) to between 4.7 m and 10.3 m depth, and three test pits to between 1.9 m and 2.6 m depth. The principal strata encountered within and close to the site area may be summarised as follows:

- FILLING – Brown and grey, sandy clay filling to a depth of approximately 0.5 m, although deeper along the western boundary of the site (up to 2 - 3 m deep). Filling in some areas included inclusions of gravel, building materials, coal, ash and slag; overlying,
- CLAY/SHALY CLAY – Very stiff, light grey and brown clay and shaly clay to approximately 3 - 4 m depth; overlying,
- SHALE – Extremely low to very low strength, light grey and brown shale to approximately 6 - 7 m depth; overlying;
- SHALE – Medium strength, sightly weathered, fractured to slightly fractured, dark grey shale.

Groundwater was observed at depths of approximately 6 - 8 m within the boreholes during auger drilling.

5.3 Contamination Results

No contamination of concern was identified in the previous report from the site with contamination testing (DP, 2003b). It is noted that filling has been encountered on the site in the previous reports, including filling containing traces of ash and slag, which can be associated with elevated concentrations of metals and PAH.

The reports from surrounding areas generally reported results below the adopted human health investigation levels current at that time, although asbestos cement fragments have been detected in some locations. The previous results do indicate the potential presence of metals and PAH above current ecological investigation levels/ ecological screening levels in areas surrounding the site.

6. Review of Historical and Site Use Information

6.1 Records under the CLM and POEO Acts

The EPA publishes records under the Contaminated Land Management Act 1997 (CLM Act) and the Protection of the Environment Operations Act 1997 (POEO Act). These records were searched for the site on 17 February 2015.

The EPA records of contaminated sites are published under Section 58 of the CLM Act on a public database accessed via the Internet. The notices relate to investigation and/or remediation of site contamination considered to pose a significant risk of harm under the definition in the CLM Act. More specifically, the Notices cover the following:

- actions taken by the EPA under Section 15, 17, 19, 21, 23, 26 or 28 of the CLM Act
- actions taken by the EPA under Section 35 or 36 of the Environmentally Hazardous Chemicals Act 1985
- site audit statements provided to the EPA under Section 52 of the CLM Act on sites subject to an in-force declaration or order

The EPA record of Notices for Contaminated Land does not provide a record of ALL contaminated land in NSW.

The search of the public database revealed that the site is not listed. There are also no listed sites within the University or the RPA Hospital.

Notices issued under the CLM Act are also recorded on the Section 149 Planning Certificate(s) pertaining to the site.

A search was also undertaken of sites reported to the EPA under Section 60 of the CLM Act (duty to report contaminated sites). The contamination at sites on this list may not warrant regulatory intervention. Neither the subject site nor any other areas of the university or the RPA Hospital were listed.

The EPA also issues environmental protection licenses to the owners or operators of various industrial premises under the POEO Act. License conditions relate to pollution prevention and monitoring, and cleaner production through recycling and reuse and the implementation of best practice.

The EPA has made available a public register of licences under Section 308 of the POEO Act. The register contains:

- environment protection licences
- applications for new licences and to transfer or vary existing licences
- environment protection and noise control notices
- convictions in prosecutions under the POEO Act
- the results of civil proceedings

- license review information
- exemptions from the provisions of the POEO Act or Regulations
- approvals granted under clause 9 of the POEO (Control of Burning) Regulation
- approvals granted under clause 7A of the POEO (Clean Air) Regulation

A search of the public register on did not locate any listing for the subject site. The Sydney South West Area Health Service has a license for the RPA Hospital at Missenden Road. The license is for the Hazardous, Industrial or Group A Waste Generation or Storage, comprising:

(a) Clinical and related wastes (R100);

(b) Grease trap waste (K110); and

(c) Waste from the production, formulation and use of photographic chemical and processing materials (T120).

6.2 Previous Reports

DP (2003b) identified that the "George H Bosch" Building (the area Bosch 1A and 1B) forms part of the original grant to the University of Sydney dated 1855. The land was dedicated for university purposes in government gazettes dated 1863 and 1865. A title plan dated 1880 shows the site and land to the north of the site as part of the original grant, with the RPA Hospital to the west, Presbyterian College to the south, Training College to the east and Womens College to the south east. A label on land to the south west of the University campus states "Camperdown Estate".

6.3 Dangerous Goods Stores and Chemical Use

The below information on Dangerous Goods Stores at the site has been based on site observations and information provided by Ms Liz Partridge of Campus Infrastructure Services sourced from the university records. Relevant manifests and emails are included in Appendix D.

