URBAN ENVIRONMENTAL

PHASE II
CONTAMINATION ASSESSMENT
12 – 40 BONAR & 5 LOFTUS STREETS
ARNCLIFFE

Prepared for:

Meriton Apartments Pty Ltd

2 September, 2005

Project Ref: SJ259.R01

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EXECUTIVE SUMMARY

Urban Environmental Consultants Pty Ltd were commissioned by Meriton Apartments Pty Ltd to undertake a phase 2 contamination assessment of the site located at 12 – 40 Bonar & 5 Loftus Streets, Arncliffe, as per our proposal dated 28 July, 2005 and Meriton confirmation fax dated 8 August, 2005. The investigation is required as part of a development application to Rockdale City Council for medium density residential redevelopment of the site. The objective of the assessment is to build upon previous investigations at the site to determine the potential for contamination and remediation if required. The investigations have been undertaken as per Rockdale City Council Draft Development Control Plan No: 80 – Bonar Street Precinct, Section 6.6 Contamination and its provisions.

The site is bounded by Hirst St to the south, Bonar St to the east and Loftus St to the west in a commercial industrial part of Arncliffe. Butlers Hire occupies the property located at 5 Loftus Street and 40 Bonar Street. The site is currently used as a shipment yard for hire equipment such as scaffolding, fences and tarpaulins. The commercial property located at 12 Bonar Street is currently used for the storage and shipment of furniture.

A preliminary contamination assessment of the site was previously undertaken by Urban Environmental titled "Preliminary Contamination Assessment Stage 1 Bonar Street, Precinct Arncliffe" Report reference SJ188.R01 dated 22 September, 2004 as part of the rezoning application for the site. Historical review indicated the Bonar St precinct has had a predominantly commercial/industrial use from the 1950's to the present with various companies occurring in the precinct. These companies were predominantly manufacturers of goods along with a bus depot and mechanics. From the turn of the century through to the 1940's the titles were under private individuals, indicating residential occupancy, which correlated with the aerial photography.

Previous boreholes were drilled on site and analysed for a broad range of contaminants including Metals (Cu, Pb, Zn, Cr, Cd, As, Hg), Petroleum Hydrocarbons (TPH/BTEX), Polyaromatic Hydrocarbons (PAHs), Volatile Halogenated Compounds (VHCs), Phenols, PCBs, Pesticides (OCP/OPPs) and Asbestos. Results indicated low levels of metals, TPH/BTEX and PAH's were detected in soil samples from across the site. No Pesticides, PCBs, Phenols, VHCs or asbestos were detected above criteria in soils across the Stage 1 portion of the precinct. No groundwater impact was detected in the monitoring well MW1 on site. Based on this previous investigation the main contaminants of concern were determined to be Metals, Petroleum Hydrocarbons and Polyaromatic Hydrocarbons, particularly within fill materials.

The current investigation targeted accessible areas around the site predominantly warehouse buildings with sufficient headroom to permit drill rig access. A quarter of the site was inaccessible due to office buildings and other structures. The drill locations were additional to previous drilling undertaken across the driveway areas on site so as to provide a broad coverage of the site. Twelve boreholes were drilled across the site with three monitoring wells installed to determine groundwater conditions.

The investigation showed that the site is underlain by fill material encountered to depths averaging between 0.6m and 2.1m depth across the site. The underlying soil profile consisted mainly of estuarine alluvial sand, clay and silty clays (organic in parts) that were saturated at depths greater than 2.0m below ground surface (bgs). Based on observed organic content in these sediments potential for acid sulphate soil exists and select samples were analysed for POCAS.

The laboratory results indicate that petroleum hydrocarbons (TPH and BTEX compounds) were detected in soil samples from BH2 (0.2m) and BH3 (0.5m & 2.0m) at levels below the *NSW EPA (1994) Guidelines for the Assessment of Service Station Sites*. All remaining samples were below the guidelines. PAH concentrations were detected in samples from BH2, 3, 4, 5 & 9 at levels below the *NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme, Health-Based Investigation Levels – NEHF Setting D – residential with minimal access to soil.*

The laboratory results indicate that metals in all soil samples submitted for analysis were either below the laboratory limits of reporting or detected at concentrations below the *NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme, Health-Based Investigation Levels – NEHF Setting D – residential with minimal access to soil.* All metal concentrations were found to be below the *NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme provisional phytotoxicity based investigation levels (Column 5)* with the exception of the following samples – Copper BH9 & 12 - 0.5m, Lead BH5 - 0.5m, Zinc BH5 & 9 - 0.5m.

Preliminary analysis of estuarine sediments indicate that in BH12 2.0m, acid sulphate soil potential is present with results for Total Potential Acidity (TPA) and Total Sulfidic Acidity (TSA) at 40 mol H+/tonne.

Groundwater sampling results showed that no TPH/BTEX compounds were detected in the monitoring wells with results below the *NSW EPA (1994) threshold concentration of 10,000µg/L (an indicator of oil and grease) for the protection of aquatic ecosystems.* No BTEX were detected in the monitoring wells. Metals As, Ni & Hg were detected in the groundwater in sample MW2 at levels below the *ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality - 95% protection level for slightly to moderately disturbed freshwater ecosystems.*

The current and past investigations of the site indicate localised low level contamination potential with results within the NSW EPA Soil Investigation Levels for Urban Redevelopment Sites (NEHF D) for residential with minimal access to soil and is predominantly associated with former fuel storage facilities and placement of fill materials across the site. Shallow groundwater conditions occur and limited TPH contamination was detected in the monitoring wells installed on site at levels below current guidelines. Acid sulphate soil potential exists in the estuarine sediments, particularly below the water table and further assessment will be required during the excavation phases of development.

The site is considered suitable for the proposed medium density development though based on the phase 2 investigations the following activities are recommended during the excavation demolition of the site:

- Areas that are currently inaccessible due to building coverage should be examined upon demolition of these structures to confirm similar soil conditions encountered in this investigation.

- In areas requiring basement excavation and should the fill materials be excavated for off site disposal, a waste classification as per *NSW EPA (1999) Environmental Guidelines: Assessment, Classification and Management of Non-Liquid Wastes* should be undertaken to determine reuse or disposal options.

- Areas to be excavated into the underlying estuarine sediments will require testing for acid sulphate soil potential to determine appropriate soil & groundwater treatment and management as per the *NSW Acid Sulphate Soils Management Advisory Committee ASSMAC (1998) Guidelines.*

1 INTRODUCTION

1.1 Background

Urban Environmental Consultants Pty Ltd were commissioned by Meriton Apartments Pty Ltd to undertake a phase 2 contamination assessment of the site located at 12 – 40 Bonar & 5 Loftus Streets, Arncliffe, as per our proposal dated 28 July, 2005 and Meriton confirmation fax dated 8 August, 2005. The investigation is required as part of a development application to Rockdale City Council for medium density residential redevelopment of the site.

