



Douglas Partners
Geotechnics | Environment | Groundwater

Report on
Preliminary Site Investigation with Limited Sampling

Biological Sciences Project
UNSW Gate 11, Botany Street, Kensington

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

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Executive Summary

This report details the methodology and results of a Preliminary Site Investigation with limited sampling (PSI) undertaken by Douglas Partners Pty Ltd (DP) for the Stage 1 of the proposed Biological Sciences Project within the University of New South Wales (UNSW) at Botany Street, Kensington. The investigation was commissioned by Taylor Thomson Whitting on behalf of the University of New South Wales (UNSW), and the original final report was issued in January 2014. This report update was commissioned by Brookfield Multiplex Construction Pty Ltd (BMC) on behalf of UNSW for submission as part of the State Significant Development (SSD) Application. The updated report incorporates additional information which has become available since the original final report, specifically an underground petroleum storage system (UPSS) at/ adjacent to the site.

The project includes the construction of a new building for research and tertiary education purposes. The new building will have a lower ground floor (RL 53.0 m) which will be founded at a similar level to the existing ground surface levels, except at the eastern end where excavation to depths of up to 3 m is anticipated.

DP conducted several environmental investigations within the University for the existing Lowy Cancer Research Facility (C25) and the ongoing upgrade of the Wallace Wurth Building (C27), which are both located in the vicinity of the subject site. A review of the previous environmental investigations carried out at sites C25 and C27 have been incorporated in Section 4.7. The boundary of the proposed Stage 1 works has been defined in Section 3.1 and shown in Drawing 1, Appendix A. The C25 and C27 sites are indicated on Drawing 2.

In summary, the objectives of the assessment were to:

- Review previous DP assessments conducted at sites C25 and C27;
- Obtain historical information of the site;
- Identify potential sources of contamination and determine the contaminants of concern;
- Identify areas of potential contamination;
- Identify potential human and ecological receptors;
- Identify potentially affected media (soil, groundwater, etc.);
- Investigate the status of on-site soil and groundwater contamination;
- Provide an opinion on the suitability of the site for the proposed Stage 1 works of the project including bulk excavation at the eastern end of the site; and
- Provide recommendations for further assessment and/or remediation, if considered necessary.

The site has a rectangular shape with a plan area of approximately 40 m by 80 m and an eastern frontage to Botany Street. The total site area is approximately 3,200 square metres (0.32 hectares).

Historical photos indicate that the north eastern portion of the University including the subject site was previously used as a quarry for the extraction of deeply weathered igneous material (essentially clay). The former quarry was backfilled in an uncontrollable manner with deep, contaminated and heterogeneous material. The discovery was made during a detailed site environmental investigation conducted by DP in 2006 for the Lowy Cancer Research Centre.

At the time of investigation, the site consisted of a four to five storey Biomedical Theatres building (E27) and other ancillary structures including:

- landscaped garden areas, part of an asphaltic concrete road which provides vehicular access from nearby Gate 11 to Samuels Lane;
- a landscaped garden area with above and underground services, concrete paths and stairs to the east; and
- waste storage areas, electrical substation, concrete pavements/loading dock.

Based on a site inspection and anecdotal information, an underground petroleum storage system (UPSS) is located to the north of the eastern portion of the site, an underground trade waste tank is located between the BEES Work Area and Substation No. 6, and it is understood that two additional trade waste tanks may exist in an area to the east of the Biomedical Theatres. Above ground chemical waste and biowaste stores are also present at the site, and a substation is partly located at the site (located both sides of the site boundary).

A review of the site information and previous DP investigations triggered the requirement for soil and groundwater sampling. The primary objective of this investigation is to confirm that the former landfill activities occurred at the Lowy Cancer Research Centre has not affected the subject site, which would add significant restrictions on the proposed development.

A total of six bore locations were placed (where possible) along the boundary of the proposed building primarily for geotechnical purposes, two of which were positioned slightly outside of the site due to access constraints (i.e. site building/structures and internal underground services) and the operational status of the site (i.e. constant movement of delivery trucks and university staff). Two of the soil test bores were converted into groundwater monitoring wells to assess the quality of groundwater flowing into and exiting the site. Based on site observation, there was no visual or olfactory indication of significant contamination in soil and groundwater bores.

Relatively shallow sand filling (ranging from 0.4 m to 3.4 m) was encountered at the subject site and confirms that the subject site has not been part of the former landfill activities. This is further supported by analytical results which indicate non-detectable to low concentrations of contaminants in soil and groundwater.

Six soil samples and two groundwater samples were analysed for various combinations of the identified contaminants of concern. All contaminant concentrations in the soil samples analysed were within the adopted health based assessment criteria (HIL D). Asbestos was not detected. The groundwater results indicated that all organic contaminant concentrations were below the laboratory practical quantitation level, and that metals were either below the groundwater investigation levels or within expected background concentrations.

All total concentrations were within the General Solid Waste (non-putrescible) criteria for off-site disposal at landfill. No signs of environmental concerns such as staining or odour were noted in the fill during sampling. It is considered that the filling material described herein is suitable for disposal to a landfill licensed by EPA to accept General Solid Waste, provided the material is not cross-contaminated/ mixed with other non-reported material. If any issues of concern not identified herein (such as oiliness, fibre cement, unnatural staining or odours) are observed during excavation, this classification would not apply and further assessment would be required.

In regards to the natural material at the site, based on the site observations and analytical results, the orange/brown/light grey fine to medium grained natural sandstone exhibits no signs of contamination and is classified as Virgin Excavated Natural Material (VENM) unless an issue of concern as described above was identified, in which case further assessment would be required.

Whilst no asbestos containing material was identified at the site, based on the presence of building rubble, in particular at BH5, it is considered that the possibility of asbestos being present in the filling cannot be ruled out as asbestos is commonly associated with building or demolition rubble. If asbestos-based materials are identified during excavation this may change the classification of the fill soil to Special Waste (Asbestos). Materials containing asbestos require to be disposed to a landfill licensed to accept Special Waste (Asbestos).

As part of the Review of Environmental Factors (REF) work (which does not form part of the SSD application) it is understood that:

- the UPSS will be removed by an experienced contractor in accordance with Australian Standard AS4976-2008 and the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008 and associated guidance issued by the EPA; and
- the existing underground trade waste tank(s) will be decommissioned and removed in accordance with the Department of Water and Energy Liquid Trade Waste Regulation Guidelines 2009.

Notwithstanding that soil and groundwater contamination were not identified, there was limited access resulting in a limited number of sample locations and that some bores were on the site boundary, it is therefore recommended that an Unexpected Finds Protocol is put in place prior to commencement of excavation to manage unexpected contamination (including asbestos). Given the above restrictions on sampling such contamination may exist between bore locations.

It is considered that, based on the results of the investigation, the site can be made suitable for the proposed use as an educational establishment. It is understood that any works required to render the site suitable for the proposed development will be undertaken as part of the Enabling Works (which are not part of the SSD application).

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Report on Preliminary Site Investigation with Limited Sampling Biological Sciences Project, Gate 11, Botany Street Kensington (UNSW)

1. Introduction

This report details the methodology and results of a Preliminary Site Investigation with limited sampling (PSI) undertaken by Douglas Partners Pty Ltd (DP) for the initial stage of the proposed Biological Sciences Project within the University of New South Wales (UNSW) at Botany Street, Kensington. The investigation was commissioned by Taylor Thomson Whitting on behalf of the University of New South Wales (UNSW), and the original final report was issued in January 2014. This report update was commissioned by Brookfield Multiplex Construction Pty Ltd (BMC) on behalf of the UNSW for submission as part of the State Significant Development (SSD) Application. The updated report incorporates additional information which has become available since the original final report, specifically an underground petroleum storage system (UPSS) at/ adjacent to the site.

The project includes the construction of a new building for research and tertiary education purposes. The new building will have a lower ground floor (RL 53.0 m) which will be founded at a similar level to the existing ground surface levels, except at the eastern end where excavation to depths of up to 3 m is anticipated. Further information on the proposed development is provided in Section 3.2.

DP has conducted several environmental investigations within the University for the existing Lowy Cancer Research Facility (C25) and the ongoing upgrade of the Wallace Wurth Building (C27), which are both located in the vicinity of the subject site. A review of the previous environmental investigations carried out at sites C25 and C27 have been incorporated in Section 4.7. The boundary of the proposed Stage 1 works has been defined in Section 3.1 and shown in Drawing 1, Appendix A. The C25 and C27 sites are indicated on Drawing 2.

In summary, the objectives of the assessment were to:

- Review previous DP assessments conducted at sites C25 and C27;
- Obtain historical information of the site;
- Identify potential sources of contamination and determine the contaminants of concern;
- Identify areas of potential contamination;
- Identify potential human and ecological receptors;
- Identify potentially affected media (soil, groundwater, etc.);
- Investigate the status of on-site soil and groundwater contamination;
- Provide an opinion on the suitability of the site for the proposed Stage 1 works of the project including bulk excavation at the eastern end of the site or provide recommendations for further assessment and/or remediation, if considered necessary.

This assessment was conducted in conjunction with a provisional waste classification and a geotechnical investigation. The results of the waste classification have been incorporated in Section

11.2 and the results of the geotechnical investigation have been reported separately. (Project No. 73492.00 Document No. 1, dated July 2013).

2. Scope of Work

The scope of works was as follows:

2.1 Site History

- Review information provided by UNSW;
- Review of historical title deeds and aerial photos to identify land uses and changes in the land that may indicate potential for contamination;
- Review of Section 149 (2) & (5) planning certificates;
- Review of available Council records relating to the site;
- Review of public databases held under the *Contaminated Land Management Act 1997* and the *Protection of the Environment Operations Act 1997*;
- Review of records held under the WorkCover Stored Chemical Information Database (SCID). The records held by WorkCover include the current and historic licences to store Dangerous Goods;
- Review of geological and topographical maps/drawings;
- Obtain and review information for groundwater bores registered with the NSW Office of Water (NOW).

2.2 Fieldwork

- Site walkover which included observations of any potentially contaminating activities or sources of contamination;
- Electromagnetic scanning followed by non-destructive pot-holing to approximately 1.5 m depth to locate the boreholes clear of the existing services;
- Coring of the concrete pavement to allow for drilling;
- The drilling of six boreholes (BH1 to BH6 inclusive) to depths of between 8.0 m and 9.8 m using a bobcat-mounted drilling rig. The boreholes were initially drilled using spiral flight augers within the soil and weathered rock and then cased and continued into the underlying rock using diamond core drilling techniques to obtain continuous core samples of the rock. Coring was undertaken for geotechnical purposes;
- Groundwater observations were made during auger drilling of the boreholes;
- Installation of two groundwater monitoring wells in boreholes BH1 and BH4, comprising a 50 mm diameter slotted PVC pipe to allow for future measurement of groundwater levels and sampling of the groundwater for the contamination assessment;

- Soil samples were taken at 0.2 m and then at intervals of 0.5 m or at changes in material or any signs of contamination to 0.5 m into natural soil; and
- Soil samples were screened using a photoionisation detector (PID) to assess the presence of volatile organic compounds.

2.3 Laboratory Analysis

- Laboratory analysis was conducted on six selected samples (plus 1 QA/QC sample) at a NATA accredited laboratory for a range of common contaminants.
 - Heavy metals - As, Cd, Cr, Cu, Pb, Hg, Ni, Zn – six samples;
 - Total recoverable hydrocarbons (TRH) – six samples;
 - Monocyclic aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene – BTEX) – six samples;
 - Polycyclic aromatic hydrocarbons (PAH) – six samples;
 - Phenols – six samples;
 - Polychlorinated biphenyls (PCB) – six samples;
 - Organochlorine pesticides (OCP) – six samples;
 - Asbestos – six samples;
 - Intra-laboratory replicate for heavy metals and TRH/BTEX – one sample;
 - Trip blank – one sample; and
 - Trip spike – one sample.
- Toxicity characteristic leaching procedure (TCLP) tests were not required for the preliminary waste classification;
- The remaining soil samples are stored for one month, pending the need for further analyses; and
- Two groundwater samples were collected from the groundwater wells installed as part of the geotechnical investigation and analysed in the laboratory for a range of common contaminants:
 - Heavy metals– two samples;
 - TRH/BTEX – two samples;
 - PAH (low level) – two samples;
 - Phenol – two samples;
 - PCB/OCP (trace level) – two samples;
 - Hardness & pH – two samples;
 - Intra-laboratory replicate for heavy metals and TRH/BTEX only – one sample;

2.4 Reporting

- A contamination assessment report was prepared, including discussion of site history search, area of environmental concerns and associated contaminants of concern, analytical results, conclusions, and recommendations for future remedial actions, if required.

3. Site Identification

3.1 Site Identification

The site is located at the north-eastern section of Lot 1 in Deposited Plan 510271, which forms the eastern portion of the UNSW Kensington Campus. The site is located in Kensington, in the Parish of Alexandria, County of Cumberland and the local government area of Randwick City Council. A site plan and locality map is shown in Drawing 1, Appendix A.

The site has a rectangular shape with a plan area of approximately 40 m by 80 m and an eastern frontage to Botany Street. The total site area is approximately 3,200 m² (0.32 hectares).

A total of six bore locations were placed (where possible) along the boundary of the proposed building primarily for geotechnical purposes, two of which were positioned slightly outside of the site due to access constraints (i.e. site building/structures and internal underground services) and the operational status of the site (i.e. constant movement of delivery trucks and university staff). At the time of the investigation, the site consists of a four to five storey Biomedical Theatres building (E27) and other ancillary structures including:

- landscaped garden areas, part of an asphaltic concrete road which provides vehicular access from nearby Gate 11 to Samuels Lane;
- a landscaped garden area with above and underground services, concrete paths and stairs to the east; and
- waste storage areas, electrical substation, concrete pavements/loading dock.

A description of the site is outlined in Section 7.

The site's immediate surrounding uses include:

- An eight storey, concrete-framed building (Biosciences Building D26) to the north and west;
- A multi storey building (Samuels Building No. F25) to the south; and
- Botany Street to the east.

3.2 Proposed Development

The proposed land use is for research and tertiary education teaching facilities.

The Biological Sciences Project consists of two stages. Stage 1 comprises the construction of a new nine (9) storey building in the existing location of E27 Bio Theatres Building; fit out of the lower ground floor of the southern/western wing of Building D26; construction of an eastern atrium; construction of

the structure and lift core to a western atrium; and upgrade of the landscape surrounding the newly constructed Building E26.

Stage 2 comprises the refurbishment of the ground floor of the existing Building D26; creation of a link through to the newly constructed Building E26 on the north and western elevation; completion of the construction of the western atrium; refurbishment of facades to the existing Building D26; construction of a stair block in between Wallace Wurth and Building D26; and upgrade of the landscape to the open areas surrounding the D26 and Biolink buildings.

Prior to the commencement of the Stage 1 and 2 works (which are the subject of the current application) “Enabling Works” will be conducted as per a Review of Environmental Factors (REF) which the UNSW prepared in April 2014. The works associated with the REF include:

- demolition of the Biomedical Theatres (E27) Building, Microtechniques Building (E25) and other ancillary structures on the site;
- re-alignment of high voltage (HV) power supply to a number of upper campus buildings, including demolition of the existing Substation 6 and the creation of two new substations;
- relocation of a number of underground services;
- realignment of the Library Walk where it meets Gate 11, and Gate 11 road works;
- establishment of a temporary loading dock;
- tree removal;
- landscaping works to the Australia Graduate School of Management (AGSM) Building; and
- replacement of sewer and stormwater services along Botany Street

The new building will comprise a lower ground floor (RL 53.0 m) which will be founded at a similar level to the existing ground surface levels over the majority of the building footprint, except at the eastern end where excavation to depths of up to 3 m is anticipated. Further excavation of approximately 0.3 m is anticipated to allow for construction of the floor slab (i.e. a bulk excavation level at RL 52.7 m).

4. Previous Assessments

4.1 Lowy Cancer Research Centre

DP carried out the following series of environmental investigations for the Lowy Cancer Research Centre (the C25 site), which is located approximately 70 m north and north-west of the subject site.

- *“Report on Phase 2 Contamination Assessment, Proposed Cancer Research Facility, C25, The University of New South Wales, Kensington”* (DP, ref 44291a, December 2006);
- *“Report on Supplementary Contamination Assessment, Cancer Research Facility, C25, The University of New South Wales, Kensington”* (DP, ref 44291b, January 2007);
- *“Remediation Action Plan, Proposed Cancer Research Facility, High Street, The University of New South Wales”* (DP, ref 44291E, November 2007);
- *“Report on Remediation and Validation Assessment, Proposed Cancer Research Centre, High Street University of New South Wales, Kensington”* (DP ref 44291E-11, August 2008); and

- *“Report on Environmental Management Plan, Proposed Cancer Research Centre, High Street University of New South Wales, Kensington”* (DP ref 44291E-13, August 2008).

The C25 site was formerly a quarry for the extraction of deeply weathered igneous material (essentially clay) circa 1930. The C25 site was underlain by variable and problematic ground conditions with deep contaminated sandy filling, shallow groundwater, and highly fractured rock resulting from a major igneous intrusion (dyke). A near-vertical igneous dyke, approximately 1 m wide, and striking approximately north-west to south-east, intercepted the basement excavation for the C25 Building. It is understood that the igneous dyke does not intercept the subject site.

Based on the previous borehole logs, the thickness of filling generally increased towards the western portion of the C25 site. The western portion of the C25 site was underlain by deep sandy filling with anthropogenic inclusions to depths of 4.5 m to 9 m. The depth of filling encountered along the eastern boundary of the C25 site was significantly reduced to range between 1.9 m and 3.1 m.

Elevated levels of heavy metals, TRH and PAH were detected in both soil and groundwater at the C25 site as a result of historical, uncontrolled fill activities. Subsequent remediation works involved the complete removal of all filling within the footprint of the existing Cancer Research Centre and the establishment of barriers to isolate and shield any potential impacts from the peripheral surrounding area. The adopted remediation strategy for the management of the remaining area consisted of the placement of a capping layer of clean fill of at least 0.5 m over the layer of filling to prevent human access to the subsoil.

Given that over 95% of the filling material had been removed from the C25 site, it was anticipated that on-site source of soil and groundwater contamination had been effectively removed. It was, therefore, concluded in the final remediation and validation report that the impact of the residual filling remaining on site on soil and groundwater within and beyond the C25 site was considered to be minimal.

4.2 Wallace Wurth Building

DP also carried out the following environmental investigations for the upgrade of Wallace Wurth Building (the C27 site), which is located immediately to the east of the adjacent Lowy Cancer Research Centre and approximately 30 m north of the subject site.

- *“Report on Stage 1 Contamination Assessment with Limited Sampling, Proposed Wallace Wurth Upgrade, C27, Cnr Botany & High Streets, The University of New South Wales, Kensington”* (DP, ref. 71543.01, March 2010);
- *“Report on Phase 2 Contamination Assessment, Proposed Wallace Wurth Upgrade, C27, Cnr Botany & High Streets, The University of New South Wales, Kensington”* (DP, ref. 71543.03, July 2011).

Given the close proximity of the Wallace Wurth Building to the C25 site, DP recommended that intrusive sampling was required in order to confirm the status of soil and groundwater underlying site C27.

The initial environmental investigation indicated that the C27 site encountered relatively shallow filling ranging up to depth of 0.35 m to 3.3 m in comparison with the deep filling encountered at C25. Elevated level of medium to long chain total recoverable hydrocarbon (TRH) was detected in one of

the groundwater wells (GW1) and the initial contamination assessment recommended a further round of sampling to assess the nature of TRH contamination in groundwater at the C27 site.

Subsequent assessment comprised the installation of a replacement well, GW1A, constructed close to the known location of GW1 and this well was sampled as TRH was detected during the initial assessment. Analytical results indicated that TRH was not detected in the adjacent well. It was concluded in the subsequent stage of the assessment that the elevated level of TRH presented during the initial stage of the assessment was not considered significant.

5. Site History

The site historical information review comprised a review of historical aerial photographs, WorkCover Dangerous Goods records relating to licensed dangerous goods storages, searches of NSW EPA databases relating to known contaminated sites and a search of the NOW groundwater bore database. Historical title deeds, aerial photos, groundwater bore database, Section 149 (2&5) Certificates and Council records were obtained from the previous reports conducted at the C25 and C27 sites located in close proximity to the subject site.

5.1 Title Deeds

The historical title deeds search revealed that the University was formerly used for public recreational purposes (Randwick Park) between 1903 and 1959. The Crown Land was granted to the University in the early 1950s.

5.2 Aerial Photographs

Aerial photographs from 1930, 1943, 1951, 1955, 1961, 1963, 1965, 1970, 1981, 1994 and 1998 were reviewed to assess the changes in uses and significant disturbance of the site. The aerial photos are presented in Appendix B with findings of the aerial photos outlined below.

5.2.1 The Site

According to the 1930 aerial image, bulk excavation was evident in the north-eastern portion of the UNSW campus. The subject site, sites C25 and C27 appeared to have been part of an extensive excavation corresponding to quarrying related activities.

In the 1943, 1951 and 1955 aerial images, the site appears vacant and used for open space. The construction of University buildings commenced in the early 1960s with the Biological Science (Site C25) and Wallace Wurth (Site C27) buildings established prior to 1961. These buildings are shown on Drawing 2.

The Biomedical Theatres building was constructed between 1961 and 1963 along with other ancillary structures constructed in the 1970s. The site appears to be generally consistent with current layout since 1981.

5.2.2 The Surrounding Land

In the earliest available aerial image (1930), surrounding land uses consisted of residential houses to the north, east and south and open space/ fields to the west. The former Kensington and current Randwick racecourses are located further to the west and northwest of the site as seen in the 1930 aerial image. The former Kensington Racecourse was in the early stages of redevelopment by the UNSW in the 1951 aerial photo. Development has continued within the UNSW campus to the present day.

5.3 Council Records

New planning certificates have not been obtained for the site. The planning certificates (dated 16 February 2010) relate to the previous DP report conducted in 2010; however, they are believed to be relevant for the purposes of this report.

The subject site is located within the Randwick City Council local government area and is currently zoned *No. 5 (Special Uses Zone)*.

According to the Section 149(2) Planning Certificate, the site has not been declared to be a 'significantly contaminated site'. However, the land (note: referring to the main UNSW campus) is the subject to an ongoing maintenance order under the *Contaminated Land Management Act 1997* and Council has received a copy of the site audit statement (SAS). This statement referred to the C25 site (now remediated and subject to on-going monitoring) and does not imply to the subject site.

A review of the DP (2010) report indicated that the Randwick Council has no records of any development applications between 1949 and 1965, a period when quarrying activities were performed within the current University boundary. It is understood that Council was not the regulatory authority for the University during this period.

5.4 WorkCover NSW Dangerous Goods Database

As part of the desktop study, a WorkCover NSW dangerous goods database search request was made to WorkCover NSW in order to confirm or otherwise the presence of registered dangerous goods storages including underground/aboveground fuel tanks. The results of WorkCover's search of the Stored Chemical Information Database shows that no licensed storages have been identified. WorkCover's letter is included in Appendix B.

5.5 Observed Dangerous Goods

A fill point for an underground petroleum storage system (UPSS) is located adjacent to the site, and the UPSS may extend onto the site. It is understood that UNSW informed BMC of the presence of the UPSS, however DP had not been provided with any documentation for the UPSS at the time of reporting.

The UPSS comprises one underground storage tank (UST), with no bowser observed. The locations of the pipework and outlet point for the UST are not known. The UST location has been identified

based on a fill point located adjacent to, but outside the boundary of the subject site, but understood to be within Stage 2 of the proposed Biological Sciences Project. The actual alignment of the UST relative to the site is unknown, and it and/ or associated pipework could extend onto the site.

The fill point was opened and inspection of the dipstick indicated that it was a 10,000 L UST with approximately 6,200 L of petroleum product remaining in the UST.