In addition to the below formal storages it is understood that each laboratory group keeps day to day quantities of chemicals within their lab spaces. Small quantities of chemical as required for cleaning and maintenance are also expected to be used at the site.

The following Dangerous Goods Stores have been identified:

- Building D15. The store was labelled "Depot D15 Flammable Goods Store" an internal sign also stated "Please Store Radioactive Waste (activity <100bq/gm) Below". The store contained various chemicals in small (generally less than 20 L to30 L) containers on shelves.

  The provided manifesto for the store states an average storage of 2,200 L and a maximum storage of 6,000 L, with stored products including ethanol, acetone, hexanes, methanol, xylenes, diethyl ether and formaldehyde.

Further information provided by USyd states that *for discipline of Pharmacology, most of the dangerous goods currently being stored in D15 are Flammable liquid (Class 3) and small amount of Toxic chemicals (Class 6.1) + Corrosive materials (Class 8).*

Further information provided by USyd states that *the radioactive waste stored in D15 (to be picked up by contractor) are solely tritium 3H and 32P waste*.

- A store on Level 2 of the Blackburn Building comprising a Cryogenics specimen storage tank, typical storage 2,500 L and a maximum storage of 3,000 L.
- A store comprising two cages to the north of the Blackburn Building labelled "Non-Flammable Non-Toxic Gas 2) used to store gas cylinders (including nitrogen, carbon dioxide and carbogen).
- A store in the semi-basement level of the QEII building. The store comprised a single room containing chemicals in small (generally less than 20 to 30 L containers on shelves. Chemicals included benzene, xylene, absolute ethanol AR, mortein plus (appeared to be an old container, contained pyrethrum and piperonyl butoxide, petroleum distillate), hydrochloric acid, acetone and turpentine.

There was no dangerous goods storage on the manifest for Bosch (D04).

6.4 Aerial and Historical Photographs

Photographs were obtained from the Client, the NSW Government Land and Property Information, Google Earth and Nearmap. Extracts of relevant photographs are provided in Appendix E.

1865: this photograph shows the area of the site with Orphan Creek and St Johns College in the background. The area to the east of Orphans Creek was being used for grazing. A number of small buildings (houses?) are present to the rear (west) of St Johns College. The land to the east of Orphans Creek appears to generally have been sloping gently towards the Creek, whilst land to its west appears to have had steeper gradient slopes towards the Creek.

1930: this aerial photograph shows University Oval No. 1, the RPA Hospital, Western Avenue, and buildings consistent with colleges to the east of Western Avenue. A creek was present flowing towards the site from the south, and appears to have entered the site or the area immediately west of the site near the location of Bosch 1B. The alignment of the creek at or to the west of the site cannot be distinguished, however, there are two dark lines, possibly rows of trees, one near the current low area of the site through Bosch 1B and the Blackburn Building, and one between the current alignment of the RPA Hospital and Blackburn Building (although this could be a shadow). One of these dark lines could be the creek alignment. A small building was present in the general area of current Building D15, and a group of buildings was present mostly to the west of the Bosch 1B Building, but possibly overlapping with the current alignment of the Bosch 1B Building. The rest of the site appears to have been divided into five rectangular areas, possibly for recreational use.

C 1932: this photograph general agrees with the 1930 aerial photograph, and also shows the newly constructed Blackburn Building. The Bruce Williams Pavilion can be seen adjacent to University Oval No. 1.

1943: this photograph shows the presence of the Blackburn Building and the cluster of buildings near the west of the Bosch 1b Building from the 1930 photograph. The remainder of the site appears to have been car parks, roads and landscaping. Zig zag lines can be seen in the south eastern corner of the site (Area of and to the west of Bosch 1A, and Bosch Glasshouse). These lines are consistent with trenches used for training for World War 2, and were also present in other parts of the university campus in this photograph.

1970: the Blackburn, QEII, Bosch 1A and 1B Buildings were present. The central portion of the Blackburn Building had been extended compared to the 1943 photograph. The areas to the north, south and south west of Bosch 1A appear to have been grassed. A small structure/ retaining wall may have been present in the west of the grassed area to the north of Bosch 1A. The surrounding building layouts are all consistent with the university, hospital and associated uses.

1994: this photograph is not clear enough to see the Victor Coppleson or D15 buildings (if present), the Bosch Glasshouse is not present. Other than these areas the site layout is generally consistent with the 1970 photograph.