A preliminary contamination assessment of the site was previously undertaken by Urban Environmental titled "Preliminary Contamination Assessment Stage 1 Bonar Street, Precinct Arncliffe" Report reference SJ188.R01 dated 22 September, 2004 as part of the rezoning application for the site.

1.2 Objectives

The objective of the assessment is to build upon previous investigations at the site to determine the potential for contamination and remediation if required. The investigations have been undertaken as per Rockdale City Council Draft Development Control Plan No: 80 – Bonar Street Precinct, Section 6.6 Contamination and its provisions.

1.3 Scope of Works

To achieve the objective, the following work scope was undertaken:

- Review of background geological and hydrogeological information;
- A review of readily available reports and records;
- Build upon previous investigations conducted at the site;
- Site inspection to identify underground utilities and services at the site;
- Drilling of twelve boreholes (BH1-BH12) across the site in accessible areas;
- Collection of representative soil samples from each borehole;
- Installation of three monitoring wells (MW1-MW3);

- Purging and well development following installation;
- Monitoring, gauging and sampling of three monitoring wells (after 7 days);
- Laboratory analysis of soil and groundwater samples from the boreholes and monitoring wells for contaminants of concern including total petroleum hydrocarbons (TPH), including constituent hydrocarbon chainlength groups (C_6 - C_9, C_{10} - C_{14}, C_{15} - C_{28}, C_{29} - C_{36}), BTEX compounds (benzene, toluene, ethylbenzene and xylenes), polyaromatic hydrocarbons (PAHs), priority metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and selected analysis for POCAS – acid sulphate soil.
- Preparation of a report detailing the findings of the site investigations.

2 BACKGROUND INFORMATION

2.1 Site Identification

The site is bound by Hirst St to the south, Bonar St to the east and Loftus St to the west in a commercial industrial part of Arncliffe. A Site Plan (Figure 1) shows the location of the property and current buildings on site.

2.2 Previous Investigations

A preliminary contamination assessment of the site was previously undertaken by Urban Environmental titled "Preliminary Contamination Assessment Stage 1 Bonar Street, Precinct Arncliffe" Report reference SJ188.R01 dated 22 September, 2004 as part of the rezoning application for the site. A summary of the findings of this report is provided below:

The review of the historical titles indicated the Bonar St precinct has had a predominantly commercial/industrial use from the 1950's to the present with various companies occurring in the precinct. These companies were predominantly manufacturers of goods along with a bus depot and mechanics. From the turn of the century through to the 1940's the titles were under private individuals, indicating residential occupancy, which correlates with the aerial photography.

The aerial photography review indicated the precinct appeared to have been in its current form since the 1970s. There were fewer commercial warehouses located at the site in 1951, amongst semi rural residential properties. Back in the 1930s, the site was mainly farmland with houses and commercial sheds scattered across the site.

Six boreholes were drilled on site and analysed for a broad range of contaminants including Metals (Cu, Pb, Zn, Cr, Cd, As, Hg), Petroleum Hydrocarbons (TPH/BTEX), Polyaromatic Hydrocarbons (PAHs), Volatile Halogenated Compounds (VHCs), Phenols, PCBs, Pesticides (OCP/OPPs) and Asbestos. Results indicated low levels of metals, TPH/BTEX and PAH's were detected in soil samples from across the site. No Pesticides, PCBs, Phenols, VHCs or

asbestos were detected above criteria in soils across the site. No groundwater impact was detected in the monitoring well MW1 on site.

2.3 Regional Geology and Soils

The Geological Series Sheet of the Sydney area (Sheet 9130 1:100,000 scale) indicates the site is underlain by Wianamatta Group Hawkesbury Sandstone, in the south west portion. The majority of the site is underlain by Quaternary deposits, which include silty to peaty quartz sand, silt and clay.

Review of the DLWC Soil Landscape Series Sydney Sheet 9130 indicates the site forms part of various landscapes including Gymea Erosional Soil Landscape, the Birrong Fluvial Landscape with areas of Disturbed Terrain also noted in the vicinity.

The Gymea Erosional Soil Landscape consists of undulating to rolling rises and low hills on Hawkesbury Sandstone. Soils comprise shallow to moderately deep yellow earths and earthy sands on crests, localised podsolic soils on shale lenses and shallow to moderately deep silicious and leached sands along drainage lines. The soils are described as having, high erosion hazard, shallow highly permeable soil and very low soil fertility.

The Fluvial Birrong Landscape comprises level to gently undulating alluvial flood plain draining Wianamatta Group Shales. The soils in this landscape are described as deep (<250cm) yellow podzolic soils and yellow solodic soils on older alluvial terraces and deep (>250cm) solodic soils and yellow solonetz on current floodplain. These soils are subject to localised flooding, have a high soil erosion hazard, saline subsoils, with seasonal waterlogging and very low soil fertility.

Disturbed Landscapes are described as level to hummocky terrain, extensively disturbed by human activity including complete disturbance, removal or burial of soil. Sites include quarries, tips, land reclamation, and large cut and fill features. Original vegetation has been cleared and weeds are abundant.

The original soils in this landscape have been removed, greatly disturbed or buried. Landfill includes soil, rock, building and waste materials. These soils have high variability that may include engineering hazard, unconsolidated low bearing strength materials, impermeability, poor drainage, very low fertility and toxic materials. They can be sources of sediment and groundwater contamination.

Review of the DLWC Acid Sulphate Soil Risk Map – Botany Bay Edition 2 1997 indicates the site is within a typical landform comprising bedrock slopes. Acid sulphate soils are not known or expected to occur in these environments. The environmental risk is indicated as land management activities not likely to be affected by acid sulphate soil materials.

Based on investigations undertaken the site is underlain by a layer of fill material overlying variable fluvial/alluvial sediments consisting of quartz sand, silt and clay which is organic in part. Based on observed organic content in these sediments potential for acid sulphate soil exists.

2.4 Regional Hydrology and Hydrogeology

No surface water features are present in the immediate vicinity of the site. The nearest water body located approximately 1km downgradient of the site in an easterly direction, is the Cooks River which is part of the Botany Bay marine environment.

Groundwater was encountered within the sandy clay layers at depths greater than 2.0m below ground surface (bgs) in the boreholes drilled on site.

