ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

SYDNEY HARBOUR FORESHORE AUTHORITY

ON

PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT

FOR

PROPOSED COMMERCIAL DEVELOPMENT

AT

'DARLING WALK', DARLING HARBOUR

APRIL 2007

REF: E21073F-RPT

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EXECUTIVE SUMMARY

Sydney Harbour Foreshore Authority commissioned Environmental Investigation Services (EIS), a division of Jeffery & Katauskas Pty Ltd (J&K), to undertake a preliminary environmental site screening to assess the likelihood of contamination of the subsurface soils and groundwater for a proposed commercial development at 'Darling Walk', Darling Harbour. The site is identified as Lot 318 in DP 871455 and at the time of this investigation was occupied by a commercial/retail building.

This assessment has been commissioned as part of a proposed development that includes demolition of the existing building and construction of a new commercial building with up to three basement levels. The 'commercial/industrial' land use category has been adopted for this assessment based on the proposed development and with regards to the suitability of future site use.

The primary objective of the investigation was to assess the soil and groundwater conditions at the site in relation to the suitability of the site for the proposed land use in accordance with the *Guidelines for Consultants Reporting on Contaminated Sites NSW EPA 1997* and the *State Environmental Planning Policy No.55 – Remediation of Land* (SEPP55). Secondary investigation objectives were to undertake a waste classification assessment for off-site disposal of excavated soil and rock associated with the proposed development works and to assess soil conditions in relation to the potential for occurrence of acid sulfate soils at the site.

At the time of the investigation the site was predominantly occupied by a large concrete, steel and glass building. The building was divided into three sections on the ground floor by two walkways that extended through the building. The surrounding land uses included a man-made lake, commercial and light industrial areas, Chinese Gardens and the cross city tunnel opening.

The search of historical information has indicated that the site was part of an area that was reclaimed prior to 1870. From 1870 to the 1970's at least part of the site was occupied the by railway goods yards. The world's first freezing works were constructed on the south section of the site in 1861 and extended to the area presently occupied by the Chinese Gardens. Since the mid 1980s, when the railway goods yards closed, the site and surrounding areas have progressively been developed as commercial and retail areas. The site was developed as parkland in the 1980's prior to construction of the present development during the mid to late 1990's.

Based on historical site information and site observations, the main potential on-site contamination sources are considered to be:

- potentially contaminated land-filled material across the site;
- potential heavy metal contamination associated with the former industrial use;
- potential PAH contamination associated with the fill material at the site.

The EIS field investigations in March and April 2007 included six sampling locations at approximately 30% of the NSW EPA minimum sampling density for a site of this size.

The subsurface investigation generally encountered pavers at the surface in all boreholes, except BH4, where asphaltic concrete was encountered, overlying silty sand, silty clayey sand, clayey sand or sand fill material, which in turn overlayed natural silty sand or clayey sand and sandstone bedrock. Immediate groundwater seepage was encountered in BH1 and BH5 at a depth of approximately 3.5m. Fill material was encountered to depths of approximately 3.5m to 4.5m in BH1, BH2 and BH5 and extended to the termination of BH3, BH4 and BH7 at depths of approximately 1m to 2.4m.

A total of twelve fill samples obtained by EIS were analysed for a broad range of commonly encountered chemical contaminants including heavy metals, total petroleum hydrocarbons (TPH) and monocyclic aromatic (BTEX) compounds, polycyclic aromatic hydrocarbons (PAHs), organochlorine (OC) pesticides, polychlorinated biphenyls (PCBs) and asbestos.

Elevated concentrations of benzo(a)pyrene and nickel above the site assessment criteria were encountered in the samples from BH3 (1.1-1.4) and BH7 (0.1-0.4) respectively. Further assessment of these and other potential hotspot locations will be necessary to establish the extent of the contamination.

The EIS assessment has identified minor risks generally associated with historical landfilling activities, ie nickel, PAH and Benzo(a)pyrene. It is considered that contamination hotspots identified by the existing assessment work would not preclude future development of the site provided appropriate management and/or remediation activities are undertaken as part of the development program. Further investigation should be undertaken that includes sampling and analysis from an additional 16 boreholes across the site together with sampling and analysis from three groundwater monitoring wells across the site. A summary of the results and discussion of additional investigation recommendations are included within the report.