2001: this photograph shows the Victor Coppleson and the previously constructed buildings. The west of the Blackburn Building had been extended compared to the 1970 photograph. The location of the D15 Building is obscured by tree cover. Other than these areas the site layout is generally consistent with the 1970 photograph.

2005, 2006: these photographs are generally consistent with the 2001 photograph.

2007: the site layout was generally consistent with the 2001 photograph, although Building D15 can now be clearly seen.

2009, 2012, 2014: the site layout was generally consistent with current site layout. The Bosch Glasshouse had been constructed and the substation, emergency generator and the covered seating area to the east of Bosch 1B were present.

6.5 Personal Communication

Ms Liz Partridge of Campus Infrastructure Services was present during DP's site walkover, and, in conjunction with building managers, provided background information on the site, including:

- The site was likely used as a farm prior to acquisition/development by the university.
- The medical research facilities at the site have close links to the Royal Prince Alfred Hospital located immediately to the west.
- The former presence of a north-flowing creek (Orphans Creek) immediately to the west of the site.
- The approximate ages of buildings, as provided in Section 2.
- Current and former buildings uses. A brief description of current building uses is provided in Section 2. Other information of note is as follows:
  - Blackburn has been used for medical research and associated purposes since its construction.

- Bosch 1A has always been used as lecture theatres.
- QEII previously had “dry laboratories” at grade, with “wet laboratories” on upper floors.

Ms Sandra Chapman of Human Resources provided the following information on Dangerous Goods at the site:

- D15 – A mixed waste store which has a maximum storage of 500 L. This store is used for low level radiation waste (<100Bq/g) awaiting disposal. Also in D15 is a flammable store with a typical storage of 2,200 L and a maximum storage of 6,000 L.
- D04 Bosch – There are no recorded minor Dangerous Goods stores on the manifest.
- D06 Blackburn – Level 2, there is a Cryogenic specimen storage tank, with a typical storage of 2,500 L and a maximum storage of 3,000 L.

Mr David Wiltshire of Campus Infrastructure Services provided information on a flooding of the Bosch 1B basement plant room (and other areas of the site) following blockage of a stormwater pipe three or four years before preparation of this report. Mr Wiltshire stated that the water broke the asbestos fire door of the plant room, resulting in asbestos being distributed through the plant room. The plant room was subsequently remediated and cleared for asbestos, and various plant which had been damaged by the water was also replaced at this time.

6.6 Other Sources

The following additional information was obtained:

- The Bosch 1A and 1B Buildings were completed in 1965 and 1968 respectively and used as lecture theatres (Bosch 1A) and a library and animal houses (Bosch 1B)[1]
- On the western side of the University grounds were the upper reaches of Orphan School Creek which had tributaries starting near St Andrews and St Johns Colleges, which flowed north then west into Johnstons Creek.[2]
- The first use of the land was cultivation and the area of the university is marked on maps as “Grose Farm” until around the mid 1800’s. Grose Farm was used for grazing cattle around the time it was acquired by the university.[3]

6.7 Surrounding Land Uses

Identified current and previous land uses/ buildings are summarised in Table 1. In general, the area to the west of the site was developed as RPA Hospital circa 1880, with the remaining land surrounding the site being used as part of the university campus or associated colleges since at least this time.

The identified land uses are generally considered to have a low potential to impact the site, however some storage of fuel or chemicals may have occurred.

[1] http://sydney.edu.au/medicine/about-the-school/history.php
[2] http://sydney.edu.au/documents/about/heritage/gcp_chapter2.pdf
[3] http://sydney.edu.au/documents/about/heritage/gcp_chapter2.pdf

Table 1: Identified Current and Previous Land Uses/ Buildings

Area	Current Use	Known Historic Uses
North	Chapel Unknown Building University Oval No. 1 Bruce Williams Pavilion	Possible mortuary (in current Chapel)
North East	Western Avenue	-
East	Wesley College	Training College (circa 1880)
South East	The Womans College	The Womans College (since at least circa 1880)
South	St Andrew's College, including: Harper House Gillespie Hall St Andrew's Oval Western Avenue Carpark (under oval)	Presbyterian College (circa 1880)
South West	Royal Prince Alfred (RPA) Hospital (Gloucester House)	RPA Hospital (opened 1882)
West	Royal Prince Alfred (RPA) Hospital	RPA Hospital (opened 1882)
North West	RPA Hospital	RPA Hospital (opened 1882)

7. Proposed Development

It is understood that redevelopment of the site will be carried out over two or more stages. The number of stages, location and footprint areas of proposed buildings and the number of storeys for each of the proposed buildings are not known at this point. However, it is understood that proposed buildings may be up to eight or nine storeys high overlying up to three or four basement levels.