In addition to the UPSS, and site observation indicated the presence of several gas storage areas divided into non-flammable/non-toxic and flammable gas store. The non-flammable/non-toxic gases, i.e. nitrogen refrigerated liquid and carbon dioxide, were stored in a metal demountable structure located to the west of the Biomedical Theatres. The flammable gases, with a maximum storage capacity of 500 L, are stored in a lockable cage located to the north of the Biomedical Theatres. An underground trade waste tank (coded D26 – 2/69) was discovered between the BEES Work Area and Substation 6. Moreover, based on anecdotal information (Ms Silvie Pappas, Aurora Projects Pty Ltd), there may be two more underground trade waste tanks at the site. The observed dangerous goods were used by the Lowy Cancer Research Centre and the Faculties of Science (Schools of BEES and BABS). Overall, the dangerous goods storage areas were observed to be generally well maintained with restricted access and because gases were stored, are not significant from a contamination perspective.

5.6 Regulatory Notices Search

The below databases were searched on 28 October 2014.

The NSW EPA publishes records of contaminated sites under Section 58 of the *Contaminated Land Management (CLM) Act* 1997 on a public database accessed via the Internet. The Notices relate to investigation and/or remediation of contaminated site considered to be significantly contaminated under the definition in the CLM Act. More specifically, the Notices cover the following:

- actions taken by the EPA under Section 15, 17, 19, 231, 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 search of the public database revealed that the subject site, or adjacent properties were not listed.

The EPA also lists site reported to it under Section 60 of the CLM Act. There was no listing for the site or adjacent sites.

The NSW EPA also issues environmental protection licences to the owners or operators of various industrial premises under the *Protection of the Environment Operations Act* 1997 (POEO Act). Licence conditions relate to pollution prevention and monitoring, and cleaner production through recycling and reuse and the implementation of best practice.

The NSW 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;
- licence 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 did not locate any listing for the subject site.

5.7 Groundwater Bore Search

A groundwater bore database search conducted on 28 October 2014 identified nineteen registered groundwater bores within a 500 m radius of the site, all located across or up-gradient of the site. The intended uses of the bores were for groundwater remediation (the majority of the bores), recreation, domestic, commercial and industrial purposes. Most of the bores were shallow (less than 6 m deep) with no standing water levels provided. Two deeper wells (43 m and 150 m deep) had standing water levels of 8.6 m and 16.5 m respectively.

6. Geology, Hydrogeology and Topography

Reference to the Sydney 1:100 000 Series Geological Sheet indicates that the site is underlain by Quaternary aged sediments comprising medium to fine grained Aeolian sand (deposited by transgressive dunes) overlying Hawkesbury Sandstone which typically comprises medium to coarse grained quartz sandstone with some shale and laminite bands or lenses.

Reference to the Acid Sulphate Soil Risk Map indicates the site is not in an area of potential risk for acid sulphate soils.

The geological mapping was confirmed by the fieldwork which identified filling and natural sand overlying sandstone bedrock.

7. Site Description

At the time of the original site walkover, the following site uses and general features were observed:

- Access was made available via Gate 11, located in the south-eastern portion of the site (Photo 1, Appendix B).
- The ground level of the Biomedical Theatres building was used as a science laboratory workshop (Photo 2).

- The Dangerous Goods Stores were located to the west and rear of the Biomedical Theatres building (Photo 3).
- An underground liquid trade waste tank was located between the BEES Work Area (F26) and Substation No. 6. The estimated dimension of the tank is approximately 4.55 m x 4.2 m x 2.19 m, which can store up to a nominal 15,000 L of liquid trade waste. It should be noted that the dimension and weight of the tank is only an assumption based on site observation and the standard dimensions and weights of custom manufactured tanks outlined in the NSW EPA's *Guidelines for Assessing Service Station Sites* (Photo 4). Advice from the client states that *D26 Trade Waste Tank# D26 – 2/69 only serves Biolink and is only used for dilution purposes. That tank is checked regularly, pH balancer added if required, also noted was that the tank was refurbished approximately 8 years ago and as it's used for dilution purposes has never been pumped* (email from Project Manager, Aurora, dated 16 July 2013). As a pH balancer is used, it is assumed that the contents are probably on the acid side of neutral.
- A substation (No. 6) was observed to the west of the Biomedical Theatres (Photo 5).
- A biological hazard waste (biowaste), chemical waste and general waste storage areas are located at rear of the Biomedical Theatres, adjacent to the loading dock zone (Photo 6).
- An aboveground reservoir tank was observed adjacent to the chemical waste storage area (Photo 7).
- A landscaped garden area with above-ground and underground services, concrete paths and stairs to the east (Photo 8).

A site inspection on 28 October 2014 confirmed the site was still in the same general condition as the above, but the following was noted:

- The presence of a UPSS fill point adjacent to the site, with the possibility that the UPSS and/or pipework extends onto the site as discussed in Section 5.5 (fill point shown on Photo 9);
- Site sheds had been constructed in the area between and to the north of Buildings D26 and E27; and
- Some of the landscaping/ plants had been removed from the area to the north of Building E27.

8. Potential for Contamination

Based on the current and previous site uses and DP's site observations the potential contamination sources (or areas of environmental concern) are summarised in Table 1 below.

Table 1: Areas of Environmental Concern (AEC's)

Potential AEC	Description of Potential Contaminating Activity	Chemicals of Concern
Imported filling	Fieldwork carried out at the C25 site located in close proximity to the subject site identified deep, variable and contaminated filling to depths of 4.5 m to 9 m. Based on historical aerial photo evidence, it is presumed that quarry activities may have extended to the	Heavy metals and TPH, BTEX, PAH, PCB, OCP, and asbestos.

Potential AEC	Description of Potential Contaminating Activity	Chemicals of Concern
	subject site (although considered unlikely given the shallow depth of filling). Soil and groundwater sampling and testing is required to confirm this (conducted as part of this PSI).	
Underground petroleum storage system	An UPSS is present immediately adjacent to the site, and may extend onto the site	TPH, BTEX, PAH, lead, (possible low risk of VOC)
Underground trade waste tank (coded D26 – 2/69)	An underground trade waste tank was discovered during the site inspection. A soil test bore was drilled in the vicinity of the tank to possibly determine the condition of the tank i.e. any potential for leakage.	No information is available on the tank contents except that it is used for “dilution” purposes. Assumed to contain wastes with an acid pH.
Chemical waste and general waste storage area.	Given that the waste storage areas were observed to be generally well maintained and isolated with hardstand below, the potential for soil and groundwater contamination is considered to be low or limited with the exception of accidental spillage.	Heavy metals, TPH/BTEX, PAH and phenols.
Substation	The substation is enclosed in a concrete, structure with hardstand below the structure. It is, therefore, anticipated that the potential impact of the substation to the surrounding soil and groundwater would appear minimal.	Heavy metals (copper, lead and mercury), PCB and TPH.

The anticipated contaminants of concern from general anthropogenic sources from past and present site activities include heavy metals, TPH, BTEX, PAH, OCP, PCB, phenols and asbestos.

9. Fieldwork and Analyses

9.1 Data Quality Objectives and Project Quality Procedures

The data quality objectives (DQO) are qualitative and quantitative statements that specify the quality of the data required for the assessment, as stipulated in the NSW DECCW reporting guidelines. The DQO must ensure that the data obtained are sufficient to achieve the objectives of the assessment.

The DQO were developed for this current preliminary contamination assessment in accordance with the Australian Standards “*Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-volatile and semi-volatile compounds*” (AS4482.1- 2005) and “*Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 2: Volatile substances*” (AS4482.2-1999).

The seven step DQO process is as follows:

- a) State the Problem
- b) Identify the Decision
- c) Identify Inputs to the Decision
- d) Define the Boundary of the Assessment
- e) Develop a Decision Rule
- f) Specify Acceptable Limits on Decision Errors
- g) Optimise the Design for Obtaining Data.

(a) Stating the Problem

The site is proposed for redevelopment. The problems to be addressed by this assessment are to identify potential areas of environmental concern and to evaluate the suitability of the site for continued University use. The objectives of the PSI are to:

- Obtain historical information of the site;
- Identify potential sources of contamination and determine the contaminants of concern;
- Identify areas of potential contamination;
- Identify potential human and ecological receptors;
- Identify potentially affected media (soil, groundwater, etc.);
- Investigate the status of on-site soil and groundwater contamination;
- Provide an opinion on the suitability of the site for the proposed Stage 1 works of the project including bulk excavation at the eastern end of the site or provide recommendations for further assessment and/or remediation, if considered necessary.

(b) Identifying the Decisions

The decisions to be made in completing the preliminary site investigation with limited sampling are as follows:

- Is there likely to be an elevated potential for soil contamination within the site?
- Is the site considered to be significantly contaminated under the existing or future potential land uses?
- Is there likely to be any significant contamination issues that would pose restrictions on future redevelopment?
- Is there any potential for groundwater contamination?
- Are there any off-site migration issues to be considered?
- Does the site require further investigation, remediation and/or validation to ensure suitability of the site for continued use?

(c) Identify Inputs to the Decision

The inputs into the decision process are as follows:

- Historical information regarding past land uses and features;

- Site operations and observations;
- Soil and groundwater sampling;
- Soil profile information obtained through the sampling phase;
- Chemical test data on soil and groundwater samples; and
- Comparison of test data against applicable soil and groundwater assessment criteria.

(d) Define the Boundary of the Assessment

The boundary of the assessment is the boundary of the site, as shown on Drawing 1, Appendix A.

(e) Develop a Decision Rule

The information obtained through this assessment will be used to make an assessment regarding the contamination issues likely to impact on the existing land use or future development. The decision rule in conducting this assessment is as follows:

- Sampling locations were distributed in a general systematic grid pattern subject to site accessibility;
- Laboratory test results will be assessed individually, not statistically, given the biased location of a number of the samples;
- The site assessment criteria (SAC) are endorsed by NSW EPA, or for analytes where there are no EPA endorsed criteria, other relevant Australian or internationally recognised standards have been referred to as screening thresholds;
- The soil test results will provide an indication of the likely potential for contamination of the site on a broad scale, and/or at target areas;
- The groundwater test results will provide an indication on the potential for groundwater impact from the site;
- Relevant site information, observations and exceedance of the SAC and/or groundwater investigation levels (GIL) will be used as a basis for the identification of target locations and/or contaminants for further investigation (if required); and
- Further detailed investigation will be recommended, if required.

Laboratory test results will be accepted and considered useable for this assessment under the following conditions:

- All laboratories used are accredited by National Association of Testing Authorities (NATA) for the analyses undertaken;
- All practical quantitation limits (PQL) set by the laboratories fall below the assessment criteria adopted, or indicate across-the-board lack of detection (i.e. some of the GIL are difficult to achieve routinely by NATA accredited laboratories);
- The reported concentrations of analytes in the replicate sample pairs are within accepted limits;
- The quality assurance / quality control (QA/QC) protocols and results reported by the laboratories comply with the requirements of the National Environment Protection Measure (NEPM) 2013 *"Guideline on Laboratory Analysis of Potentially Contaminated Soils"* and Australian and New

Zealand Environment and Conservation Council (ANZECC) 2000 “*Guidelines for the Laboratory Analysis of Contaminated Soils*”.

(f) Specify Acceptable Limits on Decision Errors

The limits on decision errors for this assessment are as follows:

- The analyte selection is based on the potential for contamination discussed in Section 8 of this report;
- The GIL adopted from the guidelines stated in Table 6 have risk probabilities already incorporated;
- The acceptable limits for replicate comparisons are outlined in Appendix E;
- The acceptance limits for laboratory QA/QC parameters are based on the laboratory reported acceptance limits and those stated in the NEPM 2013 “*Guideline on Laboratory Analysis of Potentially Contaminated Soils*” and ANZECC 2000 “*Guidelines for the Laboratory Analysis of Contaminated Soils*”.

(g) Optimise the Design for Obtaining Data

- The procedures adopted for the collection of environmental samples were developed prior to implementation, in accordance with NSW EPA guidelines and current industry practice. The sampling programme was designed to maintain integrity of data collection during the assessment, including decontamination techniques, sample labeling, storage and chain-of-custody protocols;
- Sample locations were selected to provide a general coverage of the site (note: locations determined mainly for geotechnical purposes);
- The analytical program was developed based on site history information, site observations and sub-surface conditions;
- Only laboratories accredited by NATA for the analyses undertaken were used for this assessment. The laboratory performance is assessed through review of statistics calculated for QA samples such as blanks, spikes, duplicates and surrogates;
- Procedures for the collection of environmental samples were developed prior to undertaking the fieldwork, and were in line with NSW EPA guidelines and current industry practice. The field QA/QC program incorporates preparation of traceable documentation of procedures used in the sampling and analytical program and in data validation procedures.

9.2 Data Quality Indicators

The performance of the assessment in achieving the DQO were assessed through the application of Data Quality Indicators (DQI), defined as follows:

- **Precision:** A quantitative measure of the variability (or reproducibility) of data;
- **Accuracy:** A quantitative measure of the closeness of reported data to the “true” value;
- **Representativeness:** The confidence (expressed qualitatively) that data are representative of each media present on the site;
- **Completeness:** A measure of the amount of useable data from a data collection activity;

- **Comparability:** The confidence (expressed qualitatively) that data can be considered equivalent for each sampling and analytical event.

9.3 Drilling Methods

All sample locations were cleared for services and underground pipes by a services locator and review of Dial-before-you-dig (DBYD) plans.

Three of the boreholes (BH2, 3 and 5) required concrete coring using a diatube prior to the commencement of drilling. A total of six boreholes (i.e. BH1-BH6) were initially drilled to a provisional depth of 0.4 m to 1.5 m using either vacuum excavation or hand auger in order to prevent potential damage to underground services. Subsequent drilling method involved solid flight auger into filling and sand until sandstone was intercepted. The bedrock was cored using NMLC which allow for recovery of a core of material that can be examined and logged to determine the strength, degree of weathering, understanding of any how intact the rock is and identify any discontinuities or other planes of weakness. The borehole logs are attached in Appendix C together with the location of the boreholes presented in Drawing 1, Appendix A.

9.4 Field Quality Assurance and Quality Control

The field QC procedures for sampling, as prescribed in Douglas Partners *Field Procedures Manual*, were followed during the assessment (Appendix E).

9.5 Laboratory QA/QC

The analytical laboratory, accredited by NATA, is required to conduct in-house QA/QC procedures. These are normally incorporated into every analytical run and include reagent blanks, spike recovery, surrogate recovery and duplicate samples. These results are included in the laboratory reports in Appendix D.

9.6 Sample Location and Rationale

The placement of bore locations were primarily determined for geotechnical purposes i.e. to provide coverage of the proposed building extension. Two of the test bores were positioned slightly outside of the proposed site boundary due to access constraints (i.e. site building/structures and internal underground services) and the operational status of the site (i.e. constant movement of delivery trucks and university staff).

Soil samples were collected at broadly regular intervals based on field observations, including changes in strata and signs of contamination to 0.5 m into natural.

Two groundwater monitoring wells were positioned at the up-gradient and down-gradient of the site boundary in order to assess the quality of groundwater flowing into and exiting the site.

9.7 Soil Sampling Procedure

All sampling data were recorded on DP Borehole Logs with essential information included in the chain-of-custody sheets. The general sampling procedure adopted for the collection of environmental samples is summarised below:

- Collect soil samples directly from the hand auger or solid flight auger using disposable sampling equipment;
- Transfer samples into laboratory-prepared glass jars, completely filled to ensure the headspace within the sample jar is minimised, and capping immediately to minimise loss of volatiles;
- Label sample containers with individual and unique identification, including project number, sample location and sample depth; and
- Place the glass jars, with Teflon lined lid, into a cooled, insulated and sealed container for transport to the laboratory.

Envirolab Services (NATA accreditation number: 2901) was employed to conduct the primary environmental sample analysis. The laboratory is required to carry out routine in-house QC procedures.

9.8 Groundwater Piezometer Construction and Development

Boreholes 1 and 4 were converted into groundwater monitoring wells upon completion of drilling. The groundwater monitoring wells were constructed using 50 mm diameter acid washed, class 18, PVC casing and machine-slotted well screen. Joints were screw threaded, thereby avoiding the use of glues and solvents which may contaminate the well waters.

At each of the well location, screen was extended close to or to top of sandstone. Casing was then joined to the screen to top of the well. The filter pack was made of fine-grained (> 50 mm) clean gravel. A bentonite seal was placed on top of the filter pack, close to or to top of sandstone. The seal prevents potential contaminants from entering the well screen via fill material or surface water. The annular space was backfilled with clean fill and then with the final capping of a lockable Gatic cover at surface.

Details of the well construction are included in the Bore Report Sheets in Appendix C.

Groundwater wells were developed on 12 June 2013 using a 12 volt, PVC submersible pump to remove a minimum of three well volumes or pumped until dry. In general, the wells should be left for a period until the chemistry in groundwater can be demonstrated to have stabilised (generally between 24 hours and seven days) before samples are collected.

9.9 Groundwater Sampling Methodology

Groundwater sampling was carried out on 19 June 2013 (seven days after development) using a 12 volt peristaltic ('low-flow') pump. In general, the use of low-flow pumps capable of controlling flow rates and minimising purging requirements are the preferred methods of groundwater sampling. Prior to sampling, the water level was determined by an electrical interface meter prior to and post sampling in order to determine the recharge rate of groundwater. Moreover, the interface meter can detect the

presence of both floating non-aqueous liquids (LNAPL) and sinking non-aqueous liquids (DNAPL). A bailer is also used to visually confirm the presence of possible product in groundwater.

The samples were collected upon effective stabilisation of field parameters viz. pH, conductivity, redox and dissolved oxygen. The groundwater parameters were measured with a TPS multi-parameter water quality meter. The measurement of field parameters is recorded in Appendix C. Groundwater was collected in containers compatible to the analytes to be tested and supplied by the laboratory. Samples allocated for BTEX analyses were carefully transferred into laboratory-prepared, hydrochloric acid preserved vials with no headspace.

This was followed by the collection of groundwater into sample containers for the remainder of the analytes in appropriately preserved plastic and glass containers. The groundwater samples collected for inorganic testing were filtered in the laboratory.

Sample handling and transport was as set out below:

- Sample containers were labelled with individual and unique identification, including project number and sample number;
- Samples were placed in insulated coolers to be maintained at a temperature of approximately 4°C until transported to the analytical laboratory, and
- Chain-of-custody documentation was maintained at all times and countersigned by the receiving laboratory on transfer of samples.

All samples were dispatched to Envirolab for analysis.

9.10 Analytical Rationale

The analytical scheme was designed to obtain an indication of the potential presence and possible distribution of common contaminants that may be attributed to past and present activities within the site, as discussed in Section 8.

The site area is understood to be approximately 3,200 m² (0.32 ha). According to the NSW EPA *Sampling Design Guidelines* (1995), a minimum of nine systematic sampling locations are required to characterise the site. In general, contamination assessment is progressed in a staged manner due to the complexity of site conditions and contaminant properties and/or the discovery of unexpected contamination. As an initial assessment, DP considers that six boreholes (67% of the recommended sampling density) are sufficient to provide a general characterisation of the site.

10. Site Assessment Criteria

10.1 Soil Assessment

Section 105 of the *Contaminated Land Management Act 1997* (CLM Act) allows the NSW Environment Protection Authority (EPA) to make or approve guidelines for purposes connected with the objects of the Act. These guidelines must be taken into consideration by contaminated land consultants in undertaking investigation and reporting on contaminated sites.

The *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM) prepared by the National Environment Protection Council (NEPC) is one of the primary guidelines approved by the NSW EPA under the CLM Act. The NEPM consists of a policy framework for the assessment of site contamination, Schedule A (Recommended General Process for the Assessment of Site Contamination) and Schedule B (Guidelines), which provides the benchmark for human health and ecological investigation levels in soil and groundwater.

The NEPC has recently updated the NEMP (previously prepared in 1999) with the primary focus on the reduction of remediation works and the significant costs associated with these works through the implementation of more thorough site-specific and/or risk-based investigations. The new NEPM guidelines were released on 17 May 2013 and are now endorsed by the NSW EPA.

10.2 Soils – Health Investigation Levels (HIL)

Table 2 shows the health investigation levels (HIL) that have been adopted as site assessment criteria for assessing the human health risk from a contaminant via all relevant pathways of exposure. The HIL are intentionally conservative and are based on a reasonable worst-case scenario for four generic land use settings:

- HIL A – Low density residential (residential with garden/accessible soil); e.g. home grown produce, day care centres, preschools and primary schools;
- HIL B – High density residential (residential with minimal access to soil); e.g. high-rise buildings and flats;
- HIL C – Public open space (parks, playgrounds, playing fields); and
- HIL D – Commercial and industrial (shops, offices, factories and industrial sites).

The above examples do not specify the land use category for a tertiary institution. Based on a review of Appendix C, Schedule B7 of NEPM, HIL A, B and C were derived from parameters which take risk exposure factors for young children (0-5 years old) into consideration. Given that adult students or adult workers are the more likely targeted groups within a university setting, DP considers that HIL D would be the most appropriate land use type for this investigation. HIL D is also consistent with the previous investigations conducted within the University.

The HIL have been attained from Column D (Commercial/Industrial) of Table 1A(1) of Schedule B 1 – *Guideline on Investigation Levels for Soil and Groundwater*, NEPM 1999 as amended 2013. Table 3 only includes contaminants tested in this assessment and not the full list provided in NEPM 1999 as amended 2013.

Table 2: Health Investigation Levels for soil contaminants

Contaminant	HIL D Commercial/Industrial (mg/kg)
Metals and Inorganics	
Arsenic	3 000
Cadmium	900
Copper	240 000
Lead	1 500
Mercury (inorganic)	730
Nickel	6 000
Zinc	400 000
Hexavalent chromium	3600
PAHs	
Carcinogenic PAHs (as Benzo(a)pyrene TEQ)	40
Total PAH	4 000
OCP	
DDT+DDE+DDD	3 600
Aldrin + Dieldrin	45
Chlordane	530
Endosulfan (total)	2 000
Endrin	100
Heptachlor	50
HCB	80
Methoxychlor	2 500
Phenol	240000
Pentachlorophenol	660
Other Pesticides	
Chlorpyrifos	2 000
Other Organics	
PCBs	7

It is noted that NEPM 2013 does not provide a HIL for total chromium, but does provide a HIL for chromium (VI) of 3 600 mg/kg. Similarly, NEPM 1999 as amended 2013 does not provide a HIL for total phenolics, but does provide a HIL for phenol of 240 000 mg/kg, pentachlorophenol of 660 mg/kg and cresols of 25 000 mg/kg. Therefore analytical testing undertaken for total chromium and total phenols are considered to be screening tests. It is also noted that NEPM 1999 as amended 2013 does not provide HIL for the complete list of pesticide contaminants tested in this assessment.

Table 3: Soil Health Screening Levels for Vapour Intrusion

Contaminant	Soil Type	HSL D Commercial/ Industrial (mg/kg)			
		depth 0 m to <1 m	depth 1 m to <2 m	depth 2 m to 4 m	depth 4 m+
Toluene	Sand	NL	NL	NL	NL
Ethylbenzene		NL	NL	NL	NL
Xylenes		230	NL	NL	NL
Naphthalene		NL	NL	NL	NL
Benzene		3	3	3	3
TPH C ₆ -C ₁₀ less BTEX		260	370	630	NL
TPH >C ₁₀ -C ₁₆ less Naphthalene		NL	NL	NL	NL

Note: NL Not limiting

Table 3 shows the health screening levels (HSLs) for petroleum hydrocarbon compounds adopted for the assessment and are based on the exposure to petroleum hydrocarbons through the dominant vapour inhalation exposure pathway only (i.e. not direct contact to soils). The HSL have been obtained from Column HSL D (Commercials / Industrial) of Table 1A (3) of Schedule B 1, *Guideline on Investigation Levels for Soil and Groundwater*, NEPM 2013. Given that sand filling was encountered in all test bores, sand was selected as the dominant soil type for HSLs for vapour intrusion.