A search of DLWC database indicated there were 26 groundwater bores present within a 1km radius of the site in the Botany Bay Sand Beds. Based on local geology and hydrogeology, groundwater is expected to occur within the underlying quaternary sand formation at shallow depths.

2.5 Site Condition and Surrounding Environment

The surrounding environment consists mainly of commercial businesses and residential properties including the following:

- A primary school on Loftus Street and residential properties across Bonar Street to the north;
- Residential properties and commercial warehouses across Hirst Street to the south;
- Commercial and Industrial properties across Loftus Street to the west;
- A former Bowls Club and greens across Bonar Street to the east.

Butlers Hire occupies the property located at 5 Loftus Street and 40 Bonar Street. The site is currently used as a shipment yard for hire equipment such as scaffolding, fences and tarpaulins. The site is covered in bitumen with some concrete sections around the main building. There is an operational above ground diesel storage tank and bowser located at the site as shown in Figure 1. During the investigations, a site worker identified an area adjacent to BH3 where a former underground storage tank used to exist. Slight Hydrocarbon odours were noticed during the drilling of BH3.

The commercial property located at 12 Bonar Street is currently used for the storage and shipment of furniture. There was no evidence of any USTs, and almost the entire site, including the warehouse floor was covered by a relatively new concrete slab.

3 ENVIRONMENTAL ASSESSMENT METHODOLOGY

3.1 Sampling Rationale and Assessment Criteria

This limited phase 2 assessment targeted accessible areas around the site predominantly warehouse buildings with sufficient headroom to permit drill rig access. A quarter of the site was inaccessible due to office buildings and other structures. The drill locations were in additional to previous drilling undertaken across the driveway areas on site so as to provide a broad coverage of the site. The three monitoring wells installed were also spread across the site to determine groundwater conditions.

Based on the previous assessment the contaminants of concern were determined to be Metals (Cu, Pb, Zn, Cr, Cd, As, Hg), Petroleum Hydrocarbons (TPH/BTEX), Polyaromatic Hydrocarbons (PAHs). Due to estuarine sediments being present on site select samples from at or below the watertable (2m) were analysed for POCAS – acid sulphate soil potential.

Petroleum hydrocarbons (TPH/BTEX) in soils have been assessed with primary reference to the *NSW EPA (1994) Guidelines for Assessing Service Station Sites* which are considered appropriate for sensitive landuse areas such as residential. PAH and metal concentrations in soils have been assessed with reference to the *NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme, Health-Based Investigation Levels – NEHF Setting D – residential with minimal access to soil including high rise apartments and flats.* These are considered appropriate as the site is proposed for medium density residential redevelopment.

In terms of environmental risk the soil validation sample results for metal concentrations were also considered with reference to the *NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme provisional phytotoxicity-based investigation levels for sandy loams, pH 6-8, Column 5*. Phytotoxicity is used as the indicative environmental effect to be dealt with in the context of urban redevelopment.

The assessment criteria adopted for groundwater impact beneath the area of investigation is based on the *ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality - 95% protection level for slightly to moderately disturbed freshwater ecosystems* for benzene, xylene, naphthalene and metals. TPH and PAHs in the groundwater have been assessed against *NSW EPA (1994) Guidelines for Assessing Service Station Sites – Threshold concentration for the protection of aquatic ecosystems.* Due to the presence of groundwater bores located within 1km of the site, and in terms of groundwater, the freshwater guidelines are considered appropriate assessment criteria. However, stormwater drains in the area receiving road and surface runoff are likely to discharge into the tidal water river system located one kilometre east of the site.

Site Assessment Criteria

	Primary Soil Assessment Criteria* (mg/kg)	Groundwater Assessment Criteria*** (ug/L)
TPH C_6-C_9	65	10,000*
TPH C_{10}-C_{36}	1000	Included above
Benzene	1	950
Toluene	1.4	ID
Ethyl Benzene	3.1	ID
Xylenes	14	350 (ortho-xylene)
PAHs	80**	3*
Copper	4000**	1.4
Lead	1200**	3.4
Zinc	28000**	8
Chromium	400**	ID
Cadmium	80**	0.2
Arsenic	400**	24
Mercury	60**	0.6
Nickel	2400**	11

Note: * NSW EPA (1994) Guidelines for Assessing Service Station Sites - Threshold Concentrations for Sensitive Land Use (soils) Protection of Aquatic Ecosystems Fresh (groundwater)
** NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme – Soil Investigation Levels for Urban Redevelopment Sites in NSW. Health-Based Investigation Levels – NEHF Setting D - residential with minimal access to soil including high rise apartments and flats
***Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000) – 95% protection level for slightly to moderately disturbed freshwater ecosystems
ID = Insufficient data to derive a reliable trigger value
NE = Guideline not established

3.2 Drilling and Soil Sampling

The investigation area was inspected and checked for underground utilities and services prior to the final location of each borehole.

At each selected drilling point, the concrete was cored and penetrated with an auger V bit. The holes were then drilled by hand auger to below any fill material to confirm that there were no obstructions from utilities or services. Drilling was completed to the selected maximum depth up to 3m. Further details of monitoring well installation and sampling procedures are presented in the Field Quality Assurance Plan in Appendix D.

Soil samples were collected at 1.0m intervals from the auger flights for description of the soil profile and collection of soil samples for laboratory analysis. The description of soil profile of each borehole was noted in a field drill log. Soil samples were retained for laboratory analysis according to visual and olfactory observations and photoionisation detector (PID) readings.

Figure 1 shows the location of twelve boreholes (BH1-BH12) drilled across the site, and the installed monitoring wells (MW1-MW3). All boreholes were drilled to depths of at least 2.0m. The soil profile of each borehole is described on drilling logs included in Appendix A.

3.3 Groundwater Sampling and Monitoring

Monitoring well installation details are recorded on field log sheets contained in Appendix A and monitoring well installation and sampling procedures are described in Appendix D. Well development was undertaken on the day of installation and the wells were allowed to settle and sampled five days after installation.

No free product was detected in any of the monitoring wells. Standing water levels were between 2.1m and 2.9m bgs. The field monitoring gauging data is presented in Table 6.

3.4 Field Sample Collection and Laboratory Analysis

The laboratory analytical methods, field QA/QC and laboratory QA/QC procedures are detailed in the Laboratory Quality Assurance Plan, included in Appendix E. The borehole sample locations are shown in Figure 1.

4 RESULTS

4.1 Soil Analytical Results

Laboratory analytical results are contained in Appendix C and summarised in Tables 1, 2 and 3.

4.1.1 Hydrocarbons

Laboratory results of soil analyses for BTEX and TPH are compared in Table 1 with the Site Assessment Criteria.