8. Geotechnical Comments

In the absence of any detailed plans, the comments given below are of a general nature only to provide some geotechnical guidance for future development. When details of the proposed development are known, the geotechnical advice should be reviewed.

8.1 Site Preparation

The following site preparation measures are recommended in areas where no basement excavation and/or filling to finished site levels is proposed:

- Prepare the surface by removing any topsoil, uncontrolled filling or other unsuitable material.

- Proof roll the exposed surface using a minimum 10 tonne deadweight smooth drum roller (preferable) in non-vibration mode. The subgrade should be rolled a minimum of six times with the last two passes observed by an experienced geotechnical engineer to detect any soft spots.
- Any loose/soft areas identified during proof rolling should be removed as directed by the geotechnical engineer.
- Replacement filling should then be placed in (loose) layer thickness not greater than 300 mm and compacted to a dry density ratio of 98% to 102% (for light floor load support similar to residential use) or 100% to 102% (for pavements) relative to Standard compaction and with moisture contents maintained within 2% of optimum moisture content (OMC). The select fill should be free of oversize particles (>100mm) and deleterious material.
- Some moisture conditioning (i.e. drying or wetting) may be required when reusing site won high plasticity clays for filling.
- Density testing of the filling in accordance with AS 3798:2007 *Guidelines for earthworks for commercial and residential developments*.
- The residual clays on site are derived from shale and are expected to be moderately to highly reactive to changes in moisture content. It is therefore important, when compacting site won clayey filling, to provide an upper limit on compaction and to keep the moisture content close to OMC to limit the risk of future swelling.

8.2 Excavation Conditions

8.2.1 Methods of Excavation

Depending on the depth, excavations will likely involve the removal of filling, clay and shale of varying strength. The filling, clay and extremely low to very low strength shale expected within the top 6 − 7 m depth should be readily excavated using conventional earthmoving equipment. Excavation within medium strength shale expected below this depth will require medium to heavy ripping. The use of large hydraulic rock breakers may be required in areas where widely spaced fracturing is present within the medium strength shale. Hydraulic rock breakers and possibly a rock saw could be used for excavation of footings and trenches in medium strength shale.

The exposed surface after excavation is expected to comprise clay or shale. Both of these materials quickly deteriorate when they become wet and therefore do not provide a good working area. Working platforms should be provided over the clay and shale and could comprise granular materials such as recycled concrete or ripped sandstone.

8.2.2 Vibrations

If excavation requires heavy ripping or hydraulic rock breaking in the vicinity of adjacent structures, it would be prudent to monitor and limit vibrations. Generally, a maximum peak particle velocity of 8 mm/sec (in any component direction) at the foundation level of adjacent structures is suggested for both structural and human comfort considerations, although this vibration limit may need to be reduced if there are sensitive buildings or equipment in the area.

If vibrations are an issue, consideration will have to be given to limiting vibrations during construction by appropriate selection of the type and size of equipment used.

8.2.3 Groundwater

Groundwater was encountered at depths of approximately 6 - 8 m during investigations within the vicinity of the site. For excavations shallower than this depth, no significant groundwater inflows into the excavation are anticipated, however there is likely to be some flows along joints and bedding planes within the shale bedrock, particularly after rainfall. This seepage should be relatively minor and is expected to be controllable by pumping from sumps in the excavation. The permanent drainage system for the site should allow for removal of seepage and low flows from joints in the basement area. Such groundwater is likely to have significant concentrations of iron which will tend to precipitate on exposure to air giving rise to gelatinous masses of iron oxide/hydroxide sludge. This will need to be taken into account when designing drainage lines and pumpout systems, so as to incorporate provision for regular maintenance (e.g. flushing and 'rodding').

For excavations deeper than about 6 m, the groundwater table may be encountered during excavation. In this case it may be necessary to construct a watertight wall around the perimeter of the proposed excavation, and to carry out dewatering prior to excavation below the groundwater table. Further testing of the soil and rock mass permeability and likely inflow rates will generally be required.

8.2.4 Reuse and Disposal of Excavated Material

Excavated natural material could generally be reused on site as general or structural filling subject to the material not being contaminated or containing deleterious materials. If excavated rock is reused, some pieces of rock may have to be broken down to an appropriate size for reuse.