Assessment of the natural soils for the presence of potential acid sulfate soils indicated that potential acid sulfate soils are present at the site. Preliminary calculations indicate that the liming rate will be approximately 24kg/tonne. An acid sulfate soil management plan should be prepared for the site.

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1 INTRODUCTION

Sydney Harbour Foreshore Authority commissioned Environmental Investigation Services (EIS), a division of Jeffery & Katauskas Pty Ltd (J&K), to undertake a preliminary environmental site screening to assess the likelihood of contamination of the subsurface soils and groundwater for a proposed commercial development at 'Darling Walk', Darling Harbour. The site is identified as Lot 318 in DP 871455 and at the time of this investigation was occupied by a commercial/retail building. The site location is shown on Figure 1 and the investigation was confined to the site boundaries as shown on Figure 2.

The screening was undertaken generally in accordance with an EIS proposal of 8 March 2007 and Sydney Harbour Foreshore Authority written acceptance of 20 March 2007.

The proposed development includes demolition of the existing building and construction of a new commercial building with up to three basement levels.

This report describes the investigation procedures and presents the results of the environmental site assessment, together with comments, discussion and recommendations.

2 ASSESSMENT OBJECTIVES

2.1 Investigation Objectives

The primary objective of the investigation was to make a preliminary assessment of the soil and groundwater conditions at the site in relation to the suitability of the site for the proposed land use in accordance with the *Guidelines for Consultants Reporting on Contaminated Sites NSW EPA 1997* and the *State Environmental Planning Policy No.55 – Remediation of Land* (SEPP55).

A secondary investigation objective was to undertake a waste classification assessment for off-site disposal of excavated soil and rock associated with the proposed development works.

An additional objective was to assess soil conditions in relation to the potential for occurrence of acid sulfate soils at the site.

2.2 Scope of Work

The scope of work undertaken to achieve the objective included:

1. Assessment of historical site use, including review of historical aerial photographs, land title records search, review of the deposited plan and development applications/building approvals held by Council.
2. Review of regional geology and groundwater conditions, including the location of registered groundwater bores and major underground services in the vicinity of the site.

3. Search of WorkCover Dangerous Goods Licenses for underground fuel storage tanks (USTs), and investigation/remediation orders issued by the NSW EPA (DEC).
4. Design and implementation of a field sampling program.
5. Preparation of a report presenting the results of the assessment of potential soil and groundwater contamination.

Field work for this investigation was undertaken on 23 and 26 March 2007.

2.3 Data Quality Objectives

The purpose of Data Quality Objectives is to develop criteria to assess the reliability of the laboratory data. The Data Quality Objectives established for this project are summarised below:

- Collection and analysis of 10% of the field samples as intra-laboratory duplicates.
- Relative percentage differences (RPDs) were calculated for intra-laboratory duplicates. The RPD was calculated as the absolute value of the difference between the initial and repeat result divided by the average value, expressed as a percentage. The following acceptance criteria were used to assess the RPD results:
    - For results that were greater than 10 times the Practical Quantitation Limit (PQL) RPDs less than 50% were considered acceptable.
    - For results that were between 5 and 10 times PQL RPDs less than 75% were considered acceptable.
    - For results that were less than 5 times the PQL RPDs less than 100% were considered acceptable.
- Review of laboratory QA/QC data (including surrogate recovery, repeat analysis, duplicates, matrix spikes and method blanks).

The success of the Data Quality Objectives is based on assessment of the data set as a whole and not on individual acceptance or exceedance within the data set.

3 SITE INFORMATION

3.1 Site Description

The site identification details are summarised below:

Site Owner:	Sydney Harbour Foreshore Authority
Site Address:	Harbour Street, Darling Harbour
Lot & Deposited Plan:	Lot 318 in DP 871455
Local Government Authority:	City of Sydney Council
Site Area:	Approximately 10,000m^2
AHD:	Approximately 3-4m
Geographical Location (MGA):	N: 6250090 E: 333670 (approximately)
Site Locality Plan:	Refer to Figure 1
Site Layout Plan	Refer to Figure 2

The site is located to the west of Harbour Street within a regional topographic setting that typically falls towards Darling Harbour at approximately 2-3° and flattens towards the site. The site is generally level with minor slopes for steps, gutters and drainage.