The results show that TPH and BTEX were detected in samples from BH2 (0.2m) and BH3 (0.5m & 2.0m) at levels below the *NSW EPA (1994) Guidelines for the Assessment of Service Station Sites*. All remaining samples were below criteria.

4.1.2 Metals

Laboratory results of selected metal analyses are compared in Table 2 with the Site Assessment Criteria. Concentrations of copper (Cu), lead (Pb), zinc (Zn), chromium (Cr), cadmium (Cd), nickel (Ni), arsenic (As) and mercury (Hg) in all soil samples submitted for analysis were either below the laboratory limits of reporting or detected at concentrations below the *NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme, Health-Based Investigation Levels – NEHF Setting D – residential with minimal access to soil.*

In terms of environmental risk the soil sample results for metal concentrations were considered with reference to the *NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme provisional phytotoxicity based investigation levels (Column 5).* All metal concentrations were found to be below the NSW EPA (1998) provisional phytotoxicity investigation levels with the exception of the following samples – Copper BH9 & 12 - 0.5m, Lead BH5 - 0.5m, Zinc BH5 & 9 - 0.5m.

4.1.3 Organics

Total PAHs and benzo(a)pyrene results are presented in Table 3 and compared with the Site Assessment Criteria. The results show that low levels of PAHs were detected in samples from BH2, 3, 4, 5 & 9 at levels below the *NSW EPA (1998) Guidelines for the NSW Site Auditor Scheme, Health-Based Investigation Levels – NEHF Setting D – residential with minimal access to soil.*

4.1.4 Acid Sulphate Soil Potential

Two select samples of estuarine sediment from at or below the water table were analysed for acid sulphate soil potential (POCAS). Results from BH9 & 12 (2.0m) as shown in the laboratory certificate contained in Appendix B indicate that in BH12 acid sulphate soil potential is present with results for Total Potential Acidity (TPA) and Total Sulfidic Acidity (TSA) at 40 mol H+/tonne.

4.2 Groundwater Analytical Results

Laboratory analytical results are given in Appendix C and summarised in Tables 4, 5 & 6.

4.2.1 Hydrocarbons

Laboratory results of groundwater analyses for BTEX and TPH are compared in Table 4 with the Site Assessment Criteria.

Results show that no TPH/BTEX were detected in the monitoring wells with results below the *NSW EPA (1994) threshold concentration of 10,000µg/L (an indicator of oil and grease) for the protection of aquatic ecosystems.* No BTEX were detected in the monitoring wells with results below the *ANZECC (2000) Guidelines.*

4.2.2 Metals

Laboratory results of groundwater analyses for Metals are compared in Table 5 with site criteria. Metals As, Ni & Hg were detected in the groundwater in sample MW2 at levels below the *ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality - 95% protection level for slightly to moderately disturbed freshwater ecosystems.*

4.3 Laboratory QA/QC Results

A total of 7 soil and 4 groundwater samples (including duplicate samples), were submitted to the NATA registered Labmark laboratory. Standard laboratory QA/QC procedures are contained in Appendix B and Appendix C. The required laboratory QA/QC procedures and data quality objectives are presented in the Laboratory Quality Assurance Plan, Appendix E.

Review of laboratory quality data against data quality objectives indicates that the accuracy of the laboratory analyses is satisfactory. The laboratory analytical data presented in Appendix B and Appendix C demonstrate that the analytical laboratory adhered to appropriate QA/QC procedures and results are acceptable.

4.4 Site Geological Information

The site is underlain by fill material encountered to depths ranging on average between 0.6m and 2.1m. The underlying natural soil profile consisted mainly of sand, clay and silty clays (organic in parts) which were saturated at depths greater than 2.1m below ground surface (bgs). A detailed description of the lithology logged in each investigation borehole is given in Appendix A.

4.5 Site Hydrogeological Information

Three (3) groundwater monitoring wells (MW1-MW3) were installed across the site as shown on Figure 1. Well construction details are shown on the drilling logs included in Appendix A.

4.5.1 Groundwater Gauging Data

Current groundwater gauging data collected during field activities conducted on 15 August 2005 is presented in Table 6. Current groundwater gauging results are summarised below:

- No phase separated hydrocarbons (PSHs) were detected during the gauging or sampling of monitoring wells located at the site.
- Gauging of the monitoring wells indicated that the depth to static groundwater levels (SWLs) ranged from 2.1mm (MW3) to 2.9m bgs (MW1).

5 DISCUSSION

5.1 Site Impacts

The following points summarise the results of the assessment conducted at 12 – 40 Bonar & 5 Loftus Streets, Arncliffe.

- Fill material consisting of a mix of sand, silts, gravel and clay was encountered beneath the bitumen and concrete surfaces to depths on average ranging between 0.3m and 2.1m bgs.
- An estuarine soil profile consisting mainly of sand, clay and silty clays (organic in parts) saturated at depths greater than 2.0m, underlies the site.
- Groundwater was detected in monitoring wells on site with levels below ground surface ranging between 2.1m and 2.9m.
- The nearest significant environmental receptor is the Cooks River, part of the Botany Bay marine environment, located approximately 1km east of the site.
- No petroleum hydrocarbon concentrations exceeded the *NSW EPA (1994) Guidelines* in the soil samples obtained from site.
- TPH in the C_{15}-C_{36} range was detected in a soil sample (BH2) directly beneath the concrete surface adjacent to the above ground diesel tank located at Butlers Hire yard (5 Loftus Street). The source of impact is likely to be from spills at the bowser during refuelling operations.
- Metal concentrations were below the *NSW EPA (1998) Guidelines NEHF D - residential with minimal access to soil* in all samples selected for laboratory analysis.
- No PAHs, were detected above criteria in soils sampled across the site.
- No Petroleum Hydrocarbons (TPH/BTEX) or metals, were detected in groundwater samples from across the site at levels above the *NSW EPA (1994) threshold concentration of 10,000µg/L (an indicator of oil and grease) for the protection of aquatic ecosystems and ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality - 95% protection level for slightly to moderately disturbed freshwater ecosystems.*

- Preliminary analysis of estuarine sediments indicate that in BH12 2.0m, acid sulphate soil potential is present with results for Total Potential Acidity (TPA) and Total Sulfidic Acidity (TSA) at 40 mol H+/tonne.