Excavated materials to be taken off site will need to be disposed of in accordance with current EPA policies. This includes filling and natural materials that may be removed from the site. Accordingly, environmental testing will need to be carried out to classify spoil prior to transport from the site.

8.3 Excavation Support

8.3.1 Batter Slopes

Batter slopes may be possible in areas where excavations are set back sufficiently from adjacent structures and boundaries. Suggested temporary and permanent batter slopes for unsupported excavations up to a maximum height of 3 m are shown in Table 2. These batters are subject to assessment of jointing in the rock by a geotechnical engineer. If adverse jointing is present in the rock then flatter batters or stabilisation may be required. Also, if surcharge loads are applied near the crest of the slope then further geotechnical review, and probably flatter batters or stabilisation using rock bolts or soil nails, may be required.

Table 2: Recommended Safe Batter Slopes for Exposed Material

Exposed Material	Maximum Temporary Batter Slope (H : V)	Maximum Permanent Batter Slope (H : V)
Filling and Clay	1.5 : 1	2 : 1
Extremely Low to Very Low Strength Shale	1 : 1	1.5 : 1
Medium Strength Shale	0.5 : 1*	1 : 1*

Note: * Subject to jointing assessment by experienced Geotechnical Engineer / Engineering Geologist

The shale is expected to deteriorate and break down if left exposed to weather. Any rock faces exposed over the long term should be covered with mesh reinforced shotcrete pinned to the face with dowels.

8.3.2 Retaining Walls

Where batter slopes cannot be accommodated, excavations within soils and weathered rock will require both temporary and permanent lateral support during and after excavation. For excavations above the groundwater table, and where there are no movement sensitive structures in close proximity to the excavation, bored soldier pile walls with shotcrete infill panels or similar would be suitable. Typically, soldier piles are spaced at approximately 2 - 3 m centres. Closer spaced piles may be required to reduce wall movements or to prevent collapse of infill materials where pavements, structures or services are located in close proximity to the excavation. For excavations below the groundwater table in soil, a watertight wall such as a secant pile or diaphragm wall may be required around the perimeter of the excavation.

Shoring piles should be founded within rock at least 1.0 m below the base of the bulk excavation (or any perimeter drainage trenches or other excavations) in order to provide lateral restraint at the base of the excavation. Shoring piles may be used to carry vertical structural loads and may be designed on the basis of the typical allowable foundation pressures given in Section 8.4.

It is suggested that the preliminary design of shoring systems be based on the typical earth pressure coefficients provided in Table 3. Active earth pressure coefficient (K_a) values may be used where some wall movement is acceptable, and 'at rest' earth pressure (K_o) values should be used where wall movement needs to be limited.

Table 3: Typical Design Parameters for Shoring Systems

Material	Unit Weight (kN/m^3)	Earth Pressure Coefficient	
		Active (K_a)	At Rest (K_0)
Filling	20	0.4	0.6
Clay/Shaly Clay	20	0.3	0.5
Extremely Low to Very Low Strength Shale	21	0.2	0.3
Medium Strength Shale	22	0.15	0.25

A triangular pressure distribution may be adopted for the preliminary design of shoring that is restrained by a single row of 'tie-back' anchors, or for cantilever walls. It should be noted, however, that cantilever walls are generally associated with relatively high lateral deflections or movements in towards the excavation and as such are not used where structures are located behind the shoring, or for the support of excavations more than 3 m deep.

For multi-propped or anchored walls a uniform rectangular pressure distribution may be adopted for preliminary design purposes.

Detailed design of shoring systems is nowadays normally undertaken using computer software such as FLAC, PLAXIS or WALLAP, which can take due regard for soil structure interaction and the progressive nature of the excavation-shoring process.

All surcharge loads should be allowed for in the shoring design including building footings, inclined slopes behind the wall, traffic and construction related activities.

Shoring walls should be designed for full hydrostatic pressures unless drainage of the ground behind impermeable walls can be provided. Drainage could comprise 150 mm wide strip drains pinned to the face at 2 m centres. The base of the strip drains should extend out from the shoring wall to allow any seepage to flow into a perimeter toe drain which is connected to the stormwater drainage system.

Passive resistance for piles founded in rock below the base of the bulk excavation (including allowance for services or footings) may be based on an ultimate passive pressure equal to 400 kPa in extremely low to very low strength shale and 1000 kPa in medium strength shale. A factor of safety must be applied to these ultimate values to limit wall movement that is required to mobilise the passive resistance. The top 0.5 m of the rock socket should be ignored due to possible disturbance (i.e. over excavation) and tolerance effects.