Direct contact HSLs have also been included as part of the site assessment criteria as direct contact exposure is considered relevant for the future workers during the construction phase of the proposed development.

The presence of detectable asbestos will be considered significant for the current investigation as a screening threshold. If asbestos is detected, further assessment could allow the use of threshold levels in accordance with NEPM 1999 as amended 2013.

According to DEC *Guidelines for the NSW Site Auditor Scheme* (2nd edition), 2006, the phytotoxicity of contaminants in soil did not require consideration for industrial and commercial sites, and, thus, the scope of the investigation did not allow for an ecological or phytotoxicity assessment of the soil. NEPM 1999 as amended 2013, however, provides ecological investigation levels (EIL) and ecological screening levels (ESL) for some contaminants in soil for industrial and commercial sites. The EILs have been developed for selected metals and organic substances and are applicable for assessing risk to terrestrial ecosystems and generally apply to the top 2 m of soil. ESLs have been developed for selected petroleum hydrocarbon compounds and total petroleum hydrocarbon (TPH) fractions and are also applicable for assessing risk to terrestrial ecosystems and also generally apply to the top 2 m of soil. In addition, Section 3.4.2 of NEPM 1999 as amended 2013 states that: the relevance and scope of ecological assessment should be considered early in the development of the conceptual site model and data quality objectives; and commercial and industrial sites may have large building structures and extensive areas covered with concrete, other pavement or hardstand materials and may have limited environmental values requiring consideration while in operational use.

Schedule B5a Guidelines on Ecological Risk Assessment, specifically states that 'commercial and industrial land, particularly in long-established industrial areas, is often heavily contaminated by past activities or fill materials used to level the area. In these cases, jurisdictions may determine that HIL

are the most appropriate soil quality criteria and that EILs are not applicable. In many cases, the only generic ecological value for this land use will be 'transitory wildlife'. It is therefore considered that the application of EIL and ESL to the areas proposed to be covered in by the University building is not considered warranted as there is limited environmental value to be maintained within these areas.

NEPM 1999 as amended 2013 provides 'management limits' for TPH fractions, which are applied after consideration of relevant ESLs and HSLs. Management limits have been included to avoid or minimise the following potential effects of petroleum hydrocarbons on:

- formation of light non-aqueous phase liquids (LNAPL);
- fire and explosive hazards; and
- effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons.

The presence of site TRH contamination at the levels of the management limits does not imply that there is no need for administrative notification or controls in accordance with jurisdictional requirements. Management limits for commercial and industrial sites are shown in Table 5 and have been adopted as site assessment criteria, secondary to criteria for health and ecological assessment.

Table 5: Management Limits for TRH fractions in soil

TRH fraction	Soil Texture	Management Limit (mg/kg)
C ₆ -C ₉	Coarse	700
	Fine	800
>C ₁₀ -C ₁₆	Coarse	1,000
	Fine	1,000
>C ₁₆ -C ₃₄	Coarse	3,500
	Fine	5,000
>C ₃₄ -C ₄₀	Coarse	10,000
	Fine	10,000

10.3 Groundwater

For assessing groundwater quality, the potential uses of groundwater at, or down-gradient of, the site have been considered. Potential uses at, or down-gradient of, the site may include:

- Groundwater discharge to water bodies sustaining aquatic ecosystems. Eastlakes is the most likely receptor of groundwater, 2.5 km south-west of the site;
- Extraction for irrigation of gardens (considered possible); and
- Potential potable use (considered unlikely).

It is anticipated that abstraction of groundwater for potable use between the site and Eastlakes will not occur in the future. It is therefore considered that any contamination encountered in groundwater at the site does not require assessment for the protection of drinking water resources.

Given that Eastlakes is a freshwater creek and is considered to be an ecological receptor of groundwater migrating from the site, the groundwater investigation levels (GILs) adopted for the assessment are sourced from the Australian and New Zealand Conservation Council (ANZECC), and Agriculture, and Resource Management Council of Australia and New Zealand (ARMCANZ) *Australian Water Quality Guidelines 2000* values for the protection of, as a minimum, 95% of freshwater aquatic species. Selected moderate to high reliability trigger values from the guidelines are also listed in Table 1C, Schedule B1 of NEPM 2013. Exceedance of the criteria does not necessarily mean that a substance will cause ecological harm, but prompts further investigations involving an evaluation of risk to assess whether harmful effects may occur as a result of the exceedance.

The adopted GILs for analytes and the corresponding source documents are shown in Table 6. Note that the table does not provide GILs for all chemicals tested for this assessment, but does provide applicable GILs for all chemicals detected in laboratory analysis, excluding TRH.

ANZECC & ARMCANZ, 2000 provides trigger values for individual (speciated) phenols, but not for total phenols. The detection limit for total phenols has been used as a screening criterion and is listed in Table 6 as a GIL.

Table 6: Groundwater Investigation Levels

Contaminant	GIL [µg/L]	Source of GIL
Polycyclic Aromatic Hydrocarbons Naphthalene	16	ANZECC & ARMCANZ (2000) low to moderate reliability trigger values, Australian Water Quality Guidelines for the protection of 95% of fresh water species
Benzo(a)pyrene	0.1	ANZECC & ARMCANZ (2000) low reliability trigger value, Australian Water Quality Guidelines for the protection of 99% of fresh water species.
Phenols Total Phenolics	50	Detection limit used as screening criterion in absence of guideline value.
Phenol	320	ANZECC & ARMCANZ (2000) Australian Water Quality Guidelines for the protection of 95% of fresh water species.
2-Chlorophenol 2,4-Dichlorophenol 2,4,6-Trichlorophenol 2,3,4,6-Tetrachlorophenol Pentachlorophenol	340 120 3 10 3.6	ANZECC & ARMCANZ (2000) Australian Water Quality Guidelines for the protection of 99% of fresh water species.
Metals Arsenic (III) Arsenic (V) Cadmium Chromium (III) Chromium (VI) Copper Lead Nickel Zinc	24 13 0.2(S), 0.5(M), 0.8(H), 1.1(VH), 2(EH) 3.3(S), 8.3(M), 12(H), 16(VH), 28(EH) 1.0 1.4(S), 3.5(M), 5.5(H), 7.3(VH), 12.6(EH) 3.4(S), 14(M), 26(H), 40(VH), 91(EH) 11(S), 28(M), 43(H), 57(VH), 99(EH) 8(S), 20(M), 31(H), 41(VH), 72(EH)	ANZECC & ARMCANZ (2000) low to high reliability trigger values, Australian Water Quality Guidelines for the protection of 95% of fresh water species. Trigger values have been adjusted for hardness where applicable: S – Soft, M – Moderate, H – Hard, VH – Very hard, EH – Extremely hard.
Mercury (inorganic)	0.06	ANZECC & ARMCANZ (2000) Australian Water Quality Guidelines for the protection of 99% of fresh water species.
Organochlorine Pesticides Chlordane DDT Hetptachlor	0.03 0.006 0.01	ANZECC & ARMCANZ (2000) Australian Water Quality Guidelines for the protection of 99% of fresh water species.
Polychlorinated Biphenyls Aroclor 1242 Aroclor 1254	0.3 0.01	ANZECC & ARMCANZ (2000) Australian Water Quality Guidelines for the protection of 99% of fresh water species
Organophosphate Pesticides Diazinon Dimethoate Chloropyrifos Malathion Azinophos methyl Fenitrothion Parathion (ethyl)	0.01 0.15 0.01 0.05 0.02 0.2 0.004	ANZECC & ARMCANZ (2000) Australian Water Quality Guidelines for the protection of 95% of fresh water species

11. Results

11.1 Field Observations - Soil

Details of the sub-surface conditions encountered during the course of the investigation are included in the Bore Report Sheets in Appendix C. The bore locations are shown on Drawing 1, Appendix A.

A summary of the sub-surface conditions encountered at the bore locations is as follows:

- **PAVEMENTS:** concrete approximately 0.1 m to 0.2 m thick in BH2 to BH5, with roadbase approximately 0.1 m thick in BH2 and BH3. Brick paving approximately 0.1 m thick was intersected at the surface in BH6;
- **FILLING:** apparently variably compacted, sand, silty sand and sandy clay filling in all boreholes, extending to depths of between 0.4 m and 1.5 m in BH1 to BH4 and BH6. Filling extended to 3.4 m depth in BH5 below the existing raised ground level (i.e. approximately 2.2 m higher than the surrounding lower area) in the north-eastern corner. Some of the filling had inclusions of sandstone gravel and cobbles, concrete, plastic, brick and rootlets;
- **SAND:** below the filling, apparently medium dense, fine to medium grained sand to 0.6 m depth in BH2. In boreholes BH1, BH5 and BH6, loose and medium dense sand extended to greater depths of between 3.8 m and 6.2 m;
- **SANDSTONE:** sandstone bedrock was encountered at depths of between 0.4 m (RL 52.7) and 6.2 m (RL 48.9). The sandstone included variable, extremely low to medium strength sandstone (with a thin siltstone layer in BH2 and BH3) overlying more uniform medium strength (or stronger) rock at depths of between 3.5 m (RL 49.7) and 6.5 m (RL 48.6). It is noted that a layer (0.7 – 1.5 m thick) of medium and high strength sandstone was encountered at shallower depths in BH2, BH3 and BH4. This thin layer was underlain by variable lower strength rock overlying consistent medium strength (or stronger) rock. Weathered dyke material or igneous rock, which was encountered at the nearby Wallace Wurth Building and Building C25, were not encountered within the boreholes of the current investigation;
- Apart from a trace or limited presence of anthropogenic materials in filling, no indicators of potentially significant contamination were noted in any of the bores; and
- Groundwater was not encountered during drilling.

All PID readings were found to be less than 1ppm, suggesting a low probability of the presence of volatile contaminants in the soil samples.

11.2 Field Observations – Groundwater

Groundwater levels were measured immediately prior to development and immediately prior to sampling. Table 7 shows the measured groundwater levels and the volume of water removed for well development.

Table 7: Groundwater Levels

Date Well Installed	Date Well Developed	Date Well Measured	Groundwater Depth m bgl (RL)	
			BH1	BH4
5 June 2013	12 June 2013	19 June 2013	3.7 (49.4)	1.9 (51.3)

Water sampled from each of the wells appeared turbid with silty sand observed in water from both wells, BH1 appearing less turbid than BH4. No obvious signs of apparent contamination i.e. phase separate hydrocarbons (PSH) or odours, were observed or detected in either of the monitoring wells.

The groundwater monitoring wells in BH1 and BH4 were purged using a low flow pump, after which field measured parameters were considered to have stabilised. The following stabilised readings were obtained for pH, electrical conductivity, redox, dissolved oxygen and temperature.

Table 8: Stabilised Groundwater Readings Prior to Sampling

Well (bore)	pH	Electrical Conductivity (µs)	Dissolved Oxygen (ppm)	Temperature (°C)	Redox (mV)
BH1	6.21	21.1/17.8	5.4	19.7	-60.9
BH4	6.56	3.81/3.4	3.48	19.5	130.4

Details of the groundwater field sheets are presented in Appendix C.

11.3 Analytical Results

The results of laboratory analysis are summarised in the following tables:

- Table 9: Summary Results of Soil Analysis for Contamination Assessment
- Table 9A: Summary Results of Soil Analysis for Waste Classification
- Table 10: Summary of Results of Water Analysis

The full laboratory reports together with the chain of custody and sample receipt information are presented in Appendix D.

Table 9: Summary Results of Soil Analysis for Contamination Assessment (All results in mg/kg unless otherwise stated)

Sample Identification			Heavy Metals								PAH		TRH and BTEXN													OCP									PCB	Phenols	Asbestos	
Sample Location	Sample Depth Range (m)	Soil Type	Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Benzo(a)pyrene TEQ	Total +ve PAHs	TRH C6-C10 less BTEX	TRH >C10-C16 less Naphthalene	TRH C6-C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	TRH C6 - C9	TRH +C10 - C36	Naphthalene	Benzene	Toluene	Ethylbenzene	Total Xylene	DDT+DDE+DDD	Aldrin + Dieldrin	Chlordane	Endosulfan (total)	Endrin	Heptachlor	HCB	Methoxychlor					
Current Investigation Results																																						
BH1	0.5-0.6	Filling	<4	<0.4	6	16	51	0.2	6	55	<0.5	1	<25	<50	<25	<50	<100	<100	<25	<250	<0.1	<0.2	<0.5	<1	<3	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<5	NAD	
BH2	0.2-0.3	Filling	<4	<0.4	6	38	11	<0.1	15	22	<0.5	0.34	<25	<50	<25	<50	<100	<100	<25	<250	<0.1	<0.2	<0.5	<1	<3	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<5	NAD	
BH3	0.2-0.4	Filling	<4	<0.4	3	52	12	<0.1	2	17	<0.5	<0.1	<25	<50	<25	<50	<100	<100	<25	<250	<0.1	<0.2	<0.5	<1	<3	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<5	NAD	
BH4	0.22-0.4	Filling	<4	<0.4	4	23	37	0.1	2	42	<0.5	0.84	<25	<50	<25	<50	<100	<100	<25	<250	<0.1	<0.2	<0.5	<1	<3	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<5	NAD	
BH5	2.9-3.0	Filling	<4	<0.4	3	9	16	<0.1	2	17	<0.5	0.34	<25	<50	<25	<50	<100	<100	<25	<250	<0.1	<0.2	<0.5	<1	<3	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<5	NAD	
BH6	0.2-0.3	Filling	<4	<0.4	17	24	26	0.5	20	46	<0.5	3.2	<25	<50	<25	<50	<100	<100	<25	<250	<0.1	<0.2	<0.5	<1	<3	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<5	NAD	
BD2/050613	-	-	<4	<0.4	14	25	25	0.5	20	42	<0.5	0.27	<25	<50	<25	<50	<100	<100	<25	<250	<0.1	<0.2	<0.5	<1	<3	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<5	NAD	
Trip Spike	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	101%	101%	99%	99%	-	-	-	-	-	-	-	-	-	-	-	-	
Trip Blank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	
Site Assessment Criteria																																						
HIL or HSL (vapour intrusion)			3000	900	-	240000	1500	730	6000	400000	40	4000	250*	NL	-	-	-	-	-	-	-	NL	3*	NL	NL	230*	3600	45	530	2000	100	50	80	2500	7	-	NAD	
HSL (direct contact)			-	-	-	-	-	-	-	-	-	-	26,000	-	-	20,000	27,000	38,000	-	-	11,000	430	99,000	27,000	81,000	-	-	-	-	-	-	-	-	-	-	-	-	-
Management Limit			-	-	-	-	-	-	-	-	-	-	-	-	700**	1000	3500**	10000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes BD2/050613 is blind replicate of BH6/0.2-0.3
 NL Not Limiting
 NAD No asbestos detected at reporting limit of 0.1 g/kg; No respirable fibres detected
 * Only lowest HSL for vapour intrusion shown (HSL may be raised depending on soil type and soil depth)
 ** Only lowest management limit shown (management limit may be raised depending on soil type)

Table 9A: Summary Results of Soil Analysis for Waste Classification (All results in mg/kg unless otherwise stated)

Sample Identification			Heavy Metals						PAHs		Petroleum Hydrocarbons						OCP		PCB	Asbestos
Sample Location	Sample Depth Range (m)	Soil Type	Arsenic	Cadmium	Chromium	Lead	Mercury	Nickel	Benzo(a)pyrene	Total PAHs	TRH C6 - C9	TRH +C10 - C36 (Sum of total)	Benzene	Toluene	Ethylbenzene	Total Xylene	Endosulfan (total)	Total OCP	Total PCB	
Current Investigation Results																				
BH1	0.5-0.6	Filling	<4	<0.4	6	51	0.2	6	0.16	1	<25	<250	<0.2	<0.5	<1	<3	<0.1	<0.1	<0.1	NAD
BH2	0.2-0.3	Filling	<4	<0.4	6	11	<0.1	15	0.06	0.34	<25	<250	<0.2	<0.5	<1	<3	<0.1	<0.1	<0.1	NAD
BH3	0.2-0.4	Filling	<4	<0.4	3	12	<0.1	2	<0.05	<0.1	<25	<250	<0.2	<0.5	<1	<3	<0.1	<0.1	<0.1	NAD
BH4	0.22-0.4	Filling	<4	<0.4	4	37	0.1	2	0.09	0.84	<25	<250	<0.2	<0.5	<1	<3	<0.1	<0.1	<0.1	NAD
BH5	2.9-3.0	Filling	<4	<0.4	3	16	<0.1	2	0.11	0.34	<25	<250	<0.2	<0.5	<1	<3	<0.1	<0.1	<0.1	NAD
BH6	0.2-0.3	Filling	<4	<0.4	17	26	0.5	20	0.37	3.2	<25	<250	<0.2	<0.5	<1	<3	<0.1	<0.1	<0.1	NAD
BD2/050613		Filling	<4	<0.4	14	25	0.5	20	-	0.27	<25	<250	<0.2	<0.5	<1	<3	<0.1	<0.1	<0.1	NAD
General Solid Waste Thresholds without TCLP																				
CT1			100	20	100	100	4	40	0.8	NA	NA	NA	10	288	600	1000	60	NA	NA	NAD

Notes BD2/050613 is blind replicate of BH6/0.2-0.3

ND Not detected

NAD No asbestos detected at reporting limit of 0.1 g/kg; No respirable fibres detected

* Value for scheduled chemicals

NA Not applicable

Table 10: Summary of Results of Water Analysis (All results in µg/L unless otherwise stated)

Sample Location	Sample date	Heavy Metals (dissolved)								PAH			TRH								BTEX					PCB			OCP							Phenols	pH (pH units)	Hardness (mgCaCO3/L)
		Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Naphthalene	Benzo(a)pyrene	All other PAH	TRH C6-C10 less BTEX	TRH >C10-C16 less Naphthalene	TRH C6-C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	TRH C6 - C9	TRH +C10 - C36 (Sum of total)	Benzene	Toulene	Ethylbenzene	o-xylene	m+p-xylene	Arochlor 1242	Arochlor 1254	All other PCB	Heptachlor	Chlordane	DDT	Endrin	Endosulfan	All other OCP	Total Phenolics			
Current Investigation Results																																						
BH1	19-Jun-13	5	<0.1	32	<1	<1	<0.05	12	16	<0.1	<0.1	ND	<10	<50	<10	<50	<100	<100	<10	<250	<1	<1	<1	<1	<2	<0.01	<0.01	ND	<0.001	<0.002	<0.001	<0.001	<0.002	ND	<50	7.1	68 (M)	
BH4	19-Jun-13	3	<0.1	12	8	<1	<0.05	3	26	0.1	<0.1	ND	<10	<50	<10	<50	<100	<100	<10	<250	<1	<1	<1	<1	<2	<0.01	<0.01	ND	<0.001	<0.002	<0.001	<0.001	<0.002	ND	<50	4.1	120 (H)	
BD1/190613	19-Jun-13	3	<0.1	12	8	2	<0.05	2	31	<0.1	<0.1	ND	<10	<50	<10	<50	<100	<100	<10	<250	<1	<1	<1	<1	<2	<0.01	<0.01	ND	<0.001	<0.002	<0.001	<0.001	<0.002	ND	<50	-	-	
TS	19-Jun-13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94%	110%	106%	113%	110%	-	-	-	-	-	-	-	-	-	-	-	-	
TB	19-Jun-13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<2	-	-	-	-	-	-	-	-	-	-	-	-	
Assessment Criteria																																						
Groundwater Investigation Levels (GIL)	24 as As(III) 13 as As(V)	0.5 (M) 0.8 (H)	8.3 (M) 12 (H) as Cr(III) 1 as Cr(VI)	3.5 (M) 5.5 (H)	14 (M) 26 (H)	0.06	28 (M) 43 (H)	20 (M) 31 (H)	16	0.1	-	-	-	-	-	-	-	-	-	-	950	180	80	350	75+200	0.3	0.01	-	0.01	0.03	0.006	0.01	0.03	-	50	-	-	
HSLs for vapour intrusion	-	-	-	-	-	-	-	-	-	-	-	6000	NL	-	-	-	-	-	-	-	5000	NL	NL	NL	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
BD1/190613 is blind replicate of sample directly above
ND Not detected
- not defined/ not analysed/ not applicable
Bold Exceeds GIL
M Moderate water hardness
H Hard water
TS Trip Spike
TB Trip Blank

12. Review of Laboratory Results

12.1 Chemical Contaminants in Soil

Soil samples were assessed for a suite of potential contaminants of concern including heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), TRH, BTEX, PAH, PCB, OCP, phenols and asbestos.

The laboratory results (Table 9) indicated that all contaminant concentrations in the soil samples analysed were within the adopted health based SAC (HIL D).

12.2 Preliminary Waste Classification Results

12.2.1 Filling

Results shown in Table 9A have been compared to criteria sourced from *Waste Classification Guidelines* (revised December 2009). Results of preliminary waste classification testing indicate that concentrations of chemical contaminants are within the guideline values for General Solid Waste.

On this basis, the *in situ* fill observed during the testing to date, as detailed in the borehole logs, are assigned a provisional classification as General Solid Waste (non-putrescible). This provisional classification will require confirmation at the time of excavation and/or stockpiling, prior to off-site disposal, particularly given the variability of building rubble content (particularly in the vicinity of BH5). It is also recommended that an additional *in situ* assessment of the soils, using test pits, prior to commencement of excavation, but after the demolition of buildings, be carried out as additional contamination concerns (e.g. asbestos) may arise following demolition and previously inaccessible areas of the site can be accessed.

12.2.2 Natural Soil and Bedrock

The natural sand and sandstone encountered beneath the filling are considered to be generally classifiable as VENM provided that the material is not cross-contaminated or mixed with other non-VENM material. This preliminary classification remains subject to confirmation upon removal of the filling overburden and remaining free of demolition and other waste materials.

12.3 Chemical Contaminants in Groundwater

Groundwater samples were analysed for a variety of potential contaminants including heavy metals, TRH, BTEX, PAH, PCB, OCP and phenols.

The concentrations of heavy metals were below the PQL and/or less than the adopted GIL with exception of chromium in groundwater sample BH1 and copper in sample BH4 and its field replicate. Elevated levels of chromium and copper detected in groundwater are most likely to represent background impacts and are therefore not considered to be significant.

The concentrations of arsenic, cadmium, lead, mercury, nickel, zinc, TRH, PAH, BTEX, PAH, PCB, OCP and phenols were below the laboratory practical quantitation limits for both samples and, thus, below the GIL.

13. Discussion, Recommendations and Conclusion

Historical photos indicate that the north eastern portion of the University including the subject site was previously used as a quarry for the extraction of deeply weathered igneous material (essentially clay). The former quarry was backfilled in an uncontrolled manner with deep, contaminated and heterogeneous material. The discovery was made during a detailed site environmental investigation conducted by DP in 2006 for the Lowy Cancer Research Centre.

Based on site inspection and anecdotal information, an underground trade waste tank was identified between the BEES Work Area and Substation No. 6, a UPSS is located to the north of the eastern portion of the site and it is understood that two additional waste tanks may exist in an area to the east of the Biomedical Theatres. Above ground chemical waste and biowaste stores are also present at the site, and a substation is partly located at the site (located both sides of the site boundary).

A review of the site information and previous DP investigations triggered the requirement for soil and groundwater sampling. The primary objective of this investigation is to confirm that the former landfill activities occurred at the Lowy Cancer Research Centre has not affected the subject site, which would add significant restrictions on the proposed development.

A total of six bore locations were placed (where possible) along the boundary of the proposed building primarily for geotechnical purposes, two of which were positioned slightly outside of the site due to access constraints (i.e. site building/structures and internal underground services) and the operational status of the site (i.e. constant movement of delivery trucks and university staff). Two of the soil test bores were converted into groundwater monitoring wells to assess the quality of groundwater flowing into and exiting the site. Based on site observation, there was no visual or olfactory indication of significant contamination in soil and groundwater bores.