6 CONCLUSIONS

Based on the results of the phase 2 contamination assessment, Urban Environmental Consultants Pty Ltd concludes the following:

- Butlers Hire occupies the property located at 5 Loftus Street and 40 Bonar Street. The site is currently used as a shipment yard for hire equipment such as scaffolding, fences and tarpaulins. The commercial property located at 12 Bonar Street is currently used for storage and shipment of furniture.
- The previous aerial photograph review indicates the precinct appears to have been in its current form since the 1970s. There were fewer commercial warehouses located at the site in 1951, amongst semi rural residential properties. Back in the 1930s, the site was mainly farmland with houses and commercial sheds scattered across the site.
- The review of the historical titles indicates the precinct has had a predominantly commercial/industrial use from the 1950's to the present with various companies occurring in the precinct. These companies were predominantly manufacturers of goods and storage activities. From the turn of the century through to the 1940's the titles were under private individuals, indicating residential occupancy, which correlates with the aerial photography.
- Fill material consisting of a mix of sand, gravel, clay and sandstone was encountered beneath the bitumen and concrete surfaces on average at depths ranging between 0.6m and 2.1m bgs across the site. An estuarine soil profile consisting mainly of sand, clay and silty clays (organic in part) saturated at depths greater than 2.0m, underlies the fill.
- No groundwater impact was detected in the monitoring wells across the site.
- There was evidence of localised petroleum hydrocarbon impact in two boreholes (BH2 & BH3) associated with above and underground fuel storage.
- Metal concentrations were below the NSW EPA (1998) guidelines NEHF D - residential with minimal access to soil in all samples selected for laboratory analysis.

7 RECOMMENDATIONS

The current and past investigations of the site indicate localised low level contamination potential with results within the NSW EPA Soil Investigation Levels for Urban Redevelopment Sites (NEHF D) Residential with minimal access to soil, predominantly associated with former fuel storage facilities and placement of fill materials across the site. Shallow groundwater conditions occur and limited TPH contamination was detected in the monitoring wells installed on site at levels below current guidelines. Acid sulphate soil potential exists in the estuarine sediments, particularly below the water table and further assessment will be required during the excavation phases of development.

The site is considered suitable for the proposed medium density development though based on the phase 2 investigations the following activities are recommended during the excavation demolition of the site:

- Areas that are currently inaccessible due to building coverage should be examined upon demolition of these structures to confirm similar soil conditions encountered in this investigation.

- In areas requiring basement excavation and should the fill materials be excavated for off site disposal, a waste classification as per NSW EPA (1999) Environmental Guidelines: Assessment, Classification and Management of Non-Liquid Wastes should be undertaken to determine reuse or disposal options.

- Areas to be excavated into the underlying estuarine sediments will require testing for acid sulphate soil potential to determine appropriate soil & groundwater treatment and management as per the NSW Acid Sulphate Soils Management Advisory Committee ASSMAC (1998) Guidelines.

8 LIMITATIONS

Urban Environmental Consultants Pty Ltd ('Urban Environmental') has undertaken an environmental site assessment of the site in accordance with current professional and industry standards. The scope of works undertaken were limited to that set out in its email proposal dated 28 July, 2005 ('the proposal') and agreed by Ms Larissa Brennan of Meriton Apartments Pty Ltd ('the client') by fax response dated 8 August, 2005.

Urban Environmental's assessment of the site is based on a limited site investigation and upon the program of surface and subsurface screening and laboratory testing of samples as set out in the proposal. The findings of this report are based on site conditions existing at the time the sampling was conducted. On this basis Urban Environmental cannot provide unqualified warranties or assume liability for site conditions not observed and/or not accessible during the time of its investigation. Despite all reasonable care and diligence, the ground conditions encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated.

Site characteristics may change in response to natural conditions, chemical reactions, spillage of contaminated substances or dumping of fill. These changes may occur subsequent to the investigations of Urban Environmental. On this basis conclusions have been made from a limited number of observation points assuming that the geological and chemical conditions are representative across the site. No other warranties are made or intended.

No site investigations can provide absolute confirmation of the presence or absence of substances that may be considered contaminating, hazardous or polluting. Similarly the level of testing undertaken cannot be considered to unequivocally characterise the degree or extent of contamination on site.

Regulatory guideline criteria for the evaluation of environmental soil and groundwater quality are frequently reviewed and updated. Contaminant concentrations, which currently are considered acceptable may change in the future. The environmental assessment has been based on soil and or groundwater investigation levels for specific landuses outlined in NSW EPA guidelines.

Should the site require remediation or if materials are to be excavated and removed offsite, waste classification will be required which may result in materials requiring disposal to landfill. Materials classified as suitable for reuse from a contamination perspective may not be suitable for geotechnical use.

Urban Environmental cannot provide any warranties in regard to future review of this report by third parties such as EPA accredited contaminated site auditors as the scope of works were not reviewed or agreed by an auditor who may be appointed by other parties in the future. Any third party review should be undertaken on a complete final version of this report as opposed to any extracts. This report has been prepared exclusively for the client as part of the sampling performed at 12 – 40 Bonar & 5 Loftus Streets, Arncliffe. This report cannot be reproduced without the written authorisation of Meriton Apartments Pty Ltd and then can only be reproduced in its entirety.