8.3.3 Ground Anchors

The design of temporary ground anchors for the support of excavations and/or shoring systems, if required, may be carried out on the basis of the maximum ultimate bond stresses given in Table 4.

Table 4: Ultimate Bond Stresses for Rock Anchor Design

Material Description	Maximum Ultimate Bond Stress (kPa)
Extremely Low to Very Low Strength Shale	100
Medium Strength Shale	1000

The parameters given in Table 4 assume that the drilled holes are clean and adequately flushed. The anchors should be bonded behind an imaginary line drawn up at 45 degrees from the base of the excavation, and "lift-off" tests should be carried out to confirm the anchor capacities.

It is anticipated that in most cases for building excavations, the building will prop/support any shoring walls over the long term and therefore ground anchors are expected to be temporary only. The use of permanent anchors, if required, would require careful attention to corrosion protection and further geotechnical advice should be sought.

8.4 Foundations

The founding stratum is expected to vary across the site depending on the founding level and could include filling, clay and shale. It is suggested that footings are not founded in the filling unless it has been ‘reconditioned’ as controlled fill.

Footings founded in controlled fill or in stiff natural clay may be designed for an allowable bearing pressure of 150 kPa. A shaft adhesion of 20 kPa would apply for piles socketed into stiff clay, with no shaft adhesion within the top 1 m. The clays are likely to be highly reactive, and could swell significantly when saturated if groundwater seepage is encountered. This could affect the performances of footings in the clay.

It is expected that buildings with basement levels will be uniformly founded on shale. Pad footings may be possible where shale of sufficient strength is exposed for a practical sized footing, otherwise bored piles may be required to reach the higher strength shale.

Typical allowable pressures for the various foundation materials are presented in Table 5. These parameters apply to the design of spread footings, such as pad or strip footings, and rock socketed bored piles. All footings should be founded below an imaginary line drawn upwards at 45 degrees from adjacent excavations.

Table 5: Summary of Typical Design Parameters for Foundations

Material	Typical Allowable End Bearing Pressure (kPa)	Typical Allowable Shaft Adhesion (kPa)
Extremely Low to Very Low Strength Shale	700 - 1000	50 - 150
Medium Strength Shale	3500 - 6000	350 - 600

Foundations proportioned on the basis of the above parameters would be expected to experience total settlements of less than 1% of the footing width (or pile diameter) under the applied working load, with differential settlements between adjacent footings expected to be less than half of this value.

It would be prudent for footing excavations to be inspected by a geotechnical engineer to confirm that foundation conditions are suitable for the design loads. Spoon hole testing would be required for a portion of all high level footings designed for an end bearing pressure of 3500 kPa or greater.

8.5 Pavements

The design of pavements will depend on the type of subgrade material. If pavements are to be placed over the natural clay, some subgrade replacement or treatment may be required to provide a suitable subgrade for the pavement construction. A typical design CBR after replacement or treatment of the clayey subgrade could be of the order of 4%.

If pavements are to be constructed on controlled filling, testing of the subgrade material will be required to determine the design CBR for pavement design.

9. Contamination Comments

Based on the reviewed information and observations discussed herein, and the applicable regulations and guidelines, we make the following comments:

- Contamination may be present in filling of unknown origin which is known to be present at the site. Records from testing of the filling at and near the site have identified inclusions of ash, slag and building debris, which can be associated with contamination. Whilst filling is generally expected to be in the order of 0.5 m to 3 m deep based on previous investigation results, localised deeper filling may be present, for example associated with the filling of Orphans Creek or local cut and fill operations;
- The risk of extensive contamination associated with previous or current land uses (other than filling) at or adjacent to the site is considered to be generally low;
- The historical aerial photographs indicate the former demolition of buildings and the use of the site for training during World War II. These activities could have resulted in asbestos or lead contamination (particularly in backfilled zig zag trenches). It is noted that asbestos cement fragments have been identified in or on soils in some nearby areas of the University;
- Two modern emergency generators observed at the site are expected to contain internal diesel storage tanks, and the former storage and use of diesel or other fuels for emergency power purposes cannot be discounted. An older natural gas tank and line were observed in the Blackburn Building, however, and may have been used previously for emergency power;
- A variety of chemicals are used and stored on the site, and the current chemicals present at the site may differ to those used and stored historically. A number of Dangerous Goods Stores are present, with some chemical being generally inert (e.g. oxygen and nitrogen gases), whilst others have an elevated risk of contamination if spillage/ leakage has occurred (e.g. benzene). The observed volumes of chemicals were generally small, with the chemical stored in sealed

containers. It is possible that disposal of some chemicals occurs through pipes in the buildings, and if this is a case, leakage from these pipes is a potential source of contamination to the subsurface;

- Low level radioactive waste is stored in Building D15 prior to off-site disposal. It is not known where the radioactive materials are used/ produced or if higher level radioactive substances are present in other areas of the site.