Relatively shallow sand filling (ranging from 0.4 m to 3.4 m) was encountered at the subject site and confirms that the subject site has not been part of the former landfill activities. This is further supported by analytical results which indicate non-detectable to low concentrations of contaminants in soil and groundwater.

Six soil samples and two groundwater samples were analysed for various combinations of the identified contaminants of concern. All contaminant concentrations in the soil samples analysed were within the adopted health based assessment criteria (HIL D). Asbestos was not detected. The groundwater results indicated that all organic contaminant concentrations were below the laboratory practical quantitation level, and that metals were either below the groundwater investigation levels or within expected background concentrations.

All total concentrations were within the General Solid Waste (non-putrescible) criteria for off-site disposal at landfill. No signs of environmental concerns such as staining or odour were noted in the fill during sampling. It is considered that the filling material described herein is suitable for disposal to a landfill licensed by EPA to accept General Solid Waste, provided the material is not cross-contaminated/ mixed with other non-reported material. If any issues of concern not identified herein

(such as oiliness, fibre cement, unnatural staining or odours) are observed during excavation, this classification would not apply and further assessment would be required.

In regards to the natural material at the site, based on the site observations and analytical results, the orange/brown/light grey fine to medium grained natural sandstone exhibits no signs of contamination and is classified as Virgin Excavated Natural Material (VENM) unless an issue of concern as described above was identified, in which case further assessment would be required.

Whilst no asbestos containing material was identified at the site, based on the presence of building rubble, in particular at BH5, it is considered that the possibility of asbestos being present in the filling cannot be ruled out as asbestos is commonly associated with building or demolition rubble. If asbestos-based materials are identified during excavation this may change the classification of the fill soil to Special Waste (Asbestos). Materials containing asbestos require to be disposed to a landfill licensed to accept Special Waste (Asbestos).

As part of the Review of Environmental Factors (REF) work (which does not form part of the SSD application) it is understood that:

- the UPSS will be removed by an experienced contractor in accordance with Australian Standard AS4976-2008 and the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008 and associated guidance issued by the EPA; and
- the existing underground trade waste tank(s) will be decommissioned and removed in accordance with the Department of Water and Energy Liquid Trade Waste Regulation Guidelines 2009.

Notwithstanding that soil and groundwater contamination were not identified, there was limited access resulting in a limited number of sample locations and that some bores were on the site boundary, it is therefore recommended that an Unexpected Finds Protocol is put in place prior to commencement of excavation to manage unexpected contamination (including asbestos). Given the above restrictions on sampling such contamination may exist between bore locations.

It is considered that, based on the results of the investigation, the site can be made suitable for the proposed use as an educational establishment. It is understood that any works required to render the site suitable for the proposed development will be undertaken as part of the Enabling Works (which are not part of the SSD application).

14. Limitations of this Report

Douglas Partners (DP) has prepared this report for the proposed Biological Sciences Project at The University of New South Wales, Botany Street, Kensington in accordance with DP's proposal dated and acceptance received from the University of New South Wales both dated 10 May 2013 and DP's proposal dated 10 October 2014 and acceptance received from Brookfield Multiplex Constructions Pty Ltd dated 14 October 2014. The initial investigation and reporting was carried out under a consultant's agreement dated 28 May 2013. This report is provided for the exclusive use of the University of New South Wales for the specific project and purpose 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. DP has necessarily relied upon information provided by the client and/or their agents.

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

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

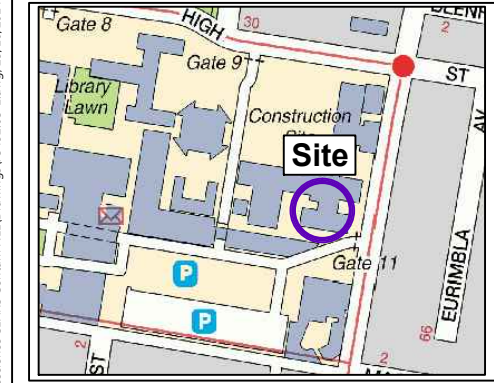
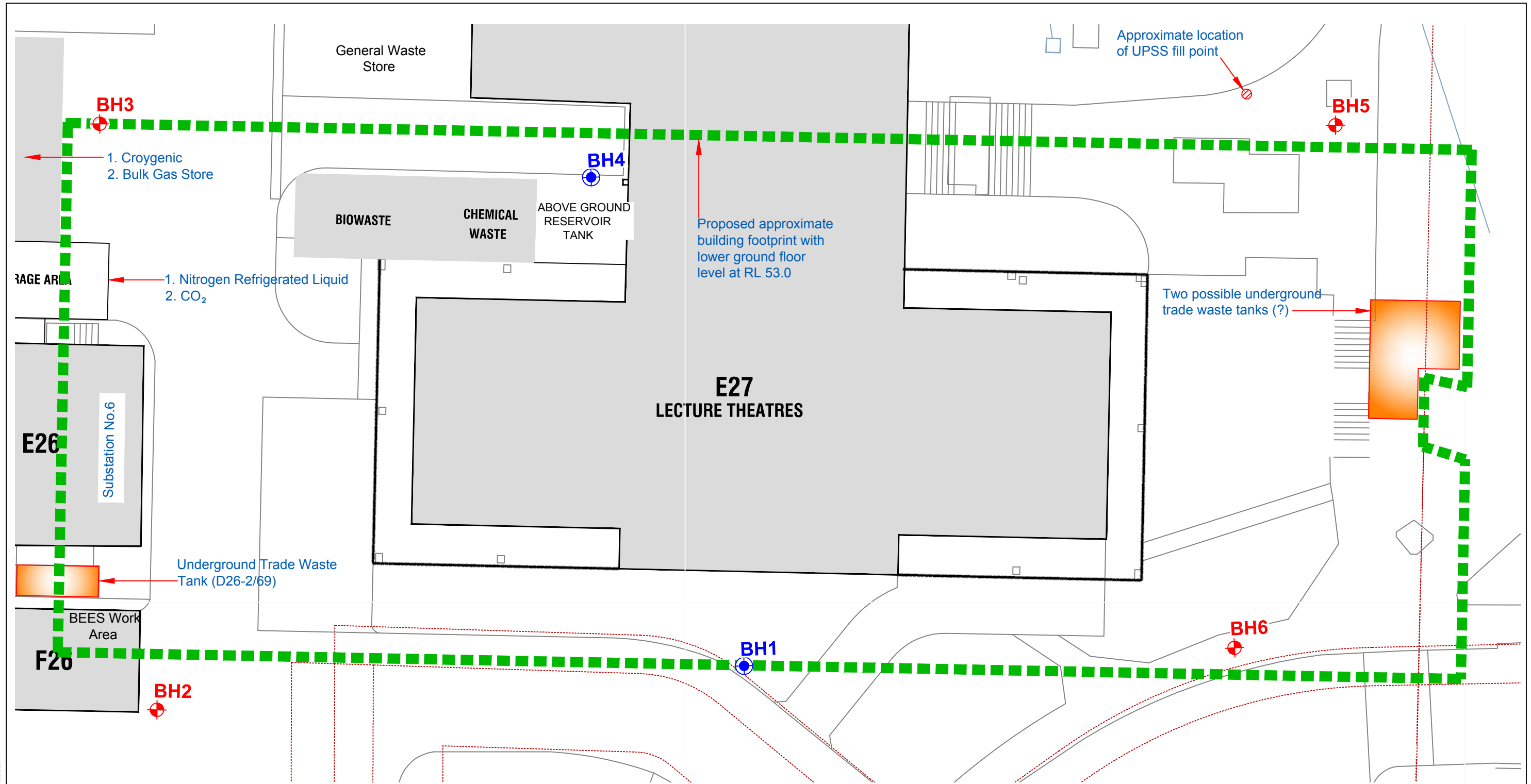
This report must be read in conjunction with all the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome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

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

Douglas Partners Pty Ltd

Appendix A

Drawings 1 & 2



NOTE: 1. Base drawing from UNSW Australia
(Dwg K-FME-2013.0002, dated 31.5.2013)
2. Test locations are approximate only and are
shown with reference to existing site features.



- LEGEND**
- Borehole
 - Borehole and Groundwater Monitoring Well

	CLIENT: Brookfield Multiplex Construction Pty Ltd		TITLE: Location of Boreholes and Site Features Proposed Biomedical Theatres Upgrade, Gate 11 Botany Street University of New South Wales, KENSINGTON		PROJECT No: 73492.03
	OFFICE: Sydney	DRAWN BY: PSCH			DRAWING No: 1
	SCALE: 1:200 @ A3	DATE: 29.10.2014			REVISION: 0



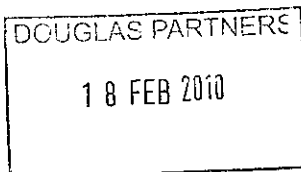
Appendix B

Site History Information

Site Photographs

PLANNING CERTIFICATE

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979



ABN 77 362 844 121

DATE OF CERTIFICATE
CERTIFICATE no.
ASSESSMENT no.
RECEIPT no.
AMOUNT

16-Feb-2010
21015
12133
2404702
100.00

Douglas Partners
96 Hermitage Rd
WEST RYDE NSW 2114

Description of land

Address:

330 Anzac Parade, KENSINGTON NSW 2033

Property Description:

LOT 1 DP 510271 -MAIN CAMPUS & DP 1038595

EAST, LOT 3 DP 1104617 DOWN CAMPUS, LOT 1 DP 522797 NEW COLLEGE, LOT 2 DP 522797 WARRANE COLLEGE, LOT 4 DP 553914 SHALOM COLLEGE, Cumberland

In accordance with the requirements of Section 149 of the Environmental Planning and Assessment Act 1979 (as amended), the following prescribed matters relate to the land at the date of this certificate.

INFORMATION PROVIDED UNDER SECTION 149 (2)

1 Names of relevant planning instruments and DCPs

- (1) The name of each environmental planning instrument that applies to the carrying out of development on the land.*
- (2) The name of each proposed environmental planning instrument that will apply to the carrying out of development on the land and that is or has been the subject of community consultation or on public exhibition under the Act (unless the Director-General has notified the council that the making of the proposed instrument has been deferred indefinitely or has not been approved).*
- (3) The name of each development control plan that applies to the carrying out of development on the land.*
- (4) In this clause, proposed environmental planning instrument includes a planning proposal for a LEP or a draft environmental planning instrument*

Response

- (1) Randwick Local Environmental Plan 1998 (Consolidation) gazetted on 15 January 2010, and relevant State Environmental Planning Policies (SEPPs) applies to the land. Refer to Attachment **A**.
- (2) Refer to Attachment **B**
- (3) Refer to Attachment **C**
- (4) Refer to Attachment **B**

2 Zoning and land use under relevant LEPs

For each environmental planning instrument or proposed instrument referred to in clause 1 (other than a SEPP or proposed SEPP) that includes the land in any zone (however described)

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- (a) the identity of the zone, whether by reference to a name (such as "Residential Zone" or "Heritage Area") or by reference to a number (such as "Zone No 2 (a)"),
- (b) the purposes for which the instrument provides that development may be carried out within the zone without the need for development consent,
- (c) the purposes for which the instrument provides that development may not be carried out within the zone except with development consent,
- (d) the purposes for which the instrument provides that development is prohibited within the zone,
- (e) whether any development standards applying to the land fix minimum land dimensions for the erection of a dwelling- house on the land, and if so, the minimum land dimensions so fixed,
- (f) whether the land includes or comprises critical habitat,
- (g) whether the land is in a conservation area (however described),
- (h) whether an item of environmental heritage (however described) is situated on the land.

Response

(a) **Zone No. 5** (Special Uses Zone)

(b) & (c) & (d) Refer to Attachment **D**.

(e) There are no dimensions applying in relation to the erection of a dwelling house on the land (for 5).

(f) The land DOES NOT include or comprise a critical habitat area under the provisions of the Threatened Species Conservation Act 1995.

(g) The land **IS** located in a heritage conservation area under the provisions of Randwick Local Environmental Plan 1998 (Consolidation).

(h) The land **IS NOT** listed as a heritage item under the provisions of Randwick local Environmental Plan 1998 (Consolidation),

The land **IS NOT** listed on the State Heritage Register under Heritage Act 1977.

3 Complying Development

(1) Whether or not the land is land on which complying development may be carried out under each of the Codes for complying development in State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

(2) If complying development may not be carried on that land because of one or more requirements under clause 1.19 of the Policy, why it may not be carried out.

Response

General Housing Code

(2) Complying development under the General Housing Code **MAY NOT** be carried out on the land. The land is:

- land within a **heritage conservation area** or a draft heritage conservation area.

Housing Internal Alterations Code

(1) Complying development under the Housing Internal Alterations Code **MAY** be carried out on the land.

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General Commercial and Industrial Code

(1) Complying development under the General Commercial and Industrial Code MAY be carried out on the land.

A copy of the Codes SEPP is available at www.planning.nsw.gov.au. For further information please call the Department of Planning's Information Centre on Freecall 1300 305 695 or 02 9228 6333.

Note: To be complying development, the development must meet the General requirements set out in clause 1.18 of the Codes SEPP. Development must also meet all development standards set out in the relevant code.

4 Coastal protection

Whether or not the land is affected by the operation of section 38 or 39 of The Coastal Protection Act 1979, but only to the extent that the council has been so notified by the Department of Public Works.

Response

Council HAS NOT been notified by the Department of Public Works that the land is affected by the operation of section 38 or 39 of the Coastal Protection Act 1979.

5 Mine subsidence

Whether or not the land is proclaimed to be a mine subsidence district within the meaning of section 15 of the Mine Subsidence Compensation Act 1961.

Response

The land IS NOT proclaimed to be a mine subsidence district within the meaning of section 15 of the Mine Subsidence Compensation Act 1961.

6 Road widening and road realignment

Whether or not the land is affected by any road widening or road realignment under:

- (a) Division 2 of Part 3 of the Roads Act 1993, or*
- (b) any environmental planning instrument, or*
- (c) any resolution of the council.*

Response

(a) The land IS NOT affected by any road widening or road realignment under Division 2 of Part 3 of the Roads Act 1993.

(b) The land IS NOT affected by any road widening or road realignment under the provisions of Randwick Local Environmental Plan 1998 (Consolidation).

(c) The land IS NOT affected by any resolution of the Council for any road widening or road realignment.

7 Council and other public authority policies on hazard risk restrictions

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Whether or not the land is affected by a policy:

- (a) adopted by the council, or
(b) adopted by any other public authority and notified to the council for the express purpose of its adoption by that authority being referred to in planning certificates issued by the council that restricts the development of the land because of the likelihood of land slip, bushfire, (other than flooding), tidal inundation, subsidence, acid sulphate soils or any other risk.

Response

- (a) The land IS affected by a policy adopted by the council as follows:

Contaminated Land Policy. This policy does not specifically identify the subject land (or any other land) as contaminated. The policy does, however, apply to all land in the City of Randwick. The policy requires Council to consider the possibility of land contamination and its implications for any proposed or permissible future uses of the land, including all rezoning, subdivision and development applications. This policy will restrict development of land:

- (1) which is affected by contamination; or
- (2) which has been used for certain purposes; or
- (3) in respect of which there is not sufficient information about contamination; or
- (4) which is proposed to be used for certain purposes; or
- (5) in other circumstances contained in the policy.

The Council HAS NOT adopted by resolution a policy that restricts the development of the subject land by reason of the likelihood of land slip, bush fire, tidal inundation subsidence or any other risk, (other than flooding).

- (b) The land IS NOT affected by a policy adopted by any other public authority and notified to the council for the express purpose of its adoption by that authority being referred to in planning certificates issued by the council that restricts the development of the land because of the likelihood of land slip, bushfire, tidal inundation, subsidence, acid sulphate soils or any other risk. (other than flooding).

7A Flood related development controls information

- (1) *Whether or not development on that land or part of the land for the purposes of dwelling houses, dual occupancies, multi dwelling housing or residential flat buildings (not including development for the purposes of group homes or seniors housing) is subject to flood related development controls.*
- (2) *Whether or not development on that land or part of the land for any other purpose is subject to flood related development controls.*
- (3) *Words and expressions in this clause have the same meanings as in the instrument set out in the Schedule to the Standard Instrument (Local Environmental Plans) Order 2006.*

Response

- (1), (2) The land IS NOT subject to flood related development controls.

8 Land reserved for acquisition

Whether or not any environmental planning instrument or proposed environmental planning instrument referred to in clause 1 makes provision in relation to the acquisition of the land by a public authority, as referred to in section 27 of the Act.

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Response

The land IS NOT affected by any environmental planning instrument or proposed environmental planning instrument referred to clause 1 that makes provision in relation to the acquisition of the land by a public authority, as referred to in Section 27 of the Act.

9 Contributions plans

The name of each contributions plan applying to the land.

Response

Section 94A Development Contributions Plan (effective July 2007)

10 (Repealed)

11 Bush fire prone land

If any of the land is bush fire prone land (as defined in the Act), a statement that all or, as the case may be, some of the land is bush fire prone land.

If none of the land is bush fire prone land, a statement to that effect.

Response

The land IS NOT bush fire prone land.

12 Property vegetation plans

If the land is land to which a property vegetation plan under the Native Vegetation Act 2003 applies, a statement to that effect (but only if the council has been notified of the existence of the plan by the person or body that approved the plan under that Act).

Response

The land IS NOT land to which a property vegetation plan applies.

13 Orders under Trees (Disputes Between Neighbours) Act 2006

Whether an order has been made under Trees (Disputes Between Neighbours) Act 2006 to carry out work in relation to a tree on the land (but only if the council has been notified of the order).

Response

The land IS NOT land to which an order under Trees (Disputes Between Neighbours) Act 2006 applies

14 Directions under Part 3A

If there is a direction by the Minister in force under section 75P (2) (c1) of the Act that a provision of an environmental planning instrument prohibiting or restricting the carrying out of a project or a stage of a project on the land under Part 4 of the Act does not have effect, a statement to that effect identifying the provision that does not have effect.

Response

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There IS NOT a direction by the Minister under section 75P (2) (c1) of the Act that a provision of an environmental planning instrument does not have effect.

15 Site compatibility certificates and conditions for seniors housing

If the land is land to which State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 applies:

(a) a statement of whether there is a current site compatibility certificate (of which the council is aware), issued under clause 25 of that Policy in respect of proposed development on the land and, if there is a certificate, the statement is to include:

- (i) the period for which the certificate is current, and*
- (ii) that a copy may be obtained from the head office of the Department of Planning, and*
- (b) a statement setting out any terms of a kind referred to in clause 18 (2) of that Policy that have been imposed as a condition of consent to a development application granted after 11 October 2007 in respect of the land.*

Response

(a) The land IS NOT subject to a current site compatibility certificate (of which the council is aware) issued under clause 25 of the State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004.

16 Site compatibility certificates for infrastructure

A statement of whether there is a valid site compatibility certificate (of which the council is aware), issued under clause 19 of State Environmental Planning Policy (Infrastructure) 2007 in respect of proposed development on the land and, if there is a certificate, the statement is to include:

- (a) the period for which the certificate is valid, and*
- (b) that a copy may be obtained from the head office of the Department of Planning.*

Response

The land IS NOT subject to a valid site compatibility certificate (of which the Council is aware), issued under clause 19 of State Environmental Planning Policy (Infrastructure) 2007.

17 Site compatibility certificates and conditions for affordable rental housing

(1) A statement of whether there is a current site compatibility certificate (affordable rental housing), of which the council is aware, in respect of proposed development on the land and, if there is a certificate, the statement is to include:

- (a) the period for which the certificate is current, and*
- (b) that a copy may be obtained from the head office of the Department of Planning.*
- (2) A statement setting out any terms of a kind referred to in clause 17 (1) or 37 (1) of State Environmental Planning Policy (Affordable Rental Housing) 2009 that have been imposed as a condition of consent to a development application in respect of the land.*

Response

The land IS NOT subject to a valid site compatibility certificate (of which the council is aware) for affordable rental housing.

Contaminated Land Management Act 1997

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Note. The following matters are prescribed by section 59 (2) of the Contaminated Land Management Act 1997 as additional matters to be specified in a planning certificate:

- (a) that the land to which the certificate relates is significantly contaminated land within the meaning of that Act—if the land (or part of the land) is significantly contaminated land at the date when the certificate is issued,
- (b) that the land to which the certificate relates is subject to a management order within the meaning of that Act—if it is subject to such an order at the date when the certificate is issued,
- (c) that the land to which the certificate relates is the subject of an approved voluntary management proposal within the meaning of that Act—if it is the subject of such an approved proposal at the date when the certificate is issued,
- (d) that the land to which the certificate relates is subject to an ongoing maintenance order within the meaning of that Act—if it is subject to such an order at the date when the certificate is issued,
- (e) that the land to which the certificate relates is the subject of a site audit statement within the meaning of that Act—if a copy of such a statement has been provided at any time to the local authority issuing the certificate.

Response on Note

(a) The land IS NOT significantly contaminated land within the meaning of the Contaminated Land Management Act 1997.

(b) The land IS NOT subject to a management order within the meaning of the Contaminated Land Management Act 1997.

(c) The land IS NOT the subject of an approved voluntary management proposal within the meaning of the Contaminated Land Management Act 1997.

(d) The land IS the subject to an ongoing maintenance order within the meaning of the Contaminated Land Management Act 1997.

(e) Council **HAS** received a copy of a site audit statement, within the meaning of the Contaminated Land Management Act 1997, for this land.

INFORMATION PROVIDED UNDER SECTION 149(5)

Additional Relevant Matters

At the date of this certificate, the following relevant matters affecting the land are provided in good faith in accordance with the requirements of Section 149(5) of the Environmental Planning and Assessment Act 1979.

NOTE: When information pursuant to Section 149 (5) is requested the Council is under no obligation to furnish any of the information supplied herein pursuant to that Section. Council draws your attention to Section 149(6) of the Act which states that a Council shall not incur any liability in respect of any advice provided in good faith pursuant to subsection 149 (5). The absence of any reference to any matter affecting the land shall not imply that the land is not affected by any matter not referred to in this Certificate.

Council resolutions to prepare draft Local Environmental Plans

Refer to Attachment **E** for advice on Council resolutions under section 54 of the Environmental Planning and Assessment Act 1979 (as amended) to prepare draft Local Environmental Plans.

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Development Consents since 1 July 1991

Development consent(s) **HAS** been granted with respect to the subject land since 1 July 1991.

Tree Preservation Orders

The land **IS** affected by a Tree Preservation Order made under clause 28 of Randwick Local Environmental Plan 1998 (Consolidation).

Foreshore Scenic Protection Areas

The land **IS NOT** within a Foreshore Scenic Protection Area as identified in Randwick Local Environmental Plan 1998 (Consolidation).

Foreshore Building Line

The land **IS NOT** subject to a Foreshore Building Line that restricts development on the land.

Boarding Houses

The land **IS NOT** affected by clause 34 of Randwick Local Environmental Plan 1998 (Consolidation) applying to a building or place used for the purposes of a boarding house.

Licences Under The Water Act 1912

The Property **IS** within the ground water extraction embargo area or the water shortage zone declared under the Water Act 1912 (see attachment).

Aircraft Noise (ANEF)

This property **IS NOT** affected by aircraft noise levels as measured by the Australian Noise Exposure Forecast (ANEF) identified by Sydney Airport Corporation Limited (SACL), endorsed by Air Services Australia (ASA).