9 REFERENCES

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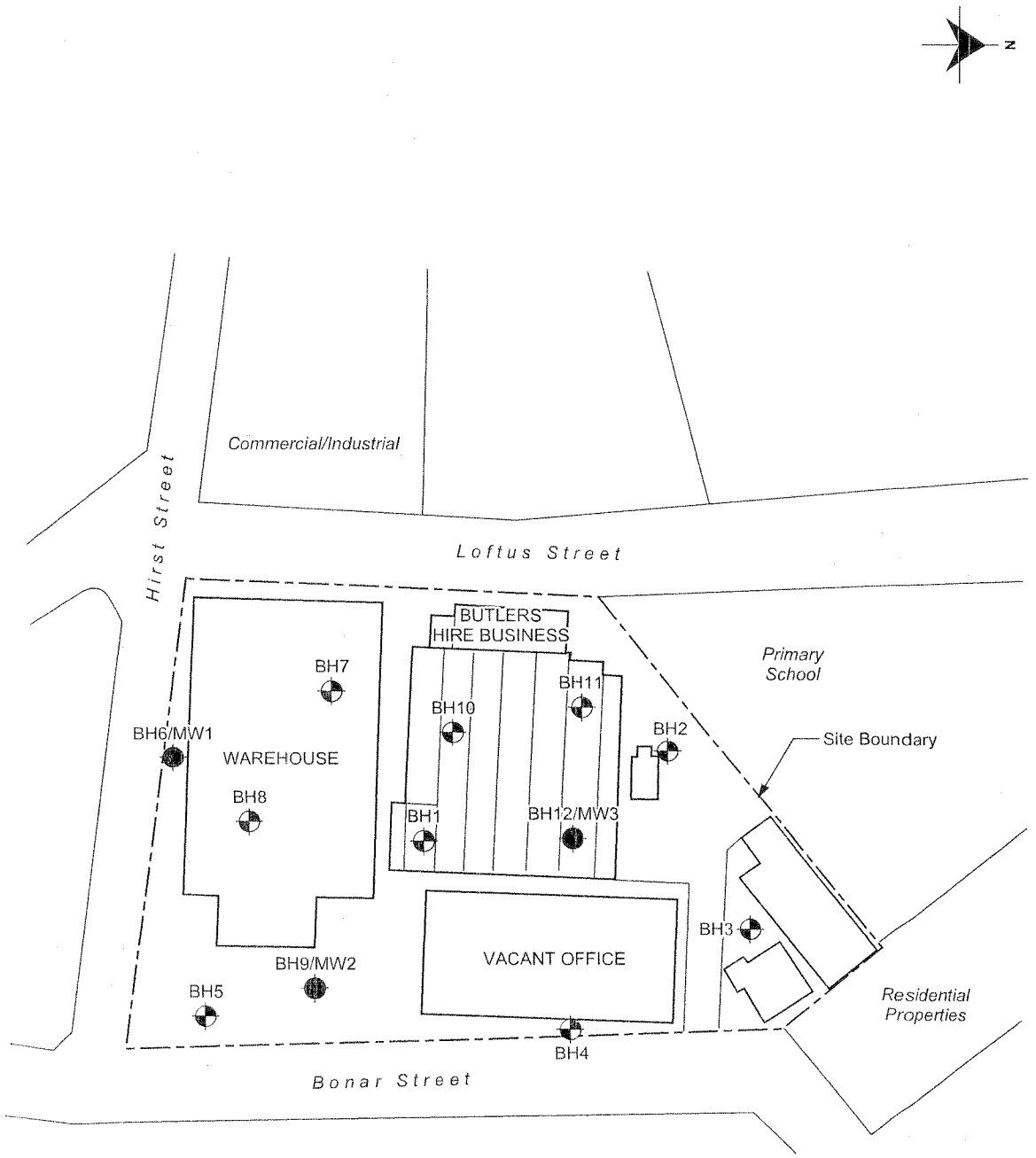
FIGURES



LEGEND

- Soil Bore Location
- Groundwater Monitoring Location

REVISION: SCALE: NTS JOB No: SJ254 FILE No: SJ257_01.cdr DATE: August 2005	DESIGNED: DRAWN: BW CHECKED: APPROVED: STATUS:	URBAN ENVIRONMENTAL	CLIENT MERITON APARTMENTS PROJECT LIMITED PHASE II ESA BONAR & HIRST STREETS, ARNCLIFFE	TITLE SITE PLAN SHOWING SAMPLE LOCATIONS FIGURE 1 A4

TABLES

TABLE 1
SOIL ANALYTICAL RESULTS
TPH & BTEX
12 - 40 BONAR & 5 LOFTUS STREETS, ARNCLIFFE
(All results as mg/kg)

Sample ID	Depth (m)	Sample Date	VOCs (ppmv)	Comments	Total Petroleum Hydrocarbons					BTEX Compounds				
					TPH	C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total BTEX	Benzene	Toluene	Ethylbenzene	Xylenes
BH1	0.5	28/08/2004	0.3	Fill	-	nd	nd	nd	nd	-	nd	nd	nd	nd
BH2	0.2	28/08/2004	0.2	Fill	480	nd	nd	240	240	-	nd	nd	nd	nd
BH2	2	28/08/2004	0.4	Sand	-	nd	nd	nd	nd	-	nd	nd	nd	nd
BH3	0.5	28/08/2004	4	Sand	70	10	60	nd	nd	8.1	nd	nd	2.1	6
BH3	2	28/08/2004	7.7	Sandy Clay	140	20	120	nd	nd	10.4	nd	nd	1.5	8.9
BH4	1	28/08/2004	0.2	Fill	-	nd	nd	nd	nd	-	nd	nd	nd	nd
BH5	0.5	28/08/2004	0.3	Sand	-	nd	nd	nd	nd	-	nd	nd	nd	nd
BH6	0.5	28/08/2004	0	Fill	-	nd	nd	nd	nd	-	nd	nd	nd	nd
BH7	0.5	10/08/2005	0	Fill	-	nd	nd	nd	nd	-	nd	nd	nd	nd
BH8	0.5	10/08/2005	0	Fill	-	na	na	na	na	-	na	na	na	na
BH9	0.5	10/08/2005	0	Fill	-	nd	nd	nd	nd	-	nd	nd	nd	nd
BH10	0.5	10/08/2005	0	Fill	-	na	na	na	na	-	na	na	na	na
BH11	0.3	10/08/2005	0	Fill	-	nd	nd	nd	nd	-	nd	nd	nd	nd
BH12	0.5	10/08/2005	0	Fill	-	na	na	na	na	-	na	na	na	na
QC4	--	10/08/2005				5	25	50	50		0.1	0.25	0.25	0.25
BH11	0.3	10/08/2005		Duplicate of BH11		5	25	50	50		0.1	0.25	0.25	0.25
				RPDs		0	0	0	0		0	0	0	0
LABMARK Laboratory Methods and Practical Quantitation Limit (PQL)														
LABMARK Method						E003.2	E006.2				E002.2			
PQL						10	50	100	100		0.2	0.5	0.5	0.5
Investigation Criteria or Regulatory Guidelines (Applicable Criteria Highlighted)														
NSW EPA (1994)						65	1000				1	1.4	3.1	14

Notes: NSW EPA Guidelines for Assessing Service Station Sites (1994) Threshold Concentrations for Sensitive Landuse

VOC (ppmv) = Volatile Organic Compounds, parts per million by volume

Results above Applicable Levels Highlighted

ND = Below PQL NA = Not Analysed

TABLE 2
SOIL ANALYTICAL RESULTS
METALS
12 - 40 BONAR & 5 LOFTUS STREETS, ARNCLIFFE
(All results in mg/kg)