Based on the available information it is considered that there is a moderate risk of some contamination being present at the site. The sources of concern are considered to be filling, asbestos and lead in surficial soils, and the use and storage of fuels and chemicals. It is noted that the quantities of fuels and chemical used and stored at the site are expected to be relatively low.

It is recommended that prior to demolition an audit of chemical use, storage and (if applicable) transport of chemical or chemical-impacted wastes though pipework be reviewed and documented to allow targeted sampling for any chemicals present in significant quantities. In the absence of this information, a broad suite of potential contaminants should be assessed in near surface soils in areas potentially impacted by the chemicals (e.g. building footprints where they were used or stored).

All radioactive materials should be managed and disposed of in accordance with state and federal legislation, including any site specific licenses, prior to demolition of the buildings.

It is also noted that biological specimens are understood to be present at the site, and should be appropriately managed during decommissioning of the current buildings. This is not considered to be a general contamination issue.

10. Further Investigation

Geotechnical investigation will be required on site once further details of the proposed development are known. Investigation for proposed buildings should include boreholes with regular soil sampling and standard penetration tests (SPTs) to allow assessment of the engineering properties of the materials encountered. For medium and high rise buildings greater than about two storeys high and/or buildings with basement levels, rock cored boreholes should be carried out to assess the strength of the bedrock in order to inform excavation conditions, excavation support and foundations. If excavation below the groundwater table is required, groundwater wells should be installed within boreholes to allow for accurate assessment and monitoring of the water table level. For pavement design, shallow boreholes with bulk sampling should be carried out to assess the CBR of the proposed subgrade.

Further contamination investigation is required to assess the suitability of the site for the proposed development and should target the specific issues/areas of concern identified in Section 9. The further investigation should include a review of any additional information available on chemical storage and use, and intrusive investigation including sampling and analysis of filling material, near surface soils and areas where spillage/leakage may have occurred from fuel or chemical storage. Some of the targeted investigation may be most easily undertaken post demolition of the subject buildings. Although the further investigation may find that remediation is required, it is considered that the contamination issues most likely to be present will be readily able to be remediated/ managed to render the site suitable for the proposed development.

Given the proposed excavation of the site, assessment of soil materials will be required for off-site disposal. Depending on the material types, chemical properties and proposed disposal location, this assessment may comprise virgin excavated natural material (VENM) assessment, waste classification assessment for disposal of filling to landfill and/ or assessment for re-use of filling on another site under the Resource Recovery assessment process.

11. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Western Avenue, University of Sydney in accordance with DP's fee proposal SYD141561 dated 21 January 2015 and acceptance received from Ms Liz Partridge of Campus Infrastructure Services dated 4 February 2015. The work was carried out under the Panel Consultancy Services Agreement between DP and The University of Sydney.

This report is provided for the exclusive use of Campus Infrastructure Services 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.

DP's advice is based upon the conditions encountered during previous investigations on sites within the vicinity of the proposed development. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions between the subject site and previous investigation points.
This report must be read in conjunction with all of the appended documentation 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.

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 sections 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 components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About this Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