Zoran Curcic
Planning Research Officer

Per:

Date: 16-Feb-2010

Attachments

ATTACHMENT A	
Name of each environmental planning instrument that applies to the carrying out of development on the land	
Relevant State Environmental Planning Policy (SEPP)	
SEPP No. 1 - Development Standards	
SEPP No. 19 - Bushland in Urban Areas	
SEPP No. 32 - Urban Consolidation (Redevelopment of Urban Land)	
SEPP No. 33 - Hazardous and Offensive Development	
SEPP No. 55 - Remediation of Land	
SEPP No. 64 - Advertising and Signage	

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SEPP No. 65 - Design Quality of Residential Flat Development
SEPP No. 70 - Affordable Housing
SEPP No. 71 - Coastal Protection
SEPP - (Housing for Seniors or People with a Disability) 2004
SEPP - BASIX (Building Sustainability Index) 2004
SEPP - (Major Development) 2005
SEPP - (Mining, Petroleum Production and Extractive Industries) 2007
SEPP - (Temporary Structures and Places of Public Entertainment) 2007
SEPP - (Infrastructure) 2007
SEPP - Exempt and Complying Development Order 2008
SEPP - (Affordable Rental Housing) 2009
REP - Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Note: Any questions regarding State Environmental Planning Policies and Regional Environmental Plans should also be directed to the Department of Planning (02) 9228 6111 or www.planning.nsw.gov.au.

Local Environmental Plan (LEP)	
Randwick LEP 1998 (Consolidation)-gazetted 15 January 2010	
Amendment No. and Subject Land	Purpose
NIL	NIL

Updated 15 January 2010

ATTACHMENT B	
Name of each proposed environmental planning instrument that applies to the carrying out of development on the land	
Name	Purpose
Planning proposal:Reclassification of land at 64-66 Minneapolis Crescent, Maroubra (Lot 102 DP 855181) and 3/90-98 King Street, Randwick (Lot 3 SP 75411) from community lands to operational lands	Reclassification of land from community to operational lands to facilitate Randwick City Council's affordable housing program
Note: Draft Local Environmental Plan that is subject to community consultation or that has been placed on public exhibition under the Environmental Planning and Assessment Act, 1979.	

Updated 15 January 2010

ATTACHMENT C	
Name of each Development Control Plan that applies to the carrying out of development on the land	
Name of DCP and Effective Date	Purpose of DCP
Development Control Plan No. 6 Land bounded by Kemmis Street, Frenchmans Road and Clovelly Road, Randwick 20 June 1986	Redevelopment controls: height, floor space ratio, design guidelines.
Development Control Plan No. 8 Military Road & Bunnerong Road, Matraville 25 March 1987	Industrial development: access, landscaping, setbacks.
Development Control Plan No. 13 Bunnerong Power Station, Matraville 11 March 1990	Heritage Gardens, landscaped buffer zones, bushland, access restrictions.
Development Control Plan No. 16 Kingsford Commercial Centre 7 May 1996	Comprehensive DCP for commercial centre.
Development Control Plan No. 18 Randwick Bus Depot, cnr King & Dangar Streets, Randwick	Comprehensive redevelopment controls.

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14 July 1993 (amended 6 June 1995)	
Development Control Plan No. 21 Amusement Centres 2 May 1995	Requirements for installation of amusement machines.
Development Control Plan No. 22 The Spot & surrounds 24 October 1995	Comprehensive DCP for The Spot commercial centre.
Outdoor Advertising 4 August 1998	Guidelines and controls for outdoor advertising throughout the City of Randwick.
Parking 24 December 1998	Standards, guidelines and design parameters for parking, car parks and vehicle manoeuvring and access.
Randwick Junction Business Centre 18 February 1999.	Guidelines and controls for development in the Randwick Junction business centre. The centre is also a Heritage Conservation Area.
Eastern Suburbs Memorial Park 3 February 2000	Guidelines and controls for development of the Memorial Park.
Multi -unit Housing 20 December 2002.	Guidelines and controls for all multi-unit housing in the Residential 2B and 2C zones.
Dwelling Houses and Dual Occupancy 20 December 2002	Guidelines and controls for development for dwelling houses in all Residential zones and for Attached Dual Occupancy in the Residential 2A Zone.
Maroubra Beach Commercial Precinct 26 May 2000	Guidelines and controls for development in the Maroubra Beach Commercial Precinct.
Backpacker Accommodation 26 May 2000	Guidelines and controls for the establishment of backpacker accommodation.
Kensington Town Centre (2002) 22 January 2003	Guidelines and controls for development in the Kensington Town Centre.
Public Notification of Development Proposals 25 February 2003	Requirements for notifying the public about all development proposals, including master plans, lodged with Council.
Defence site Kingsford 21 May 2003	Guidelines and controls for the surplus Department of Defence land-Bundock Street, Randwick.
Maroubra Junction Town Centre 18 May 2004	Guidelines and controls for development in the Maroubra Junction Town Centre
Footpath Dining and Trading 27 July 2004	Guidelines for objectives & performance criteria for outdoor dining and trading activities on public footpaths, & associated public access.
Prince Henry Hospital Site -Little Bay 8 December 2004	Guidelines and controls for the redevelopment of the former Prince Henry Hospital Site at Little Bay.
Matraville Town Centre 29 August 2006	Guidelines and controls for development in the Matraville Town Centre
Royal Randwick Racecourse 8 May 2007	Planning provisions for land uses and development within the Royal Randwick Racecourse.
University of New South Wales- Kensington Campus 16 April 2007	Detailed planning provisions for land uses and development within the UNSW Kensington Campus.
Telecommunications and Radio-communications 1 October 2007	Controls and guidelines for the siting, design and installation of telecommunication and radio-communication facilities that require development consent
Exempt and Complying Development 15 January 2008	Detailed requirements for exempt and complying development
Adopted Master Plans/Now a Deemed DCP	

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NIL	NIL
Updated 15 January 2010	

ATTACHMENT D

Zone No 5 (Special Uses Zone)

1) The objectives of Zone No. 4B are:

- a) to accommodate development by public authorities on publicly owned land, and
- b) to accommodate development for educational, religious public transport or similar purposes on both publicly and privately owned land, and
- c) to enable associated and ancillary development, and
- d) to allow for a range of community uses to be provided to serve the needs of residents, workers and visitors, and
- e) to allow for the redevelopment of land no longer required for a special use.

2) Development for the purpose of the following does not require development consent:

Bushfire Hazard reduction	Recreation
Public Utility undertakings	Roads

3) Development for the purpose of the following requires development consent:

Animal establishments	Bed and breakfast accommodation
Boarding houses	Car parks
Cemeteries	Child care centres
Clubs	Communication facilities
Community facilities	Dwellings
Dwelling houses	Earthworks
Educational establishments	Health consulting rooms
Helicopter landing sites	Home activities
Hospitals	Markets
Multi-unit housing	Outdoor advertising
Penitentiaries	Places of worship
Plant nurseries	Public transport
Recreation facilities	Restaurants

4) Any development not included in subclause (2) or (3) is prohibited.

Updated 15 January 2010

ATTACHMENT E

Name of proposed environmental planning instrument, that includes a planning proposal for a LEP or a draft environmental planning instrument

DETAILS OF RESOLUTION	DATE OF RESOLUTION
Draft Randwick Comprehensive LEP applying city wide	24 June 2008
Note: Draft Local Environmental Plans that have yet to be placed on public exhibition under the Environmental Planning and Assessment Act, 1979.	

Updated 15 January 2010

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OTHER ATTACHMENTS (Note: if applicable)

Managing groundwater in the Botany Sands Aquifer*

Who manages groundwater?

The NSW Government through the Department of Water & Energy is responsible for the management of groundwater resources in NSW.

What is the Botany Sands Aquifer?

The botany Sands Aquifer is a large volume of underground water present in the sandy ground surrounding Botany Bay. The aquifer is highly vulnerable to contamination due to the permeability of the sands, and the generally shallow water table. Any contamination from land use activity that escapes or is spilled onto the ground is likely to accumulate in the earth and leach into the groundwater.

How is the NSW Government managing the aquifer?

While only a small proportion of the aquifer area is known to be contaminated the NSW government has taken a precautionary approach to ensure public health is not put at risk from exposure to potentially contaminated groundwater. As follows:

- Since August 2003 DNR has operated an embargo on the acceptance of new licence applications to extract groundwater. See the groundwater embargo area map.
- In August 2006 DNR divided part of this area into four management zones. See groundwater management zone map:
 - Zone 1 extraction exclusion all bore water use.
 - Zone 2, 3, & 4 Ban on domestic bore water use.
 - Zone 2, 3, & 4 industrial users must test their bore water annually and provide the results to the NSW Government.

More Information

Groundwater Management

Contact the NSW Government's Botany Groundwater Hotline for information 1800 237 012. Visit NSW Department of Water & Energy's website at www.DWE.NSW.gov.au

Health Risks

Residents concerned about possible health risks from previous exposure to groundwater in zones 1, 2, 3, 4 are encouraged to contact South Eastern Sydney Illawarra Public Health Unit on 02 9382 8333, or write to the Director, Public Health Unit, Locked Bag 88, Randwick NSW 2031.

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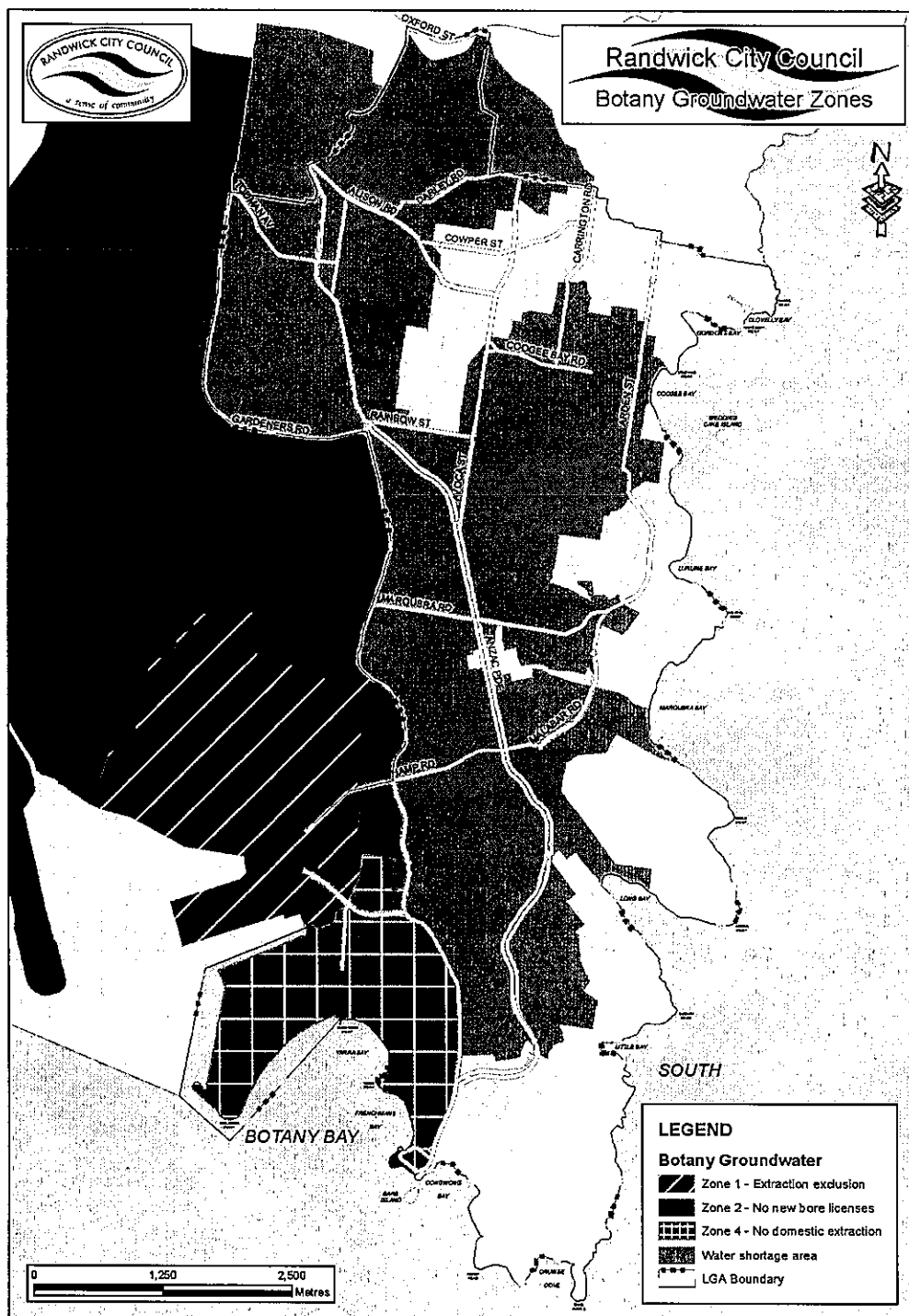




Photo 1 – Site access via Gate 11, Botany Street, Kensington



Photo 2 – Upper campus science laboratory workshop



Site Photographs

Proposed University Building Botany Street, Kensington (UNSW)

CLIENT: Brookfield Multiplex
Constructions Pty Ltd

PROJECT: 73492.03

PLATE No: 1

REV: 0

DATE: Oct 2014



Photo 3 – Dangerous goods stored to the west of the Biomedical Theatres.



Photo 4 – Liquid trade waste tank observed between the BEES Work Area and Substation No. 6.



Photo 5 – Substation No. 6



Photo 6 – Biological hazard waste, chemical waste and general waste storage area located at the rear of the Biomedical Theatres.



Site Photographs

**Proposed University Building
Botany Street, Kensington
(UNSW)**

CLIENT: Brookfield Multiplex
Constructions Pty Ltd

PROJECT: 73492.03

PLATE No: 3

REV: 0

DATE: Oct 2014



Photo 7 – Aboveground reservoir tank



Photo 8 – A landscaped garden area with above and underground services, concrete paths and stairs to the east.



Site Photographs

Proposed University Building
Botany Street, Kensington
(UNSW)

CLIENT: Brookfield Multiplex
 Constructions Pty Ltd

PROJECT: 73492.03

PLATE No: 4

REV: 0

DATE: Oct 2014



Fill Point

Photo 9 – Fill point for UPSS to the east of Building E27

t.



Site Photographs

**Proposed University Building
Botany Street, Kensington
(UNSW)**

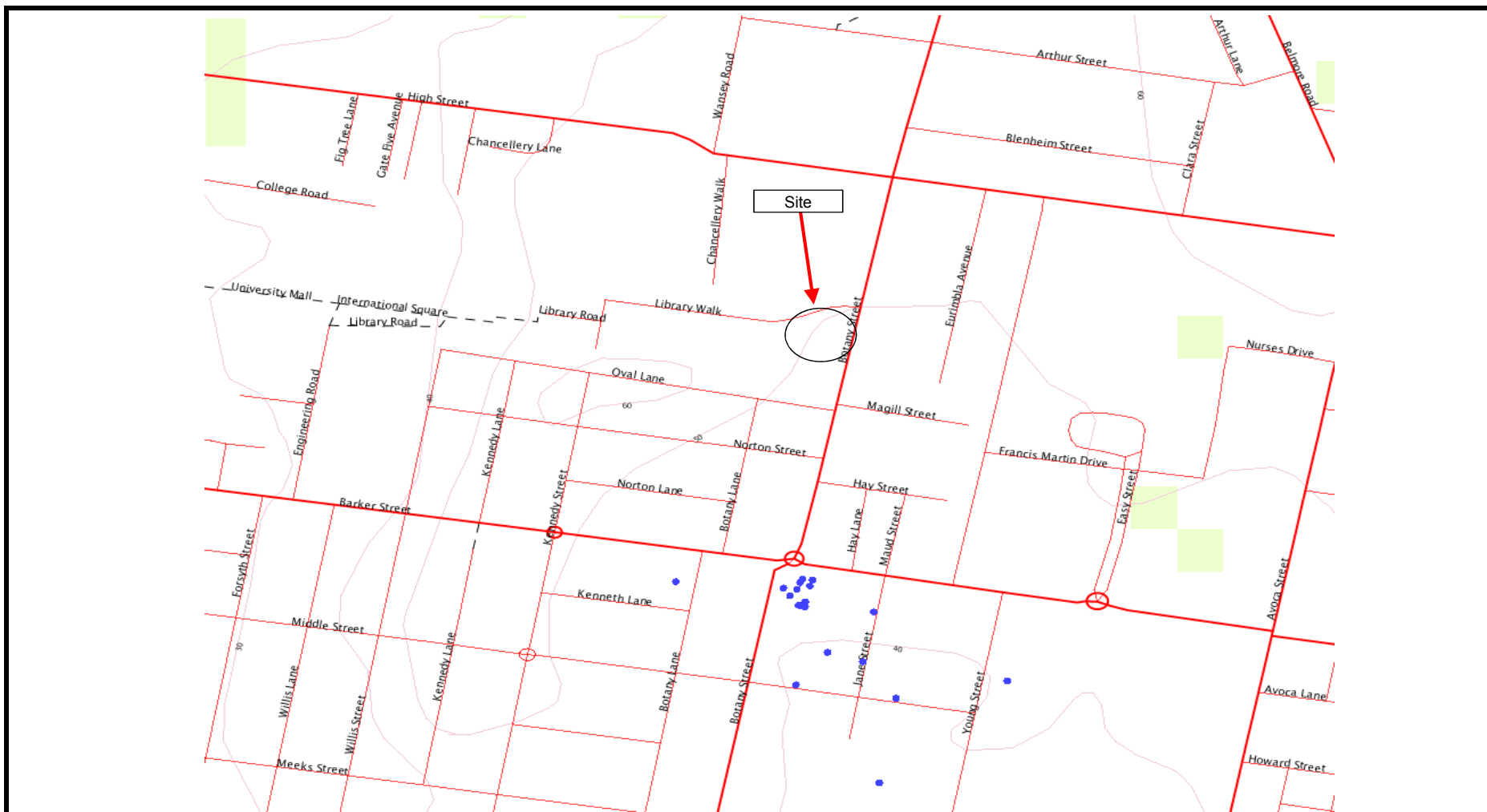
CLIENT: Brookfield Multiplex
Constructions Pty Ltd

PROJECT: 73492.03

PLATE No: 5

REV: 0

DATE: Oct 2014



Preliminary Site Investigation with Limited Sampling
Proposed Biomedical Theatres Upgrade, UNSW
Kensington

Project
73492.03

October
2014

NOW
BORES

Appendix C

Borehole Logs

Notes About this Report

Groundwater Field Sheet



Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:
4,6,7
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:
15, 30/40 mm

Sampling Methods

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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



Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

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

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

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

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

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

Definitions of grading terms used are:

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

Cohesive Soils

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

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

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

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

Soil Descriptions

Soil Origin

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

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

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



Rock Strength

Rock strength is defined by the Point Load Strength Index ($IS_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

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

* Assumes a ratio of 20:1 for UCS to $IS_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

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

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Douglas Partners



Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

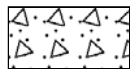
General



Asphalt



Road base



Concrete



Filling

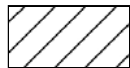
Soils



Topsoil



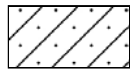
Peat



Clay



Silty clay



Sandy clay



Gravelly clay



Shaly clay



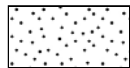
Silt



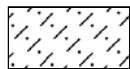
Clayey silt



Sandy silt



Sand



Clayey sand



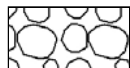
Silty sand



Gravel



Sandy gravel

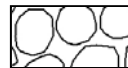


Cobbles, boulders



Talus

Sedimentary Rocks



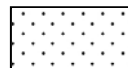
Boulder conglomerate



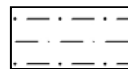
Conglomerate



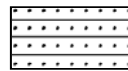
Conglomeratic sandstone



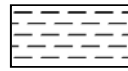
Sandstone



Siltstone



Laminite



Mudstone, claystone, shale

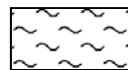


Coal

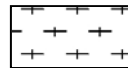


Limestone

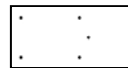
Metamorphic Rocks



Slate, phyllite, schist

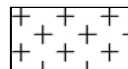


Gneiss

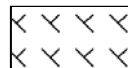


Quartzite

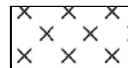
Igneous Rocks



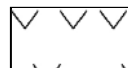
Granite



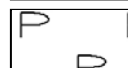
Dolerite, basalt, andesite



Dacite, epidote



Tuff, breccia



Porphyry

BOREHOLE LOG

CLIENT: The University of New South Wales
PROJECT: Proposed Building Upgrade
LOCATION: UNSW, Botany Road, Kensington

SURFACE LEVEL: 53.1 AHD[^]
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 73492
DATE: 5/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
53	0.2	FILLING - brown, silty sand filling. Some rootlets, organic matter and plastic debris, humid		D	0.0		PID<1 ppm		Gatic cover	
				D/E*	0.1				Gravel	
				B	0.3					
		FILLING - brown silty sand filling. Some rootlets, gravel and clay, humid		E	0.5		PID<1 ppm		Bentonite	
					0.6					
1	1.2	- concrete debris at 1.0m							1	
									Solid pipe	
	1.5	FILLING - light brown grey sand filling, damp (possibly natural)		E	1.4		PID<1 ppm		Gravel	
					1.5		3,3,5 N = 8			
		SAND - loose becoming medium dense, yellow brown, fine grained sand, damp		S	1.95		PID<1 ppm		2	
				A/E	2.1				Bentonite	
3	3.8	SANDSTONE - extremely low strength, light grey, fine to medium grained sandstone			3.0		18,8,8 N = 16		3	
				S	3.45					
		- very low to low strength below 4.4m							4	
	5.4	SANDSTONE - medium strength, slightly weathered, slightly fractured, light grey brown, medium to coarse grained sandstone			5.4		PL(A) = 0.7		5	
					5.5				Gravel	
	5.8	SANDSTONE - high strength, fresh, slightly fractured and unbroken, light grey, medium to coarse grained sandstone. Some siltstone/carbonaceous laminations			6.35		PL(A) = 1.1		6	
									Machine slotted PVC Screen	
				C	7.35		PL(A) = 1.5		7	
	8.42	Bore discontinued at 8.42m			8.3		PL(A) = 1.2		8	
					8.42				End cap	
	9								9	

RIG: Terrier

DRILLER: Tightsite

LOGGED: SI/AG

CASING: HQ to 5.0m

TYPE OF BORING: Vacuum excavation to 1.5m, solid flight auger to 5.4m, NMLC-Coring to 8.42m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Environmental sample duplicate BD1/050613, ^surface level interpolated from Dwg No K-FME-2013.0002, Rev A, 31.5.13. Groundwater well: slotted 2.4 - 8.4m, gravel backfill 2.4-8.4m, bentonite 2.0 - 2.4m, gatic cover at surface

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: The University of New South Wales
PROJECT: Proposed Building Upgrade
LOCATION: UNSW, Botany Road, Kensington

SURFACE LEVEL: 53.0 AHD[^]
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 73492
DATE: 5/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing							
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments	
8.0		CONCRETE																							
	0.2	ROADBASE - roadbase gravel																		D/E*					PID<1 ppm
	0.3																			D/E					PID<1 ppm
	0.4	FILLING - yellow brown sand filling, damp (possible natural)																		D/E					PID<1 ppm
	0.6																								
	1	SAND - apparently medium dense, yellow brown, fine to medium grained sand, damp																		A/E					PID<1 ppm
	1.8	SANDSTONE - extremely low then very low strength, extremely then highly weathered, light grey brown, sandstone																		A					80/30mm refusal
	2	SANDSTONE - high then medium to high strength, slightly weathered, slightly fractured, light grey brown, medium to coarse grained sandstone																		S					PL(A) = 1.8
	3																								PL(A) = 1
	3.3	SANDSTONE/SILTSTONE - very low strength, highly weathered, light grey brown, fine grained sandstone/siltstone																		C	90	52			PL(A) = 0.1
	3.9	SANDSTONE - low to medium then very low strength, slightly weathered, slightly fractured, light grey fine to medium grained sandstone																							PL(A) = 0.3
	4.92																								
	5	SANDSTONE - high strength, fresh, unbroken, light grey, medium to coarse grained sandstone																							PL(A) = 1.3
	6																			C	100	100			PL(A) = 1.2
	7																								PL(A) = 1.8
	8.0	Bore discontinued at 8.0m																							
	9																								

RIG: Terrier

DRILLER: Tightsite

LOGGED: SI/AG

CASING: HQ to 1.8m

TYPE OF BORING: Diatube to 0.2m, vacuum excavation to 0.8m, solid flight auger to 1.8m, NMLC-Coring to 8.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Environmental sample duplicate BD3/050613, ^surface level interpolated from Dwg No K-FME-2013.0002, Rev A, 31.5.13.