Sample ID	Depth (m)	Sample Date	Comments	Copper	Lead	Zinc	Chromium	Cadmium	Arsenic	Nickel	Mercury
BH1	0.5	28/08/2004	Fill	10	22	51	7	0.2	2	4	0.05
BH2	0.2	28/08/2004	Fill	38	130	130	5	0.2	5	4	0.14
BH2	2	28/08/2004	Sand	2	nd	nd	2	nd	nd	nd	nd
BH3	0.5	28/08/2004	Sand	3	9	7	nd	nd	nd	nd	nd
BH3	2	28/08/2004	Sandy Clay	nd	3	nd	9	nd	2	nd	nd
BH4	1	28/08/2004	Fill	9	21	61	3	nd	2	1	0.07
BH5	0.5	28/08/2004	Sand	80	910	220	30	1.1	8	5	0.64
BH6	0.5	28/08/2004	Fill	3	5	5	4	nd	3	nd	nd
BH7	0.5	10/08/2005	Fill	10	23	14	4	nd	nd	1	nd
BH8	0.5	10/08/2005	Fill	nd	nd	nd	4	nd	nd	nd	0.12
BH9	0.5	10/08/2005	Fill	160	260	550	14	0.5	16	12	0.14
BH10	0.5	10/08/2005	Fill	16	61	96	9	0.3	3	7	0.26
BH11	0.3	10/08/2005	Fill	13	21	19	9	nd	2	8	nd
BH12	0.5	10/08/2005	Fill	660	91	59	11	0.2	3	9	0.08
QC4		10/08/2005	Duplicate of BH11	18	26	23	10	0.05	2	9	0.025
BH11	0.3	10/08/2005		13	21	19	9	0.05	2	8	0.025
			RPDs	32	21	19	11	0	0	12	0
LABMARK Laboratory Method E022.2 Metals by ICP-MS											
Practical Quantitation Limit (PQL)				2	2	5	1	0.1	1		0.05
Investigation Criteria or Regulatory Guidelines (Applicable Criteria Highlighted)											
NSW EPA (1998) Provisional Phytotoxicity Levels				100	600	200	400	3	20	60	1
NSW EPA (1998) Soil Investigation Levels (NEHF A)				1000	300	7000	100	20	100	600	15
NSW EPA (1998) Soil Investigation Levels (NEHF D)				4000	1200	28000	400	80	400	2400	60
NSW EPA (1998) Soil Investigation Levels (NEHF E)				2000	600	14000	200	40	200	600	30
NSW EPA (1998) Soil Investigation Levels (NEHF F)				5000	1500	35000	500	100	500	3000	75

Notes:

NSW EPA Guidelines for the NSW Site Auditor Scheme (1998) - Soil Investigation Levels for Urban Redevelopment Sites in NSW
Health-Based Soil Investigation Levels - NEHF Setting A - Residential with garden accessible soil including Childrens Daycare Centres, Preschools, Primary Schools or Townhouses & Villas
Health-Based Soil Investigation Levels - NEHF Setting D - Residential with minimal access to soil including High Rise Apartments and Flats
Health-Based Soil Investigation Levels - NEHF Setting E - Parks and Recreational Open Space, Playing Fields & Secondary Schools
Health-Based Soil Investigation Levels - NEHF Setting F - Commercial or Industrial
Provisional Phytotoxicity Levels for Sandy Loams
Results Above Applicable Levels Highlighted Hotspot Criteria 2.5x Applicable Level ND = Below PQL NA = Not Analysed

TABLE 3
SOIL ANALYTICAL RESULTS
ORGANICS
12 - 40 BONAR & 5 LOFTUS STREETS, ARNCLIFFE
(All results in mg/kg)

Sample ID	Depth (m)	Sample Date	Comments	Benzo(a) Pyrene	Total PAHs	Total PCBs	Phenol	DDT	Aldrin & Dieldrin	Chlordane	Heptachlor	OPPs	VHCs
BH1	0.5	28/08/2004	Fill	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BH2	0.2	28/08/2004	Fill	1.2	9.7	nd	nd	nd	nd	nd	nd	nd	nd
BH2	2	28/08/2004	Sand	nd	nd	na	na	na	na	na	na	na	na
BH3	0.5	28/08/2004	Sand	nd	1.8	nd	nd	nd	nd	nd	nd	nd	nd
BH3	2	28/08/2004	Sandy Clay	nd	1.3	na	na	na	na	na	na	na	na
BH4	1	28/08/2004	Fill	nd	1.2	na	na	na	na	na	na	na	na
BH5	0.5	28/08/2004	Sand	nd	1.4	na	na	na	na	na	na	na	na
BH6	0.5	28/08/2004	Fill	nd	nd	na	na	na	na	na	na	na	na
BH7	0.5	10/08/2005	Fill	nd	nd	nd	nd	nd	nd	nd	nd	nd	na
BH8	0.5	10/08/2005	Fill	na	na	na	na	na	na	na	na	na	na
BH9	0.5	10/08/2005	Fill	nd	3.3	na	na	na	na	na	na	na	na
BH10	0.5	10/08/2005	Fill	na	na	na	na	na	na	na	na	na	na
BH11	0.3	10/08/2005	Fill	nd	nd	na	na	na	na	na	na	na	na
BH12	0.5	10/08/2005	Fill	na	na	na	na	na	na	na	na	na	na
QC4	--	10/08/2005	Duplicate of BH11	0.25	0.25	na	na	na	na	na	na	na	na
BH11	0.5	10/08/2005		0.25	0.25	nd	nd	nd	nd	nd	nd	nd	nd
			RPDs	0	0	-	-	-	-	-	-	-	-
LABMARK Laboratory Method				E007.2	E007.2			OC EO13.2	OC EO13.2	OC EO13.2	OC EO13.2		
Practical Quantitation Limit (PQL)				0.5	0.5			0.05	0.05	0.05	0.05		
Investigation Criteria or Regulatory Guidelines (Applicable Criteria Highlighted)													
NSW EPA (1998) Provisional Phytotoxicity Levels							70						
NSW EPA (1998) Soil Investigation Levels (NEHF A)				1	20	10	8500	200	10	50	10	ne	ne
NSW EPA (1998) Soil Investigation Levels (NEHF D)				4	80	40	34000	800	40	200	40	ne	ne
NSW EPA (1998) Soil Investigation Levels (NEHF E)				2	40	20	17000	400	20	100	20	ne	ne
NSW EPA (1998) Soil Investigation Levels (NEHF F)				5	100	50	42500	1000	50	250	50	ne	ne

Notes:
NSW EPA Guidelines for the NSW Site Auditor Scheme (1998) - Soil Investigation Levels for Urban Redevelopment Sites in NSW
Health-Based Soil Investigation Levels - NEHF Setting A - Residential with garden accessible soil including Childrens Daycare Centres, Preschools, Primary Schools or Townhouses & Villas
Health-Based Soil Investigation Levels - NEHF Setting D - Residential with minimal access to soil including High Rise Apartments and Flats
Health-Based Soil Investigation Levels - NEHF Setting E - Parks and Recreational Open Space, Playing Fields & Secondary Schools
Health-Based Soil Investigation Levels - NEHF Setting F - Commercial or Industrial
Provisional Phytotoxicity Levels for Sandy Loams
Hotspot Criteria 2.5x Applicable Level
Results Above Applicable Levels Highlighted
NE = Not established
ND = Below PQL
NA = Not Analysed