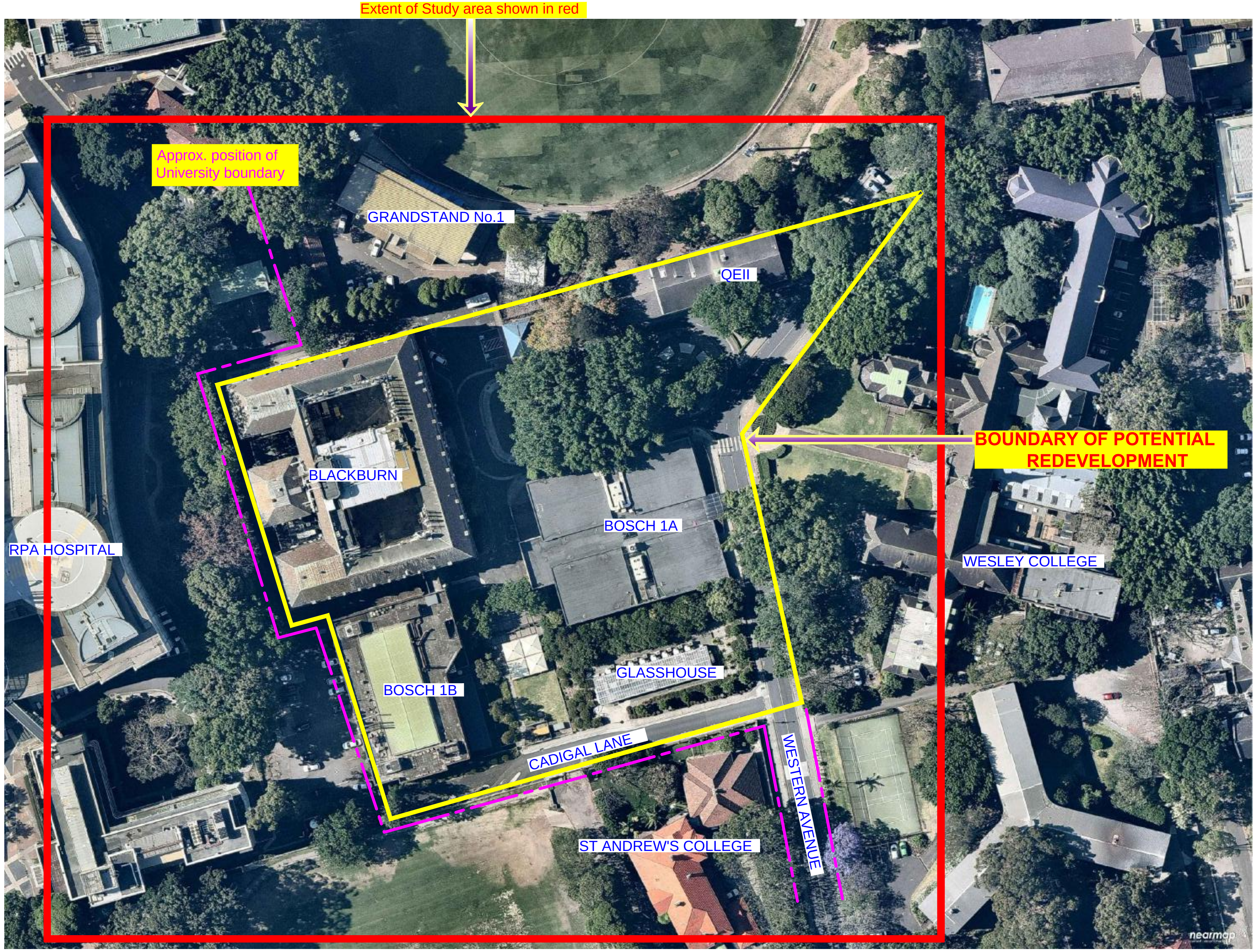
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

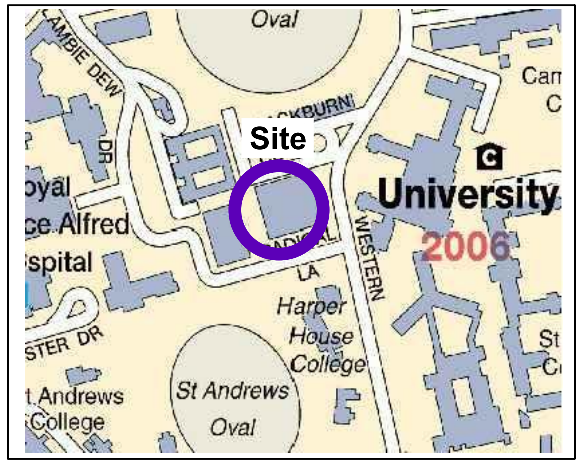
Site Inspection

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

Appendix B

Drawing No. 1 – Site Plan





Locality Plan

NOTE:
1. Base drawing from Nearmap.com

0 5 10 20 30 40 50 75 100 125m

1:1250 @ A3

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Campus Infrastructure Sercices		TITLE: **Site Plan**	PROJECT No: 84711
	OFFICE: Sydney	DRAWN BY: PSCH	**Proposed Health Precinct Development**	DRAWING No: 1
	SCALE: 1:1250@A3 approx.	DATE: 2.3.2015	**Western Avenue, UNIVERSITY OF SYDNEY**	REVISION: 0

P:\84711 CAMPERDOWN, Sydney Uni, Health Precinct Desktop Study GSY\Drawings\84711-1.dwg. 2/03/2015 11:15:24 AM

Appendix C

Site Photographs