SAMPLING & IN SITU TESTING LEGEND

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



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: The University of New South Wales
PROJECT: Proposed Building Upgrade
LOCATION: UNSW, Botany Road, Kensington

SURFACE LEVEL: 53.1 AHD[^]
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 73492
DATE: 5/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
53	0.18	CONCRETE																			
	0.24	ROADBASE - roadbase gravel																E			PID<1 ppm
	0.4	FILLING - grey sandy clay filling with some gravel, damp																E			PID<1 ppm
1		SANDSTONE - very low strength, light grey, fine to medium grained sandstone																A/E			PID<1 ppm
52		low to medium strength below 1.1m																A			
2	1.8	SANDSTONE - high strength, moderately to slightly weathered, slightly fractured, brown then light grey brown, medium to coarse grained sandstone																			PL(A) = 2.5
51																					PL(A) = 1.3
3	2.95	SILTSTONE - very low and low strength, highly and slightly weathered, grey to dark grey laminated siltstone. Some carbonaceous laminations																C	75	59	
50																					PL(A) = 0.2
4	3.8	SANDSTONE - low to medium strength, slightly weathered, slightly fractured, light grey medium grained sandstone																			PL(A) = 0.3
49																					
5	4.5	SANDSTONE - medium to high then medium strength, slightly weathered then fresh, slightly fractured and unbroken, light grey, medium to coarse grained sandstone. Some siltstone and carbonaceous laminations																C	100	97	
48																					PL(A) = 1
6																					PL(A) = 1.2
47																					PL(A) = 0.5
																					PL(A) = 0.8
7	6.7	SANDSTONE - high strength, fresh, unbroken, light grey, medium to coarse grained sandstone																			PL(A) = 1.6
46																					
8																		C	100	100	
45																					PL(A) = 1.5
9																					PL(A) = 1.4
44																					
	9.75	Bore discontinued at 9.75m																			

RIG: Terrier

DRILLER: Tightsite

LOGGED: SI/AG

CASING: HQ to 1.6m

TYPE OF BORING: Diatube to 0.18m, vacuum excavation to 0.4m, solid flight auger to 1.8m, NMLC-Coring to 9.75m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Surface level interpolated from Dwg No K-FME-2013.0002, Rev A, 31.5.13.

SAMPLING & IN SITU TESTING LEGEND

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



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BOREHOLE LOG

CLIENT: The University of New South Wales
PROJECT: Proposed Building Upgrade
LOCATION: UNSW, Botany Road, Kensington

SURFACE LEVEL: 53.2 AHD[^]
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 73492
DATE: 5/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing			Water	Well Construction Details	
				Type	Depth	Sample			
53	0.22	CONCRETE	△ △						Top cap
		FILLING - dark brown, fine to medium grained sand filling with some crushed sandstone gravel and cobbles, damp		E	0.22		PID<1 ppm		Gravel
					0.4				Just pipe
					0.9		PID<1 ppm		Bentonite
1	1.1	SANDSTONE - very low strength, light grey, fine to medium grained sandstone		E	1.0			1	
		- low to medium strength below 1.5m		E	1.4		PID<1 ppm		
				A	1.5				
2	2.0	SANDSTONE - medium strength, moderately weathered, slightly fractured, light brown, medium grained sandstone			1.95			2	
					2.0		PL(A) = 0.8		
					2.25				
	2.72	SANDSTONE - very low then low strength, moderately weathered, slightly fractured, light grey to grey, fine grained sandstone. Approximately 30% siltstone and carbonaceous laminations						3	
3	3.5	SANDSTONE - medium then high strength, fresh, slightly fractured then unbroken, light grey, medium grained sandstone. Some siltstone/carbonaceous laminations		C	3.4		PL(A) = 0.2		
4					4.55		PL(A) = 0.9		Gravel
5					5.0			5	
					5.7		PL(A) = 0.5		Machine slotted PVC screen
6				C	6.45		PL(A) = 0.8	6	
7					7.54		PL(A) = 1.2	7	
8	8.0	Bore discontinued at 8.0m			8.0			8	End cap
9								9	

RIG: Terrier

DRILLER: Tightsite

LOGGED: SI/AG

CASING: HQ to 2.0m

TYPE OF BORING: Vacuum excavation to 1.0m, solid flight auger to 2.0m, NMLC-Coring to 8.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: [^]Surface level interpolated from Dwg No K-FME-2013.0002, Rev A, 31.5.13. Groundwater well: slotted 1.0- 8.0m, gravel backfill 1.0-8.0m, bentonite 0.5-1.0m, gatic cover at surface

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: The University of New South Wales
PROJECT: Proposed Building Upgrade
LOCATION: UNSW, Botany Road, Kensington

SURFACE LEVEL: 55.1 AHD[^]
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 73492
DATE: 7/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High		Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
55	0.1	CONCRETE																									
	0.4	FILLING - yellow brown, sand and crushed sandstone filling, humid																					A/E				PID<1 ppm
		FILLING - poorly compacted, brown, fine to medium grained sand filling with some sandstone gravel and a trace of organic matter, humid																					E				PID<1 ppm
54	1																						E				PID<1 ppm
		- with some brick fragments at 1.5m																					E				PID<1 ppm
																							S				5,3,2 N = 5
53	2																						E				PID<1 ppm
																							E				PID<1 ppm
	3																						E				PID<1 ppm
52																							S				2,2,4 N = 6
	3.4	SAND - loose becoming medium dense, yellow brown, fine to medium grained sand, humid																									
	4																						E				PID<1 ppm
51																											
	5																						S				5,10,15 N = 25
50																											
	6																										
49																											
	6.2	SANDSTONE - extremely low then very low strength, light grey, fine to medium grained sandstone																					S				10,35/150mm refusal
	6.47	SANDSTONE - high strength, slightly then moderately weathered, slightly fractured and unbroken, light grey and light purple brown, medium to coarse grained sandstone																									
48	7																										PL(A) = 1.1
																											PL(A) = 1.3
47	8																						C	100	100		
																											PL(A) = 1.7
46	9	9.05m to 9.58m: fresh																									PL(A) = 1.8
	9.58	Bore discontinued at 9.58m																									

RIG: Terrier

DRILLER: Tightsite

LOGGED: SI/AG

CASING: HQ to 6.3m

TYPE OF BORING: Diatube to 0.1m, hand auger to 1.5m, solid flight auger to 6.47m, NMLC-Coring to 9.58m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Surface level interpolated from Dwg No K-FME-2013.0002, Rev A, 31.5.13.

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: The University of New South Wales
PROJECT: Proposed Building Upgrade
LOCATION: UNSW, Botany Road, Kensington

SURFACE LEVEL: 52.8 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 73492
DATE: 6/6/2013
SHEET 1 OF 1

[illegible]

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About this Report

Douglas Partners



Introduction

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

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

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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.

Groundwater Field Sheet

Project and Bore Installation Details					
Bore / Standpipe ID:	BH4				
Project Name:	UNSW Biorecience Building Upgrade				
Project Number:	73492.00				
Site Location:	Botany Street, Kensington				
Bore Easting:		Northing:			
Installation Date:	06.06.13				
GW Level (during drilling):	Not observed (NFGWOWA)				
Well Depth:	8.0	m bgl			
Screened Interval:	1.0 - 8.0	m bgl			
Contaminants/Comments:	None observed whilst drilling				
Bore Development Details					
Date/Time:	12.06.13				
Purged By:	A.G.				
GW Level (pre-purge):	1.15	m bgl			
GW Level (post-purge):	7.0	m bgl			
PSH observed:	Yes / No (interface/visual). ? mm thick				
Observed Well Depth:	7.0	m bgl (sand/silt at base)			
Estimated Bore Volume:	L				
Total Volume Purged:	25	L			
Equipment:	Development pump, bailer				
Micropurge and Sampling Details					
Date/Time:	19.06.13				
Sampled By:	A.G.				
Weather Conditions:	Wet				
GW Level (pre-purge):	1.9	m bgl			
GW Level (post sample):	7.5	m bgl			
PSH observed:	Yes / No (interface/visual). ? mm thick				
Observed Well Depth:	7.0	m bgl			
Estimated Bore Volume:	L				
Total Volume Purged:	L				
Equipment:					
Water Quality Parameters					
Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Redox (mV)
Stabilisation Criteria (3 readings)	0.1 °C	+/- 0.3 mg/L	+/- 3%	+/- 0.1	+/- 10 mV
10:12	19.1	4.18	2.8/2.5	6.53	32.6
10:14	19.4	3.49	3.3/3.0	6.55	65.5
10:16	19.5	3.28	3.3/3.0	6.56	98.8
10:18	19.5	3.46	3.3/3.0	6.56	114.1
10:20	19.5	3.47	3.7/3.4	6.56	123.3
10:22	19.5	3.48	3.8/3.4	6.56	126.4
10:24	19.5	3.48	3.8/3.4	6.56	128.6
10:26	19.5	3.48	3.8/3.4	6.56	130.4
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS		
Sample Details					
Sampling Depth (rationale):	5.0 m bgl,				
Sample Appearance (e.g. colour, siltiness, odour):					
Sample ID:					
QA/QC Samples:	BOL/190613				
Sampling Containers and filtration:					
Comments / Observations:	1000 mm sand/silt at base				

Groundwater Field Sheet

Project and Bore Installation Details					
Bore / Standpipe ID:	BHI				
Project Name:	UNSW Bioscience Building Upgrade				
Project Number:	73492.00				
Site Location:	Botany Street, Kensington				
Bore Easting:			Northing:		
Installation Date:	05.06.13				
GW Level (during drilling):	Not observed m bgl (NFGWOWA)				
Well Depth:	8.4 m bgl				
Screened Interval:	2.4 - 8.4 m bgl				
Contaminants/Comments:	None observed whilst drilling				
Bore Development Details					
Date/Time:	12.06.13				
Purged By:	A.G.				
GW Level (pre-purge):	4.0 m bgl				
GW Level (post-purge):	7.6 m bgl				
PSH observed:	Yes / No (interface/visual). ? mm thick				
Observed Well Depth:	7.6 m bgl (sand/silt at base)				
Estimated Bore Volume:	L				
Total Volume Purged:	25 L				
Equipment:	Development pump, bailer				
Micropurge and Sampling Details					
Date/Time:	19.06.13				
Sampled By:	A.G.				
Weather Conditions:	wet				
GW Level (pre-purge):	3.7 m bgl				
GW Level (post sample):	6.5 m bgl				
PSH observed:	Yes / No (interface/visual). ? mm thick				
Observed Well Depth:	7.6 m bgl				
Estimated Bore Volume:	L				
Total Volume Purged:	L				
Equipment:					
Water Quality Parameters					
Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH ✓	Redox (mV)
Stabilisation Criteria (3 readings)	0.1°C	+/- 0.3 mg/L	+/- 3%	+/- 0.1	+/- 10 mV
8:47	19.3	5.50	611 / 598	7.14	-75.7
8:49	19.7	5.75	607 / 595	6.78	-62.2
8:51	19.7	5.78	601 / 590	6.57	-53.2
8:53	19.7	5.60	639 / 575	6.32	-99.6
8:55	19.7	5.54	29 / 26	6.37	-58.2
8:57	19.7	5.74	22 / 20	6.26	-50.6
8:59	19.7	5.74	16.4 / 14.5	6.23	-65.5
9:01	19.7	5.40	21.1 / 17.8	6.21	-60.9
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS		
Sample Details					
Sampling Depth (rationale):	6.0 m bgl,				
Sample Appearance (e.g. colour, siltiness, odour):	Slightly silty				
Sample ID:					
QA/QC Samples:					
Sampling Containers and filtration:					
Comments / Observations:	800 mm sand/silt at base				

Appendix D

Laboratory Results

Project Name: UNSW - Bioscience Building Upgrade
Project No: 73492..... Sampler: AG.....
Project Mgr: PG Mob. Phone 0448 280 782.....
Email: wenfei.yuan @douglaspartners.com.au
Date Required: STD..... Lab Quote No.

To: Envirolab Services
12 Ashley Street, Chatswood NSW 2068
Attn: Tania Notaras
Phone: 02 9910 6200 Fax: 02 9910 6201
Email: tnotaras@envirolabservices.com.au

Sample ID	Sample Depth	Lab ID	Sampling Date	Sample Type S - soil W - water	Container type	Analytes												Notes
						Heavy Metals (8)	TRI/BTEX	PAH *	Phenol	PCB **	OCF **	Hardness	pH					
BH1	-	1)	19.06.13	W	G/P	X	X	X	X	X	X	X	X					* PAH (Low Level)
BH2	-	2)	19.06.13	W	G/P	X	X	X	X	X	X	X	X					** PCB/OCF (Trace Level)
BD1/190613	-	3)	19.06.13	W	G/P	X	X											
TS	-	4)		W	G		BTEX											 Envirolab Services 12 Ashley St Chatswood NSW 2067 Ph: (02) 9910 6200 Job No: 92656
TB	-	5)		W	G		X											Date Received: 20/6/13 Time Received: 17:00 Received by: PT Temp: 66/Ambient Cooling: Ice/Icepack Security: Intact/Broken/None

Lab Report No.

Phone: (02) 9809 0666

Send Results to: Douglas Partners Address: 96 Hermitage Road, West Ryde 2114

Fax: (02) 9809 4095

Relinquished by: WFY

Signed: *[Signature]*

Date & Time: 20/06/13 4:15pm

Received By: PT

Date & Time:

CERTIFICATE OF ANALYSIS

92656

Client:

Douglas Partners
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Wen Fei

Sample log in details:

Your Reference: **73492, UNSW - Bioscience Building Upgrade**
No. of samples: 5 Waters
Date samples received / completed instructions received 20/06/2013 / 20/06/2013
This report supersedes the previous report due to an amendment to sample ID #2.

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date: 27/06/13 / 3/07/13
Date of Preliminary Report: Not issued
NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:



Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ----- -----	92656-1 BH1 19/06/2013 Water	92656-2 BH4 19/06/2013 Water	92656-3 BD1/190613 19/06/2013 Water	92656-4 TS 19/06/2013 Water	92656-5 TB 19/06/2013 Water
Date extracted	-	23/06/2013	23/06/2013	23/06/2013	23/06/2013	23/06/2013
Date analysed	-	24/06/2013	24/06/2013	24/06/2013	24/06/2013	24/06/2013
TRHC ₆ - C ₉	µg/L	<10	<10	<10	[NA]	<10
TRHC ₆ - C ₁₀	µg/L	<10	<10	<10	[NA]	<10
TRHC ₆ - C ₁₀ less BTEX (F1)	µg/L	<10	<10	<10	[NA]	<10
Benzene	µg/L	<1	<1	<1	94%	<1
Toluene	µg/L	1	<1	<1	110%	<1
Ethylbenzene	µg/L	<1	<1	<1	106%	<1
m+p-xylene	µg/L	<2	<2	<2	110%	<2
o-xylene	µg/L	<1	<1	<1	113%	<1
Naphthalene	µg/L	<1	<1	<1	[NA]	<1
Surrogate Dibromofluoromethane	%	113	101	100	96	97
Surrogate toluene-d8	%	101	101	100	101	99
Surrogate 4-BFB	%	102	99	97	110	97

svTRH (C10-C40) in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ----- -----	92656-1 BH1 19/06/2013 Water	92656-2 BH4 19/06/2013 Water	92656-3 BD1/190613 19/06/2013 Water
Date extracted	-	21/06/2013	21/06/2013	21/06/2013
Date analysed	-	22/06/2013	22/06/2013	22/06/2013
TRHC ₁₀ - C ₁₄	µg/L	<50	<50	<50
TRHC ₁₅ - C ₂₈	µg/L	<100	<100	<100
TRHC ₂₉ - C ₃₆	µg/L	<100	<100	<100
TRH>C ₁₀ - C ₁₆	µg/L	<50	<50	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	µg/L	<50	<50	<50
TRH>C ₁₆ - C ₃₄	µg/L	<100	<100	<100
TRH>C ₃₄ - C ₄₀	µg/L	<100	<100	<100
Surrogate o-Terphenyl	%	69	60	106

PAHs in Water - Low Level Our Reference: Your Reference Date Sampled Type of sample	UNITS ----- -----	92656-1 BH1 19/06/2013 Water	92656-2 BH4 19/06/2013 Water
Date extracted	-	21/06/2013	21/06/2013
Date analysed	-	22/06/2013	22/06/2013
Naphthalene	µg/L	<0.1	0.1
Acenaphthylene	µg/L	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1
Phenanthrene	µg/L	<0.1	0.1
Anthracene	µg/L	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1
Benzo(b+k)fluoranthene	µg/L	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5
Total +ve PAH's	µg/L	NIL (+)VE	0.22
Surrogate p-Terphenyl-d14	%	73	69

OCP in water - trace level			
Our Reference:	UNITS	92656-1	92656-2
Your Reference	-----	BH1	BH4
Date Sampled	-----	19/06/2013	19/06/2013
Type of sample		Water	Water
Date extracted	-	27/06/2013	27/06/2013
Date analysed	-	28/06/2013	28/06/2013
HCB	µg/L	<0.001	<0.001
Heptachlor	µg/L	<0.001	<0.001
Heptachlor Epoxide	µg/L	<0.001	<0.001
Aldrin	µg/L	<0.001	<0.001
gamma-BHC (Lindane)	µg/L	<0.001	<0.001
alpha-BHC	µg/L	<0.001	<0.001
beta-BHC	µg/L	<0.001	<0.001
delta-BHC	µg/L	<0.001	<0.001
trans-Chlordane	µg/L	<0.001	<0.001
cis-Chlordane	µg/L	<0.001	<0.001
Oxychlordane	µg/L	<0.001	<0.001
Dieldrin	µg/L	<0.001	<0.001
p,p-DDE	µg/L	<0.001	<0.001
p,p-DDD	µg/L	<0.001	<0.001
p,p-DDT	µg/L	<0.001	<0.001
Endrin	µg/L	<0.001	<0.001
Endrin Aldehyde	µg/L	<0.001	<0.001
Endrin Ketone	µg/L	<0.001	<0.001
alpha-Endosulfan	µg/L	<0.001	<0.001
beta-Endosulfan	µg/L	<0.001	<0.001
Endosulfan Sulfate	µg/L	<0.001	<0.001
Methoxychlor	µg/L	<0.001	<0.001
Surrogate OC Recovery	%	90	90

PCB in water - trace level			
Our Reference:	UNITS	92656-1	92656-2
Your Reference	-----	BH1	BH4
Date Sampled	-----	19/06/2013	19/06/2013
Type of sample		Water	Water
Date extracted	-	27/06/2013	27/06/2013
Date analysed	-	28/06/2013	28/06/2013
Aroclor 1016	µg/L	<0.01	<0.01
Aroclor 1221	µg/L	<0.01	<0.01
Aroclor 1232	µg/L	<0.01	<0.01
Aroclor 1242	µg/L	<0.01	<0.01
Aroclor 1248	µg/L	<0.01	<0.01
Aroclor 1254	µg/L	<0.01	<0.01
Aroclor 1260	µg/L	<0.01	<0.01
Total PCB's (as above)	µg/L	<0.01	<0.01

Total Phenolics in Water			
Our Reference:	UNITS	92656-1	92656-2
Your Reference:	-----	BH1	BH4
Date Sampled	-----	19/06/2013	19/06/2013
Type of sample		Water	Water
Date extracted	-	25/06/2013	25/06/2013
Date analysed	-	25/06/2013	25/06/2013
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05

HM in water - dissolved				
Our Reference:	UNITS	92656-1	92656-2	92656-3
Your Reference	-----	BH1	BH4	BD1/190613
Date Sampled	-----	19/06/2013	19/06/2013	19/06/2013
Type of sample		Water	Water	Water
Date prepared	-	21/06/2013	21/06/2013	21/06/2013
Date analysed	-	21/06/2013	21/06/2013	21/06/2013
Arsenic-Dissolved	µg/L	5	3	3
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	32	12	12
Copper-Dissolved	µg/L	<1	8	8
Lead-Dissolved	µg/L	<1	<1	2
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	12	3	2
Zinc-Dissolved	µg/L	16	26	31

Miscellaneous Inorganics			
Our Reference:	UNITS	92656-1	92656-2
Your Reference	-----	BH1	BH4
Date Sampled	-----	19/06/2013	19/06/2013
Type of sample		Water	Water
Date prepared	-	21/06/2013	21/06/2013
Date analysed	-	21/06/2013	21/06/2013
pH	pH Units	7.1	4.1

Cations in water Dissolved			
Our Reference:	UNITS	92656-1	92656-2
Your Reference	-----	BH1	BH4
Date Sampled	-----	19/06/2013	19/06/2013
Type of sample		Water	Water
Date digested	-	21/06/2013	21/06/2013
Date analysed	-	21/06/2013	21/06/2013
Calcium - Dissolved	mg/L	14	33
Magnesium - Dissolved	mg/L	7.8	7.9
Hardness	mgCaCO3 /L	68	120

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Ext-020	Analysis subcontracted to Australian Government - National Measurement Institute. NATA Accreditation No: 198
Inorg-030	Total Phenolics - determined colorimetrically following distillation, based upon APHA 22nd ED 5530 D.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.