TABLE 4
GROUNDWATER ANALYTICAL RESULTS
TPH, BTEX & PAHs
12 - 40 BONAR & 5 LOFTUS STREETS, ARNCLIFFE
(All results as ug/l)

Sample ID	Sample Date	Total Petroleum Hydrocarbons				BTEX Compounds					PAHs	
		C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Benzene	Toluene	Ethyl Benzene	m,p-Xylene	o-Xylene	Naph-thalene	Total PAHs
MW1	2/09/2004	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MW1	15/08/2005	nd	nd	nd	110	nd	nd	nd	nd	nd	na	na
MW2	15/08/2005	nd	nd	nd	100	nd	nd	nd	nd	nd	na	na
MW3	15/08/2005	nd	na	na	na	nd	nd	nd	nd	nd	na	na
QCMA	15/08/2005	nd	nd	nd	330	nd	nd	nd	nd	nd	na	na
MW2	15/08/2005	25	25	100	100	0.5	0.5	0.5	1	0.5	1	1
QCMA (Dup MW2)	15/08/2005	25	25	100	330	0.5	0.5	0.5	1	0.5	1	1
RPDs	-	**0**	**0**	**0**	**-107**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
ANZECC 2000		10000*				950	ID	ID	ID	350	16	3**
LABMARK Laboratory Methods and Estimated Quantitation Limit (EQL)												
LABMARK Method		E003.1	E004.1			E002.1	E002.1	E002.1	E002.1	E002.1	E007.1	E007.1
EQL		50	50	200	50	1	1	1	2	1	2	-

Notes:

ANZECC 2000 = Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000)
95% protection level for slightly to moderately disturbed ecosystems.
* NSW EPA 1994= Guidelines for Assessing Service Station Sites (1994) Table 4 Note e
** NSW EPA 1994= Guidelines for Assessing Service Station Sites (1994) protection of aquatic ecosystems (Fresh)
All results in ug/L (parts per billion);
EQL = Estimated Quantitation Limit
nd = Below Estimated Quantitation Limit
NE = Guideline not established
ID = Insufficient data to derive a reliable trigger value.
RPDs = Relative percentage difference
Half the detection limit used when values below EQL

TABLE 5
GROUNDWATER ANALYTICAL RESULTS
METALS
12 - 40 BONAR & 5 LOFTUS STREETS, ARNCLIFFE
(All results as ug/l)

Sample ID	Sample	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Zinc	Mercury
	Date								
MW1	2/09/2004	nd	nd	nd	11	nd	14	63	nd
MW1	15/08/2005	na	na	na	na	na	na	na	na
MW2	15/08/2005	15	nd	nd	nd	6	nd	nd	0.1
MW3	15/08/2005	na	na	na	na	na	na	na	na
MW2	-	15	0.05	0.5	0.5	6	0.5	2.5	0.05
QCMA (Dup MW2)	-	15	0.05	0.5	0.5	6	0.5	2.5	0.05
RPDs	-	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
ANZECC 2000		24	0.2	ID	1.4	11	3.4	8	0.6
LABMARK Laboratory Methods and Estimated Quantitation Limit (EQL)									
LABMARK Method		E022.1	E022.1	E022.1	E022.1	E022.1	E022..1	E022.1	E026.1
EQL		1	0.1	1	1	1	1	5	0.1

Notes: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000)
for the protection of aquatic ecosystems - 95% protection level for slightly to moderately disturbed freshwater ecosystems
All results in ug/L (parts per billion);
EQL = Estimated Quantitation Limit
nd = Below Estimated Quantitation Limit
ID = Insufficient data to derive a reliable trigger value.

TABLE 6
MERITON, 12-40 BONAR & 5 LOFTUS STREETS, ARNCLIFFE
GROUNDWATER FIELD MONITORING RESULTS

SURVEY MARK: ARBRITRARY DATUM:								EQUIPMENT:		DO/Conductivity/ Temperature/pH/Redox Meter Interface Probe					
Well ID	Sample Date	Total Well Depth	TOC Elev.	DTW	Depth PSH	PSH Thickness	PSH Density	Hydro Equiv.	Corr. DTW	Corr. Water Elev.	DO	Eh	pH	EC	Temp.
UNITS	d/m/yr	m	m	m	m	m	kg/L	m	m	m	mg/L	mV	-	us	C°
MW1	15/08/2005	4.6		2.915					2.915						
MW2	15/08/2005	3.2		2.134					2.134						
MW3	15/08/2005	3.0		2.790					2.790						
Comments															

Notes: TOC = top of casing; Well casing approx 0.5m above ground level
DTW - Depth to top of groundwater from ground level;
PSH = Phase separated hydrocarbon;
Hydro. Equiv. = Thickness of the product adjusted to allow for the density of PSH.
Corr. DTW = Corrected Depth to Water which takes into account the presence of the PSH;
Corr. Water Elev. = Corrected water elevation; the water elevation presented in mAHD.
Event: Pre and post groundwater purge event data;
DO = dissolved oxygen;
EH = Redox Potential;

APPENDIX A
DRILLING LOGS

Urban Environmental Consultants Pty Ltd

BOREHOLE LOG

BOREHOLE No.: BH1

Sheet 1 of 1

Client: *Meriton Apartments Pty Ltd* Job Number:
Project: *ESA* Contractor: *Ability Plus*
Location: *Bonar Street Precinct, Arncliffe* Logged by: *PF*

Borehole diam.: 50mm Borehole Depth: 3.0m
Commenced: 28/08/04 Completed: 28/08/04

Method	Water	Monitor Well Details	Depth	Sample Type / ID	PID (ppm)	Graphic Log	GEOLOGICAL DESCRIPTION Material Type: USCS Group, Colour, Particle Size, Moisture Content, Consistency (Geologic Origin)	COMMENTS (Field Rank, Odour, Visual Blow Count, Other
			0					
							Concrete Surface	
							FILL: Sand, cream and yellow mottled with clay, moist.	
				BH1 0.5	0.3		FILL: Sandy loam, black, dry, fine to medium grained sand with 30% silts and clays, and large sandstone gravels (up to2cm).	
			1	BH1 1.0	0.2		As above with gravels up to 3cm.	
SV								
			2	BH1 2.0	0.2		As above with some red spackles (crushed brick?), damp.	
							SAND: grey, saturated, medium coarse grained with <10% clay content.	
			3	BH1 3.0	0.2			
							Borehole ceased at 3.0m	

Method
SV Solid Flight Auger with V-bit