Client Reference: 73492, UNSW - Bioscience Building Upgrade

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
vTRH(C6-C10)/BTEXNin Water						Base II Duplicate II %RPD		
Date extracted	-			23/06/2013	[NT]	[NT]	LCS-W1	23/06/2013
Date analysed	-			24/06/2013	[NT]	[NT]	LCS-W1	24/06/2013
TRHC ₆ - C ₉	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	113%
TRHC ₆ - C ₁₀	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	113%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	109%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	119%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	111%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	114%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	116%
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	90	[NT]	[NT]	LCS-W1	96%
Surrogate toluene-d8	%		Org-016	95	[NT]	[NT]	LCS-W1	103%
Surrogate 4-BFB	%		Org-016	87	[NT]	[NT]	LCS-W1	110%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
svTRH (C10-C40)in Water						Base II Duplicate II %RPD		
Date extracted	-			21/06/2013	[NT]	[NT]	LCS-W2	21/06/2013
Date analysed	-			22/06/2013	[NT]	[NT]	LCS-W2	22/06/2013
TRHC ₁₀ - C ₁₄	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W2	75%
TRHC ₁₅ - C ₂₈	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W2	97%
TRHC ₂₉ - C ₃₆	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W2	78%
TRH>C ₁₀ - C ₁₆	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W2	75%
TRH>C ₁₆ - C ₃₄	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W2	97%
TRH>C ₃₄ - C ₄₀	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W2	78%
Surrogate o-Terphenyl	%		Org-003	88	[NT]	[NT]	LCS-W2	109%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Water - Low Level						Base II Duplicate II %RPD		
Date extracted	-			21/06/2013	[NT]	[NT]	LCS-W1	21/06/2013
Date analysed	-			22/06/2013	[NT]	[NT]	LCS-W1	22/06/2013
Naphthalene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	115%
Acenaphthylene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	107%
Phenanthrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	106%

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Water - Low Level						Base II Duplicate II %RPD		
Anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	101%
Pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	109%
Benzo(a)anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	96%
Benzo(b+k)fluoranthene	µg/L	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	110%
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	127	[NT]	[NT]	LCS-W1	109%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
OCP in water - trace level						Base II Duplicate II %RPD		
Date extracted	-			27/06/2013	[NT]	[NT]	LCS-W1	27/06/2013
Date analysed	-			28/06/2013	[NT]	[NT]	LCS-W1	28/06/2013
HCB	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
Heptachlor	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	LCS-W1	63%
Heptachlor Epoxide	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
Aldrin	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	LCS-W1	62%
gamma-BHC (Lindane)	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	LCS-W1	63%
alpha-BHC	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
beta-BHC	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
delta-BHC	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
trans-Chlordane	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
cis-Chlordane	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
Oxychlordane	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
Dieldrin	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	LCS-W1	62%
p,p-DDE	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
p,p-DDD	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
p,p-DDT	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	LCS-W1	65%
Endrin	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	LCS-W1	64%
Endrin Aldehyde	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
Endrin Ketone	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
OCP in water - trace level						Base II Duplicate II %RPD		
alpha-Endosulfan	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
beta-Endosulfan	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulfate	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
Methoxychlor	µg/L	0.001	Ext-020	<0.001	[NT]	[NT]	[NR]	[NR]
Surrogate OC Recovery	%		Ext-020	[NT]	[NT]	[NT]	LCS-W1	82%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PCB in water - trace level						Base II Duplicate II %RPD		
Date extracted	-			27/06/2013	[NT]	[NT]	LCS-W1	27/06/2013
Date analysed	-			28/06/2013	[NT]	[NT]	LCS-W1	28/06/2013
Aroclor 1016	µg/L	0.01	Ext-020	<0.01	[NT]	[NT]	[NR]	[NR]
Aroclor 1221	µg/L	0.01	Ext-020	<0.01	[NT]	[NT]	[NR]	[NR]
Aroclor 1232	µg/L	0.01	Ext-020	<0.01	[NT]	[NT]	[NR]	[NR]
Aroclor 1242	µg/L	0.01	Ext-020	<0.01	[NT]	[NT]	[NR]	[NR]
Aroclor 1248	µg/L	0.01	Ext-020	<0.01	[NT]	[NT]	[NR]	[NR]
Aroclor 1254	µg/L	0.01	Ext-020	<0.01	[NT]	[NT]	[NR]	[NR]
Aroclor 1260	µg/L	0.01	Ext-020	<0.01	[NT]	[NT]	[NR]	[NR]
Total PCB's (as above)	µg/L	0.010	Ext-020	<0.01	[NT]	[NT]	LCS-W1	64%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Total Phenolics in Water						Base II Duplicate II %RPD		
Date extracted	-			25/06/2013	[NT]	[NT]	LCS-W1	21/06/2013
Date analysed	-			25/06/2013	[NT]	[NT]	LCS-W1	21/06/2013
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-030	<0.05	[NT]	[NT]	LCS-W1	85%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
HM in water - dissolved						Base II Duplicate II %RPD		
Date prepared	-			21/06/2013	92656-1	21/06/2013 21/06/2013	LCS-W1	21/06/2013
Date analysed	-			21/06/2013	92656-1	21/06/2013 21/06/2013	LCS-W1	21/06/2013
Arsenic-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	92656-1	5 4 RPD: 22	LCS-W1	92%
Cadmium-Dissolved	µg/L	0.1	Metals-022 ICP-MS	<0.1	92656-1	<0.1 <0.1	LCS-W1	95%
Chromium-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	92656-1	32 31 RPD: 3	LCS-W1	91%
Copper-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	92656-1	<1 <1	LCS-W1	89%
Lead-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	92656-1	<1 <1	LCS-W1	101%
Mercury-Dissolved	µg/L	0.05	Metals-021 CV-AAS	<0.05	92656-1	<0.05 <0.05	LCS-W1	100%

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
HM in water - dissolved						Base Duplicate %RPD		
Nickel-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	92656-1	12 11 RPD: 9	LCS-W1	92%
Zinc-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	92656-1	16 14 RPD: 13	LCS-W1	91%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Miscellaneous Inorganics						Base Duplicate %RPD		
Date prepared	-			[NT]	[NT]	[NT]	LCS-W1	21/06/2013
Date analysed	-			[NT]	[NT]	[NT]	LCS-W1	21/06/2013
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-W1	102%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Cations in water Dissolved						Base Duplicate %RPD		
Date digested	-			21/06/2013	92656-1	21/06/2013 21/06/2013	LCS-W1	21/06/2013
Date analysed	-			21/06/2013	92656-1	21/06/2013 21/06/2013	LCS-W1	21/06/2013
Calcium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	92656-1	14 15 RPD: 7	LCS-W1	99%
Magnesium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	92656-1	7.8 8.4 RPD: 7	LCS-W1	98%
Hardness	mgCaCO ₃ /L	3		[NT]	92656-1	68 72 RPD: 6	[NR]	[NR]
QUALITYCONTROL	UNITS	Dup. Sm#		Duplicate		Spike Sm#	Spike % Recovery	
HM in water - dissolved				Base + Duplicate + %RPD				
Date prepared	-	[NT]		[NT]		92656-2	21/06/2013	
Date analysed	-	[NT]		[NT]		92656-2	21/06/2013	
Arsenic-Dissolved	µg/L	[NT]		[NT]		92656-2	91%	
Cadmium-Dissolved	µg/L	[NT]		[NT]		92656-2	93%	
Chromium-Dissolved	µg/L	[NT]		[NT]		92656-2	87%	
Copper-Dissolved	µg/L	[NT]		[NT]		92656-2	90%	
Lead-Dissolved	µg/L	[NT]		[NT]		92656-2	92%	
Mercury-Dissolved	µg/L	[NT]		[NT]		[NR]	[NR]	
Nickel-Dissolved	µg/L	[NT]		[NT]		92656-2	93%	
Zinc-Dissolved	µg/L	[NT]		[NT]		92656-2	88%	

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QUALITYCONTROL Cations in water Dissolved	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date digested	-	[NT]	[NT]	92656-2	21/06/2013
Date analysed	-	[NT]	[NT]	92656-2	21/06/2013
Calcium - Dissolved	mg/L	[NT]	[NT]	92656-2	#
Magnesium - Dissolved	mg/L	[NT]	[NT]	92656-2	96%
Hardness	mgCaCO 3/L	[NT]	[NT]	[NR]	[NR]

Report Comments:

CATIONS_W: # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

OC/PCB's in water analysed by NMI. Report No.Rn0979219.

Asbestos ID was analysed by Approved Identifier:
Asbestos ID was authorised by Approved Signatory:

Not applicable for this job
Not applicable for this job

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

CERTIFICATE OF ANALYSIS

92154

Client:

Douglas Partners
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Paul Gorman

Sample log in details:

Your Reference:	<u>73492, UNSW Bioscience Building Upgrade</u>		
No. of samples:	1 soil		
Date samples received / completed instructions received	12/06/13	/	12/06/13

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	19/06/13	/	19/06/13
Date of Preliminary Report:	Not issued		

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

Results Approved By:



Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date extracted	-	13/06/2013
Date analysed	-	16/06/2013
TRHC ₆ - C ₉	mg/kg	<25
TRHC ₆ - C ₁₀	mg/kg	<25
vTPHC ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	117

svTRH (C10-C40) in Soil		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date extracted	-	13/06/2013
Date analysed	-	13/06/2013
TRHC ₁₀ - C ₁₄	mg/kg	<50
TRHC ₁₅ - C ₂₈	mg/kg	<100
TRHC ₂₉ - C ₃₆	mg/kg	<100
TRH>C ₁₀ -C ₁₆	mg/kg	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50
TRH>C ₁₆ -C ₃₄	mg/kg	<100
TRH>C ₃₄ -C ₄₀	mg/kg	<100
Surrogate o-Terphenyl	%	88

PAHs in Soil		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date extracted	-	13/06/2013
Date analysed	-	14/06/2013
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	0.1
Pyrene	mg/kg	0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	0.11
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Benzo(a)pyrene TEQ NEPMB1	mg/kg	<0.5
Total +ve PAH's	mg/kg	0.34
Surrogate p-Terphenyl-d14	%	110

Organochlorine Pesticides in soil		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date extracted	-	13/06/2013
Date analysed	-	14/06/2013
HCB	mg/kg	<0.1
alpha-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Surrogate TCMX	%	89

PCBs in Soil	UNITS	92154-1
Our Reference:	-----	BH5
Your Reference	-----	2.9-3.0
Depth		06/06/2013
Date Sampled		soil
Type of sample		
Date extracted	-	13/06/2013
Date analysed	-	14/06/2013
Arochlor 1016	mg/kg	<0.1
Arochlor 1221	mg/kg	<0.1
Arochlor 1232	mg/kg	<0.1
Arochlor 1242	mg/kg	<0.1
Arochlor 1248	mg/kg	<0.1
Arochlor 1254	mg/kg	<0.1
Arochlor 1260	mg/kg	<0.1
Surrogate TCLMX	%	89

Total Phenolics in Soil		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date extracted	-	18/06/2013
Date analysed	-	19/06/2013
Total Phenolics (as Phenol)	mg/kg	<5

Acid Extractable metals in soil		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date digested	-	13/06/2013
Date analysed	-	13/06/2013
Arsenic	mg/kg	<4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	3
Copper	mg/kg	9
Lead	mg/kg	16
Mercury	mg/kg	<0.1
Nickel	mg/kg	2
Zinc	mg/kg	17
Iron	mg/kg	1,700

Moisture		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date prepared	-	13/06/13
Date analysed	-	14/06/13
Moisture	%	8.7

Asbestos ID - soils		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date analysed	-	17/06/2013
Sample mass tested	g	Approx 40g
Sample Description	-	Brown sandy soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected

Metals in TCLP USEPA1311		
Our Reference:	UNITS	92154-1
Your Reference	-----	BH5
Depth	-----	2.9-3.0
Date Sampled		06/06/2013
Type of sample		soil
Date extracted	-	13/06/2013
Date analysed	-	13/06/2013
pH of soil for fluid# determ.	pH units	8.7
pH of soil for fluid # determ. (acid)	pH units	1.5
Extraction fluid used	-	1
pH of final Leachate	pH units	5.0

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Inorg-030	Total Phenolics - determined colorimetrically following distillation, based upon APHA 22nd ED 5530 D.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 4 hours.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using AS 4439 and USEPA 1311.
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP).
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
vTRH(C6-C10)/BTEXN in Soil						Base II Duplicate II %RPD		
Date extracted	-			13/06/2013	[NT]	[NT]	LCS-2	13/06/2013
Date analysed	-			16/06/2013	[NT]	[NT]	LCS-2	16/06/2013
TRHC ₆ - C ₉	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-2	115%
TRHC ₆ - C ₁₀	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-2	115%
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	LCS-2	126%
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	LCS-2	111%
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-2	115%
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	LCS-2	112%
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-2	119%
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	102	[NT]	[NT]	LCS-2	114%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
svTRH(C10-C40) in Soil						Base II Duplicate II %RPD		
Date extracted	-			13/06/2013	[NT]	[NT]	LCS-2	13/06/2013
Date analysed	-			13/06/2013	[NT]	[NT]	LCS-2	13/06/2013
TRHC ₁₀ - C ₁₄	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-2	104%
TRHC ₁₅ - C ₂₈	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-2	112%
TRHC ₂₈ - C ₃₆	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-2	85%
TRH>C ₁₀ -C ₁₆	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-2	104%
TRH>C ₁₆ -C ₃₄	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-2	112%
TRH>C ₃₄ -C ₄₀	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-2	85%
Surrogate o-Terphenyl	%		Org-003	93	[NT]	[NT]	LCS-2	100%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Soil						Base II Duplicate II %RPD		
Date extracted	-			13/06/2013	[NT]	[NT]	LCS-2	13/06/2013
Date analysed	-			14/06/2013	[NT]	[NT]	LCS-2	14/06/2013
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	100%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	112%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	96%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	96%

Client Reference: 73492, UNSW Bioscience Building Upgrade

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Soil						Base II Duplicate II %RPD		
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	105%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-2	93%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-2	115%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	97	[NT]	[NT]	LCS-2	114%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Organochlorine Pesticides in soil						Base II Duplicate II %RPD		
Date extracted	-			13/06/2013	[NT]	[NT]	LCS-2	13/06/2013
Date analysed	-			14/06/2013	[NT]	[NT]	LCS-2	14/06/2013
HCB	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	91%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	85%
Heptachlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	84%
delta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	90%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	90%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	86%
Dieldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	90%
Endrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	81%
pp-DDD	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	86%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-2	89%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%		Org-005	89	[NT]	[NT]	LCS-2	84%

Client Reference: 73492, UNSW Bioscience Building Upgrade

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PCBs in Soil						Base II Duplicate II %RPD		
Date extracted	-			13/06/2013	[NT]	[NT]	LCS-2	13/06/2013
Date analysed	-			14/06/2013	[NT]	[NT]	LCS-2	14/06/2013
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	LCS-2	102%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		Org-006	89	[NT]	[NT]	LCS-2	85%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Total Phenolics in Soil						Base II Duplicate II %RPD		
Date extracted	-			[NT]	[NT]	[NT]	LCS-1	18/06/2013
Date analysed	-			[NT]	[NT]	[NT]	LCS-1	18/06/2013
Total Phenolics (as Phenol)	mg/kg	5	Inorg-030	<5	[NT]	[NT]	LCS-1	96%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Acid Extractable metals in soil						Base II Duplicate II %RPD		
Date digested	-			13/06/2013	[NT]	[NT]	LCS-1	13/06/2013
Date analysed	-			13/06/2013	[NT]	[NT]	LCS-1	13/06/2013
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-1	101%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-1	113%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	107%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	107%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	104%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-1	90%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	109%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	106%
Iron	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	106%

QUALITYCONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]
QUALITYCONTROL Asbestos ID - soils	UNITS	PQL	METHOD	Blank
Date analysed	-			[NT]
QUALITYCONTROL Metals in TCLP USEPA1311	UNITS	PQL	METHOD	Blank
Date extracted	-			[NT]
Date analysed	-			[NT]

Report Comments:

Asbestos ID was analysed by Approved Identifier: Alex Tam
 Asbestos ID was authorised by Approved Signatory: Lulu Guo

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

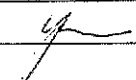
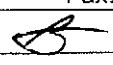
Project Name: UNSW - Bioscience Building Upgrade
Project No: 73492..... Sampler: WFY/AG.....
Project Mgr: PG Mob. Phone 0448 280 782
Email: paul.gorman@douglaspartners.com.au.....
Date Required: STD..... Lab Quote No.

To: Envirolab Services
12 Ashley Street, Chatswood NSW 2068
Attn: Tania Notaras
Phone: 02 9910 6200 Fax: 02 9910 6201
Email: tnotaras@envirolabservices.com.au

Sample ID	Sample Depth	Lab ID	Sampling Date	Sample Type S - soil W - water	Container type	Analytes														Notes
						Heavy Metals*	TRH/BTEX	PAH	Phenols	PCB	OCP	Asbestos	CEC	TCLP Prep						
BH1	0.5-0.6	1	05.06.13	S	G/P	X	X	X	X	X	X	X	X	X	X					* As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and Fe
BH2	0.2-0.3	2	05.06.13	S	G/P	X	X	X	X	X	X	X	X	X	X					
BH3	0.2-0.4	3	05.06.13	S	G/P	X	X	X	X	X	X	X		X						
BH4	0.22-0.4	4	05.06.13	S	G/P	X	X	X	X	X	X	X		X						
BH6	0.2-0.3	5	05.06.13	S	G/P	X	X	X	X	X	X	X		X						
BD2/050613	-	6	05.06.13	S	G/P	X	X							X						
Trip Spike	-	7	05.06.13	S	G		BTEX													
Trip Blank	-	8	05.06.13	S	G		X													

Lab Report No. Phone: (02) 9809 0666

Send Results to: Douglas Partners Address: 96 Hermitage Road, West Ryde 2114 Fax: (02) 9809 4095

Relinquished by: WFY Signed:  Date & Time: 05.06.13/12:50 Received By: A. War  Date & Time: 7/6/13 16:15

Relinquished by: Signed: _____ Date & Time: _____ Received By: _____ Date & Time: _____

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 92045
Date Received: 7/6/13
Time Received: 16:15
Received by: AW
Temp: Cool Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

CERTIFICATE OF ANALYSIS

92045

Client:

Douglas Partners
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Paul Gorman

Sample log in details:

Your Reference:	<u>73492, UNSW Bioscience Building Upgrade</u>		
No. of samples:	8 soils		
Date samples received / completed instructions received	07/06/13	/	07/06/13

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	17/06/13	/	17/06/13
Date of Preliminary Report:	Not issued		

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

Results Approved By:



Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- -----	92045-1 BH1 0.5-0.6 05/06/2013 soil	92045-2 BH2 0.2-0.3 05/06/2013 soil	92045-3 BH3 0.2-0.4 05/06/2013 soil	92045-4 BH4 0.22-0.4 05/06/2013 soil	92045-5 BH6 0.2-0.3 05/06/2013 soil
Date extracted	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Date analysed	-	13/06/2013	13/06/2013	13/06/2013	13/06/2013	13/06/2013
TRHC ₆ - C ₉	mg/kg	<25	<25	<25	<25	<25
TRHC ₆ - C ₁₀	mg/kg	<25	<25	<25	<25	<25
vTPHC ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	117	110	110	113	117

vTRH(C6-C10)/BTEXN in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- -----	92045-6 BD2/050613 - 05/06/2013 soil	92045-7 Trip Spike - 05/06/2013 soil	92045-8 Trip Blank - 05/06/2013 soil
Date extracted	-	12/06/2013	12/06/2013	12/06/2013
Date analysed	-	13/06/2013	13/06/2013	13/06/2013
TRHC ₆ - C ₉	mg/kg	<25	[NA]	[NA]
TRHC ₆ - C ₁₀	mg/kg	<25	[NA]	[NA]
vTPHC ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25	[NA]	[NA]
Benzene	mg/kg	<0.2	101%	<0.2
Toluene	mg/kg	<0.5	101%	<0.5
Ethylbenzene	mg/kg	<1	99%	<1
m+p-xylene	mg/kg	<2	99%	<2
o-Xylene	mg/kg	<1	99%	<1
naphthalene	mg/kg	<1	[NA]	[NA]
Surrogate aaa-Trifluorotoluene	%	115	100	115

svTRH (C10-C40) in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- -----	92045-1 BH1 0.5-0.6 05/06/2013 soil	92045-2 BH2 0.2-0.3 05/06/2013 soil	92045-3 BH3 0.2-0.4 05/06/2013 soil	92045-4 BH4 0.22-0.4 05/06/2013 soil	92045-5 BH6 0.2-0.3 05/06/2013 soil
Date extracted	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Date analysed	-	13/06/2013	13/06/2013	13/06/2013	13/06/2013	13/06/2013
TRHC ₁₀ - C ₁₄	mg/kg	<50	<50	<50	<50	<50
TRHC ₁₅ - C ₂₈	mg/kg	<100	<100	<100	<100	<100
TRHC ₂₉ - C ₃₆	mg/kg	<100	<100	<100	<100	<100
TRH>C ₁₀ -C ₁₆	mg/kg	<50	<50	<50	<50	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH>C ₁₆ -C ₃₄	mg/kg	<100	<100	<100	<100	<100
TRH>C ₃₄ -C ₄₀	mg/kg	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	83	83	82	83	87

svTRH (C10-C40) in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- -----	92045-6 BD2/050613 - 05/06/2013 soil
Date extracted	-	12/06/2013
Date analysed	-	13/06/2013
TRHC ₁₀ - C ₁₄	mg/kg	<50
TRHC ₁₅ - C ₂₈	mg/kg	<100
TRHC ₂₉ - C ₃₆	mg/kg	<100
TRH>C ₁₀ -C ₁₆	mg/kg	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50
TRH>C ₁₆ -C ₃₄	mg/kg	<100
TRH>C ₃₄ -C ₄₀	mg/kg	<100
Surrogate o-Terphenyl	%	83

PAHs in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- -----	92045-1 BH1 0.5-0.6 05/06/2013 soil	92045-2 BH2 0.2-0.3 05/06/2013 soil	92045-3 BH3 0.2-0.4 05/06/2013 soil	92045-4 BH4 0.22-0.4 05/06/2013 soil	92045-5 BH6 0.2-0.3 05/06/2013 soil
Date extracted	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Date analysed	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	0.1	0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.2	0.1	<0.1	0.2	0.5
Pyrene	mg/kg	0.2	0.2	<0.1	0.2	0.5
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	0.1	0.3
Chrysene	mg/kg	0.1	<0.1	<0.1	0.1	0.3
Benzo(b+k)fluoranthene	mg/kg	0.2	<0.2	<0.2	<0.2	0.6
Benzo(a)pyrene	mg/kg	0.16	0.06	<0.05	0.09	0.37
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.3
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Benzo(a)pyrene TEQ	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	mg/kg	1.0	0.34	NIL (+)VE	0.84	3.2
Surrogate p-Terphenyl-d14	%	106	104	105	106	103

Organochlorine Pesticides in soil						
Our Reference:	UNITS	92045-1	92045-2	92045-3	92045-4	92045-5
Your Reference	-----	BH1	BH2	BH3	BH4	BH6
Depth	-----	0.5-0.6	0.2-0.3	0.2-0.4	0.22-0.4	0.2-0.3
Date Sampled		05/06/2013	05/06/2013	05/06/2013	05/06/2013	05/06/2013
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Date analysed	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	87	87	85	87	84

PCBs in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- -----	92045-1 BH1 0.5-0.6 05/06/2013 soil	92045-2 BH2 0.2-0.3 05/06/2013 soil	92045-3 BH3 0.2-0.4 05/06/2013 soil	92045-4 BH4 0.22-0.4 05/06/2013 soil	92045-5 BH6 0.2-0.3 05/06/2013 soil
Date extracted	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Date analysed	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	87	87	85	87	84

Total Phenolics in Soil						
Our Reference:	UNITS	92045-1	92045-2	92045-3	92045-4	92045-5
Your Reference	-----	BH1	BH2	BH3	BH4	BH6
Depth	-----	0.5-0.6	0.2-0.3	0.2-0.4	0.22-0.4	0.2-0.3
Date Sampled		05/06/2013	05/06/2013	05/06/2013	05/06/2013	05/06/2013
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Date analysed	-	13/06/2013	13/06/2013	13/06/2013	13/06/2013	13/06/2013
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Acid Extractable metals in soil						
Our Reference:	UNITS	92045-1	92045-2	92045-3	92045-4	92045-5
Your Reference	-----	BH1	BH2	BH3	BH4	BH6
Depth	-----	0.5-0.6	0.2-0.3	0.2-0.4	0.22-0.4	0.2-0.3
Date Sampled		05/06/2013	05/06/2013	05/06/2013	05/06/2013	05/06/2013
Type of sample		soil	soil	soil	soil	soil
Date digested	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Date analysed	-	12/06/2013	12/06/2013	12/06/2013	12/06/2013	12/06/2013
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	6	6	3	4	17
Copper	mg/kg	16	38	52	23	24
Lead	mg/kg	51	11	12	37	26
Mercury	mg/kg	0.2	<0.1	<0.1	0.1	0.5
Nickel	mg/kg	6	15	2	2	20
Zinc	mg/kg	55	22	17	42	46
Iron	mg/kg	4,700	6,200	4,500	1,700	5,600

Acid Extractable metals in soil		
Our Reference:	UNITS	92045-6
Your Reference	-----	BD2/050613
Depth	-----	-
Date Sampled		05/06/2013
Type of sample		soil
Date digested	-	12/06/2013
Date analysed	-	12/06/2013
Arsenic	mg/kg	<4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	14
Copper	mg/kg	25
Lead	mg/kg	25
Mercury	mg/kg	0.5
Nickel	mg/kg	20
Zinc	mg/kg	42
Iron	mg/kg	5,600

Moisture						
Our Reference:	UNITS	92045-1	92045-2	92045-3	92045-4	92045-5
Your Reference	-----	BH1	BH2	BH3	BH4	BH6
Depth	-----	0.5-0.6	0.2-0.3	0.2-0.4	0.22-0.4	0.2-0.3
Date Sampled		05/06/2013	05/06/2013	05/06/2013	05/06/2013	05/06/2013
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	12/06/13	12/06/13	12/06/13	12/06/13	12/06/13
Date analysed	-	13/06/13	13/06/13	13/06/13	13/06/13	13/06/13
Moisture	%	5.4	11	14	14	4.8

Moisture		
Our Reference:	UNITS	92045-6
Your Reference	-----	BD2/050613
Depth	-----	-
Date Sampled		05/06/2013
Type of sample		soil
Date prepared	-	12/06/13
Date analysed	-	13/06/13
Moisture	%	4.4

Asbestos ID - soils						
Our Reference:	UNITS	92045-1	92045-2	92045-3	92045-4	92045-5
Your Reference	-----	BH1	BH2	BH3	BH4	BH6
Depth	-----	0.5-0.6	0.2-0.3	0.2-0.4	0.22-0.4	0.2-0.3
Date Sampled		05/06/2013	05/06/2013	05/06/2013	05/06/2013	05/06/2013
Type of sample		soil	soil	soil	soil	soil
Date analysed	-	13/06/2013	13/06/2013	13/06/2013	13/06/2013	13/06/2013
Sample mass tested	g	Approx 50g	Approx 50g	Approx 50g	Approx 50g	Approx 50g
Sample Description	-	Dark brown fine-grained soil & rocks	Dark brown fine-grained soil & rocks	Dark brown fine-grained soil & rocks	Dark brown fine-grained soil & rocks	Dark brown fine-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

Metals in TCLP USEPA1311						
Our Reference:	UNITS	92045-1	92045-2	92045-3	92045-4	92045-5
Your Reference	-----	BH1	BH2	BH3	BH4	BH6
Depth	-----	0.5-0.6	0.2-0.3	0.2-0.4	0.22-0.4	0.2-0.3
Date Sampled		05/06/2013	05/06/2013	05/06/2013	05/06/2013	05/06/2013
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	11/06/2013	11/06/2013	11/06/2013	11/06/2013	11/06/2013
Date analysed	-	11/06/2013	11/06/2013	11/06/2013	11/06/2013	11/06/2013
pH of soil for fluid# determ.	pH units	7.1	9.7	9.8	9.2	9.2
pH of soil for fluid # determ. (acid)	pH units	1.7	1.8	1.5	1.7	1.8
Extraction fluid used	-	1	1	1	1	1
pH of final Leachate	pH units	5.0	4.9	5.5	5.1	5.2

Metals in TCLP USEPA1311		
Our Reference:	UNITS	92045-6
Your Reference	-----	BD2/050613
Depth	-----	-
Date Sampled		05/06/2013
Type of sample		soil
Date extracted	-	11/06/2013
Date analysed	-	11/06/2013
pH of soil for fluid# determ.	pH units	9.2
pH of soil for fluid # determ. (acid)	pH units	1.8
Extraction fluid used	-	1
pH of final Leachate	pH units	5.2

ESP/CEC			
Our Reference:	UNITS	92045-1	92045-2
Your Reference	-----	BH1	BH2
Depth	-----	0.5-0.6	0.2-0.3
Date Sampled		05/06/2013	05/06/2013
Type of sample		soil	soil
Exchangeable Ca	meq/100g	1.9	31
Exchangeable K	meq/100g	<0.1	0.2
Exchangeable Mg	meq/100g	0.54	0.19
Exchangeable Na	meq/100g	<0.1	<0.1
Cation Exchange Capacity	meq/100g	2.5	31

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Inorg-030	Total Phenolics - determined colorimetrically following disitillation, based upon APHA 22nd ED 5530 D.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 4 hours.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using AS 4439 and USEPA 1311.
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP).
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soil based on Rayment and Lyons 2011.

Client Reference: 73492, UNSW Bioscience Building Upgrade

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
vTRH(C6-C10)/BTEXN in Soil						Base II Duplicate II %RPD		
Date extracted	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-11	12/06/2013
Date analysed	-			13/06/2013	92045-1	13/06/2013 13/06/2013	LCS-11	13/06/2013
TRHC ₆ - C ₉	mg/kg	25	Org-016	<25	92045-1	<25 <25	LCS-11	101%
TRHC ₆ - C ₁₀	mg/kg	25	Org-016	<25	92045-1	<25 <25	LCS-11	101%
Benzene	mg/kg	0.2	Org-016	<0.2	92045-1	<0.2 <0.2	LCS-11	110%
Toluene	mg/kg	0.5	Org-016	<0.5	92045-1	<0.5 <0.5	LCS-11	100%
Ethylbenzene	mg/kg	1	Org-016	<1	92045-1	<1 <1	LCS-11	102%
m+p-xylene	mg/kg	2	Org-016	<2	92045-1	<2 <2	LCS-11	93%
o-Xylene	mg/kg	1	Org-016	<1	92045-1	<1 <1	LCS-11	100%
naphthalene	mg/kg	1	Org-014	<1	92045-1	<1 <1	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	116	92045-1	117 115 RPD: 2	LCS-11	111%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
svTRH(C10-C40) in Soil						Base II Duplicate II %RPD		
Date extracted	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-11	12/06/2013
Date analysed	-			13/06/2013	92045-1	13/06/2013 13/06/2013	LCS-11	13/06/2013
TRHC ₁₀ - C ₁₄	mg/kg	50	Org-003	<50	92045-1	<50 <50	LCS-11	106%
TRHC ₁₅ - C ₂₈	mg/kg	100	Org-003	<100	92045-1	<100 <100	LCS-11	102%
TRHC ₂₈ - C ₃₆	mg/kg	100	Org-003	<100	92045-1	<100 <100	LCS-11	83%
TRH>C ₁₀ -C ₁₆	mg/kg	50	Org-003	<50	92045-1	<50 <50	LCS-11	106%
TRH>C ₁₆ -C ₃₄	mg/kg	100	Org-003	<100	92045-1	<100 <100	LCS-11	102%
TRH>C ₃₄ -C ₄₀	mg/kg	100	Org-003	<100	92045-1	<100 <100	LCS-11	83%
Surrogate o-Terphenyl	%		Org-003	83	92045-1	83 86 RPD: 4	LCS-11	121%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Soil						Base II Duplicate II %RPD		
Date extracted	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-11	12/06/2013
Date analysed	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-11	12/06/2013
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	LCS-11	103%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	LCS-11	105%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	LCS-11	100%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	0.2 0.1 RPD: 67	LCS-11	92%

Client Reference: 73492, UNSW Bioscience Building Upgrade

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Soil						Base II Duplicate II %RPD		
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	0.2 0.1 RPD: 67	LCS-11	100%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	0.1 <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	0.1 0.1 RPD: 0	LCS-11	94%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	92045-1	0.2 <0.2	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	92045-1	0.16 0.11 RPD: 37	LCS-11	112%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	107	92045-1	106 106 RPD: 0	LCS-11	101%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Organochlorine Pesticides in soil						Base II Duplicate II %RPD		
Date extracted	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-11	12/06/2013
Date analysed	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-11	12/06/2013
HCB	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	89%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	83%
Heptachlor	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	78%
delta-BHC	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	90%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	91%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	88%
Dieldrin	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	93%
Endrin	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	76%
pp-DDD	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	95%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	LCS-11	82%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Surrogate TCMX	%		Org-005	85	92045-1	87 86 RPD: 1	LCS-11	81%

Client Reference: 73492, UNSW Bioscience Building Upgrade

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PCBs in Soil						Base II Duplicate II %RPD		
Date extracted	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-11	12/06/2013
Date analysed	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-11	12/06/2013
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	92045-1	<0.1 <0.1	LCS-11	96%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	92045-1	<0.1 <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-006	85	92045-1	87 86 RPD: 1	LCS-11	82%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Total Phenolics in Soil						Base II Duplicate II %RPD		
Date extracted	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-1	12/06/2013
Date analysed	-			13/06/2013	92045-1	13/06/2013 13/06/2013	LCS-1	13/06/2013
Total Phenolics (as Phenol)	mg/kg	5	Inorg-030	<5	92045-1	<5 <5	LCS-1	94%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Acid Extractable metals in soil						Base II Duplicate II %RPD		
Date digested	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-2	12/06/2013
Date analysed	-			12/06/2013	92045-1	12/06/2013 12/06/2013	LCS-2	12/06/2013
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	92045-1	<4 <4	LCS-2	95%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	92045-1	<0.4 <0.4	LCS-2	96%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	92045-1	6 5 RPD: 18	LCS-2	99%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	92045-1	16 16 RPD: 0	LCS-2	99%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	92045-1	51 53 RPD: 4	LCS-2	94%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	92045-1	0.2 0.4 RPD: 67	LCS-2	100%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	92045-1	6 6 RPD: 0	LCS-2	98%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	92045-1	55 54 RPD: 2	LCS-2	97%
Iron	mg/kg	1	Metals-020 ICP-AES	<1	92045-1	4700 4600 RPD: 2	LCS-2	116%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank				
Date prepared	-			[NT]				
Date analysed	-			[NT]				
Moisture	%	0.1	Inorg-008	[NT]				
QUALITY CONTROL Asbestos ID - soils	UNITS	PQL	METHOD	Blank				
Date analysed	-			[NT]				
QUALITY CONTROL Metals in TCLP USEPA1311	UNITS	PQL	METHOD	Blank				
Date extracted	-			[NT]				
Date analysed	-			[NT]				
QUALITY CONTROL ESP/CEC	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base Duplicate %RPD	Spike Sm#	Spike % Recovery
Exchangeable Ca	meq/100 g	0.1	Metals-009	<0.1	92045-1	1.9 2.4 RPD: 23	LCS-1	92%
Exchangeable K	meq/100 g	0.1	Metals-009	<0.1	92045-1	<0.1 <0.1	LCS-1	95%
Exchangeable Mg	meq/100 g	0.1	Metals-009	<0.1	92045-1	0.54 0.74 RPD: 31	LCS-1	88%
Exchangeable Na	meq/100 g	0.1	Metals-009	<0.1	92045-1	<0.1 <0.1	LCS-1	100%
Cation Exchange Capacity	meq/100 g	1	Metals-009	<1.0	92045-1	2.5 3.3 RPD: 28	[NR]	[NR]

Report Comments:

Asbestos ID was analysed by Approved Identifier: Alex Tam
 Asbestos ID was authorised by Approved Signatory: Lulu Guo

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

Project Name: UNSW - Bioscience Building Upgrade
Project No: 73492 Sampler: AG
Project Mgr: PG Mob. Phone 0448 280 782
Email: paul.gorman@douglaspartners.com.au
Date Required: STD Lab Quote No.

To: Envirolab Services
12 Ashley Street, Chatswood NSW 2068
Attn: Tania Notaras
Phone: 02 9910 6200 Fax: 02 9910 6201
Email: tnotaras@envirolabservices.com.au

Sample ID	Sample Depth	Lab ID	Sampling Date	Sample Type S - soil W - water	Container type	Analytes														Notes
						Heavy Metals*	TRH/BTEX	PAH	Phenols	PCB	OCP	Asbestos	CEC	TCLP Prep						
BH05	2.0-3.0	1	06.06.13	S	G/P	X	X	X	X	X	X	X			X					* As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and Fe

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

Job No: 92154

Date Received: 12/6/13
Time Received: 13:00
Received by: PT
Temp: 60 Ambient
Cooling: Ice/Icepack
Security: 12/6/13 Broken None

Lab Report No.	Phone: (02) 9809 0666
Send Results to: Douglas Partners Address: 96 Hermitage Road, West Ryde 2114	Fax: (02) 9809 4095
Relinquished by: WFM Signed: <i>[Signature]</i> Date & Time: 12.06.13 / 10 am	Received By: PT Date & Time: 12/6/13 13:00
Relinquished by: Signed: Date & Time:	Received By: Date & Time:

Appendix E

Quality Assurance/Quality Control Procedures and Results

Equipment Calibration Certificates

OL

' *Field Procedures Manual*

oil samples were collected
g fine weather conditions.

ertaken during wet weather

samples were recorded on
ampler, duplicate locations,
le and the dispatch courier
C.

C) sheets and accompanied
ed in Appendix D, following

recision and repeatability of
e location and an identical
laced into the sampling jars
loss of volatile compounds
a DP identification number,
primary sample from the

tions of groundwater into
ere filled directly from the

one duplicate sample for

handling.

ing disposable gloves and
ing equipment was avoided

contaminated Sites (reprinted
ed to the same preservation
aining the losses in volatile
out into the field and stored
atory analysis with the final

led procedure is yet to be
erally prepared as aqueous
n the standard manner and
vn below. At this stage, the
s from in-house laboratory
ervation techniques were

b)

m+p
xylene

o
xylene

99

99

113

110

d, subjected to the same
of determining the transfer
poratory. The result of the

Table Q2: Trip Blank Results – TPH/BTEX mg/kg

Sample ID	Matrix	Benzene	Toluene	Ethyl Benzene	m + p xyelene	o xyelene
Trip Blank	Soil	<PQL	<PQL	<PQL	<PQL	<PQL
TB	Groundwater	<PQL	<PQL	<PQL	<PQL	<PQL

Levels of analytes were all below detection limits indicating that cross contamination had not occurred during the course of the round trip from the site to the laboratory.

Q1.11 Field Instrument Calibration

All soil samples were screened for the presence of total photoionisable compounds (TOPIC) using a calibrated photoionisation detector (PID). The PID was calibrated at Active Environmental Solutions Pty Ltd and in the in-house laboratory with isobutylene gas. PID calibration certificates attached.

Q1.12 Relative Percentage Difference

A measure of the consistency of results for field samples is derived by the calculation of relative percentage differences (RPDs) for duplicate samples. A RPD of +/- 30% is generally considered typically acceptable for inorganic analytes by EPA, although in general a wider RPD range (50%) may be acceptable for organic analytes.

Q1.12.1 Intra-Laboratory Analysis

Intra-laboratory duplicates were conducted as an internal check of the reproducibility within the primary laboratory (Envirolab Pty Ltd) and as a measure of consistency of sampling techniques. Replicate samples were collected at a rate of approximately one replicate sample for every ten original samples collected and also analysed at a rate of 5% of primary samples analysed.

The comparative results of analysis between original and duplicate samples are summarised in the tables below.

Table Q3: Intra-laboratory Results Heavy Metals for Soil and Groundwater

Soil Matrix	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
BH6/0.2-0.3 (Fill)	<PQL	<PQL	17	24	26	0.5	20	46
BD2/050613	<PQL	<PQL	14	25	25	0.50	20	42
Difference	0	0	3	1	1	0	0	4
RPD	0	0	19	4	4	0	0	9
Groundwater Matrix	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
BH4	3	<PQL	12	8	<1	<PQL	3	26
BD1/190613	3	<PQL	12	8	2	<PQL	2	31
Difference	0	0	0	0	1	0	1	5
RPD	0	0	0	0	67	0	40	18

Table Q4: Intra-laboratory Results TRH/BTEX for Soil and Groundwater

Soil Matrix	TRHC ₆ -C ₉	TRHC ₁₀ -C ₃₆	Benzene	Toluene	Ethylbenzene	Xylenes
BH6/0.2-0.3 (Fill)	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BD2/050613	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Difference	0	0	0	0	0	0
RPD	0	0	0	0	0	0
Groundwater Matrix	TRHC ₆ -C ₉	TRHC ₁₀ -C ₃₆	Benzene	Toluene	Ethylbenzene	Xylenes
BH4	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
BD1/190613	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
Difference	0	0	0	0	0	0
RPD	0	0	0	0	0	0

Most of the calculated RPD values were not within the acceptable range of ± 30 for inorganic analytes ($\pm 50\%$ for organic) for the sample and its replicate with the exception of those shaded. However, this is not considered to be of significant concern due to:

- The low actual differences in the concentrations of some of the replicate pairs;
- Replicates, rather than homogenised duplicates were used to avoid volatile loss;
- The replicate samples being collected in filling material which is heterogeneous in nature, therefore differences are representative of the material and not the result inconsistencies in the sampling technique or laboratory precision;
- Some of the recorded concentrations being at/ close to the practical quantitation limit;
- All other QA/QC parameters met the DQI, including inter-laboratory replicate comparisons.

The concern over the high RPDs for soil are also alleviated somewhat due to:

- A significant percentage of the fill will be waste classified and removed from site; and
- Further assessment of data gaps is recommended in the report, providing an opportunity to assess the consistency of test data across the site.

Q2. LABORATORY QUALITY ASSURANCE AND QUALITY CONTROL

Q2.1 Chain of Custody

Chain of custody information was recorded on the Chain of Custody (COC) sheets and accompanied samples to the analytical laboratory. COCs contained receipt date and time and the identity of samples. Signed copies of COCs are presented in Appendix D, following the laboratory reports.

Q2.2 Holding Times

A review of the laboratory report sheets and chain-of-custody documentation indicated that holding times were met, as summarised in the table below.

Table Q5: Holding Times

Matrix	Analyte	Recommended maximum holding time	Holding time met
Soil	Heavy Metals: As, Cd, Cr, Cu, Pb, Hg, Ni, Zn	6 months	Yes
	TPH C ₆ -C ₉	14 days	Yes
	TPH C ₁₀ -C ₄₀	14 days	Yes
	BTEX	14 days	Yes
	PAH	14 days	Yes
	OCP	14 days	Yes
	PCB	14 days	Yes
	Phenols	14 days	Yes
	Asbestos	Nil	Yes
Water	Heavy Metals: As, Cd, Cr, Cu, Pb, Hg, Ni, Zn	6 months	Yes
	TPH C ₆ -C ₉	14 days	Yes
	TPH C ₁₀ -C ₄₀	14 days	Yes
	BTEX	14 days	Yes
	PAH	7 days	Yes
	OCP	7 days	Yes
	OPP	7 days	Yes
	Phenols	28 days	Yes
	Hardness	28 days	Yes

Q2.3 Analytical Laboratory

Samples were submitted to Envirolab Services Pty Ltd (Chatswood) for analysis. Envirolab is NATA accredited with an accreditation number of 2901 and is accredited for compliance with ISO/IEC 17025. Envirolab tests comply with NATA and NEPM. In house procedures are employed by Envirolab in the absence of documented standards.

The following QA/QC procedures were conducted by the laboratory. The results are included in the laboratory reports in Appendix D.

Q2.4 Surrogate Spike

This sample is prepared by adding a known amount of surrogate, which behaves similarly to the analyte, prior to analysis to each sample. The recovery result indicates the proportion of the known concentration of the surrogate that is detected during analysis. These results are within acceptance limits as specified in Envirolab Services, indicating that the extraction technique was effective.

The laboratory acceptance criteria for surrogate samples is generally 60-140% for organics; and 10-140% for SVOC and speciated phenols.

Q2.5 Practical Quantitation Limits - PQL

The PQL is the lowest quantity of an analyte which can be detected during the analysis. PQL at different analytical laboratories can differ based on the analytical techniques.

Q2.6 Reference and Daily Check Sample Results – Laboratory Control Sample (LCS)

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

The laboratory acceptance criteria for LCS samples is generally 70-130% for inorganic/ metals; and 60-140% for organics; and 10-140% for SVOC and speciated phenols. Any observed failures to meet this acceptance criteria are reported in Table Q6, Section Q2.10.

Q2.7 Laboratory Duplicate Results

These are additional portions of a sample which are analysed in exactly the same manner as all other samples. The laboratory acceptance criteria for duplicate samples is: in cases where the level is $<5 \times \text{PQL}$ – any RPD is acceptable; and in cases where the level is $>5 \times \text{PQL}$ – 0-50% RPD is acceptable. Any observed failures to meet this acceptance criteria are reported in Table Q6, Section Q2.10.

Q2.8 Laboratory Blank Results

The laboratory blank, sometimes referred to as the method blank or reagent blank is the sample prepared and analysed at the beginning of every analytical run, following calibration of the analytical apparatus. This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, it can be determined by processing solvents and reagents in exactly the same manner as for samples. Laboratory blanks are analysed at a frequency of 1 in 20, with a minimum of one per batch. Any observed failures to meet this acceptance criteria are reported in Table Q6, Section Q2.10.

Q2.9 Matrix Spike

This is a sample duplicate prepared by adding a known amount of analyte prior to analysis, and then treated exactly the same as all other samples. The recovery result indicates the proportion of the known concentration of the analyte that is detected during analysis. The laboratory acceptance criteria for matrix spike samples is generally 70-130% for inorganic/metals; and 60-140% for organics; and 10-140% for SVOC and speciated phenols. Any observed failures to meet this acceptance criteria are reported in Table Q6, Section Q2.10.

Q2.10 Results of Laboratory QA

The laboratory QA for surrogate spikes, LCS, laboratory duplicate results, method blanks and matrix spikes were generally within the acceptance standards. There were, however a few comments made in the laboratory reports which are summarised in Table Q6 below.

Table Q6: Laboratory QA Comments

Laboratory Report	ELS Reported Comment	DP Comment
ELS 92045	No Comments	No Comments
ELS 92154	No Comments	No Comments
ELS 92656	Cations_W: # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However, an acceptable recovery was obtained for the LCS. OCP/PCB in water analysed by NMI. Report No. Rn0979219.	Not Significant

Based on the laboratory reported QA/QC results it is considered that an acceptable level of laboratory precision and consistency was achieved and that surrogate spikes, LCS, laboratory duplicate results, method blanks and matrix spike results were of an acceptable level.

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 11K101262



Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		KB2034	pH 7.02
2. pH 10.00		pH 10.00		JH1569	pH 9.95
3. pH 4.00		pH 4.00		KD1211	pH 4.01
4. mV		231.8mV		KD2048/KD1984	232.4mV
5. EC		2.76 mS		KJ1595	2.75mS
6. D.O		0 ppm		556	0.00ppm
7. Temp		21.5°C		MultiTherm	21.4°C

Calibrated by:

Joanna Wong

Calibration date:

12/06/2013

Next calibration due:

9/12/2013

SERVICE OR REPAIR: MINIRAE2000 PID

COMPANY	Douglas Partners Pty Ltd		
CONTACT	Wen-Fei Yuan		
SERIAL NO.	110003382	LAMP TYPE	10.6eV
CALL NO.	113343	RECEIVED	05/03/2013

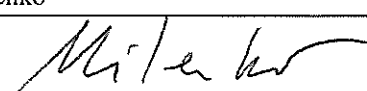
REQUEST/PROBLEM DESCRIPTION
Sent with problem description as: "PID would not turn on after day of charging..."

This equipment has been calibrated to the manufacturer's specifications, using the standards shown below:

ISOBUTYLENE STANDARD (ppm)	TRACEABILITY LOT NO.	POST CALIBRATION READING (ppm)
0	-	0
97	135816A	98.7

Cleaned sensor assembly, sensor housing and metal filter
 Cleaned and checked lamp and lamp housing
 Pump Cleaned and found operating satisfactory
 4 AA Alkaline Batteries replaced
 The instrument is calibrated and tested OK

COMMENTS/ADDITIONAL REPAIRS/SERVICES PERFORMED
NOTE: Please do not charge this PID unit. This unit is having Alkaline batteries that should be replaced when discharged.

SERVICED BY	Milenko	COMPLETED	07/03/2013
SIGNATURE			

"We do more than give you great equipment... We give you great solutions!"

Phone: (Free Call) 1300 735 295		Environmental Assessment Technologies		Fax: (Free Call) 1800 675 123	
Melbourne Branch 5 Caribbean Drive, Scoresby 3179 Email: RentalsEnviroVIC@thermofisher.com	Sydney Branch Level 1, 4 Talavera Road, North Ryde 2113 Email: RentalsEnviroNSW@thermofisher.com	Adelaide Branch 27 Beulah Road, Norwood, South Australia 5067 Email: RentalsEnviroSA@thermofisher.com	Brisbane Branch Unit 2/5 Ross St Newstead 4006 Email: RentalsEnviroQLD@thermofisher.com	Perth Branch 121 Beringarra Ave Malaga WA 6090 Email: RentalsEnviroWA@thermofisher.com	