At the time of the investigation the site was predominantly occupied by a large concrete, steel and glass building. The building was divided into three sections on the ground floor by two walkways that extended through the building. The first level was continuous along the length of the building. The north section was occupied by a former pub/nightclub that was in use by a film production company. Retail shops were located on the ground floor at the south end of the north section. The central section of the building was occupied by fast food outlets on the ground level with apparent office space on the first floor. The south section was occupied by an amusements arcade, mini golf centre, an outback centre (souvenir shop) and cafes.

A separate fast food outlet/café was located within the east boundary of the site adjacent to the north section of the large building. A bungee trampoline amusement and rock climbing wall were located within the east boundary adjacent to the south section of the large building.

The area of the site along Harbour Street (i.e. the west section) was paved with asphaltic concrete and included a fast food drive through, bus stop and loading docks. The area to the north of the building was also paved with asphaltic concrete that extended beneath the pedestrian walkway to the opening of the cross city tunnel. The areas through the walkways in the building and along the east section of the site were paved with brick pavers.

The site was bounded by a man-made lake to the west with a children's playground and additional paved walkways and water features beyond. Harbour Street bounded the site to the east with commercial and light industrial areas beyond, that typically consisted of high rise office buildings with ground floor warehouses. A small garden and footbridge bounded the site to the south with open spaces that included the Chinese Gardens beyond. A pedestrian walkway and footbridge bounded the site to the north with the cross city tunnel opening beyond and the IMAX theatre on the opposite side of the tunnel opening.

Several services pits were noted during the site inspection along the north and west site boundaries, in the garden at the south site boundary and in the central south section adjacent to the bungee trampoline. The cross city tunnel services easement

runs to the north of the site along the opening of the tunnel. Sewer access points were noted in the north section of the site and indicated that sewer services cross the site in a north-east to south-west orientation.

3.2 Regional Geology and Hydrogeology

The 1:100,000 geological map of Sydney (Map 9130, 1:100,000 Department of Mineral Resources – 1983) indicates the site to be adjacent to the boundary of areas underlain by Hawkesbury Sandstone, man-made fill and Alluvial Sediment. Hawkesbury sandstone typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses. Man-made fill typically consists of dredged estuarine sand and mud and demolition, industrial and household waste. The alluvial sediment typically consists of silty to peaty quartz sand, silt and clay, with ferruginous cementation in places and common shell layers.

Department of Natural Resources (DNR) were researched for the investigation and indicated that no registered groundwater bores lie within 1km of the site.

The stratigraphy of the site is expected to include residual clayey soils overlying relatively shallow bedrock and alluvial soils overlying relatively deep bedrock. Based on these conditions groundwater may be a potential resource in the immediate area of the site, however, the proximity to the salt water in Cockle Bay may render the use of the resource questionable.

4 SITE HISTORY ASSESSMENT

4.1 Aerial Photographs

Aerial photographs were reviewed as part of the assessment of the site history. The following information was obtained:

1930 - The photograph was of poor quality. The site was occupied by several variably sized warehouse buildings. The intersection between Harbour Street and Liverpool Street was at a similar location to the present intersection location. Harbour Street, however, was straight and extended to the north-north-east from the intersection. A relatively narrow road bounded the site to the north with a commercial/industrial area further north. Ship yard and docks were located to the north-west of the site in and around Cockle Bay. A vacant area bounded the site to the west with exposed soil and a railway line at the west boundary. Commercial/industrial areas were located to the east and south that typically included low rise warehouse and office buildings.

1951 - The site was occupied by high rise buildings in the south section and large warehouses in the north and central sections. In particular a very large warehouse occupied the central west section of the site. Railyards were located to the west of the site and included railway lines and warehouse buildings with several cars parked across the area. Large warehouses were located to the north of the site adjacent to Cockle Bay.

Mixed commercial/industrial areas were located to the east and south of the site and typically consisted of rows of medium sized buildings to the east and variably sized scattered buildings to the south. An unusually large warehouse building was located approximately 200m to 300m to the south of the site beyond Pier Street and/or Goulburn Street.

1961 - The site and surrounds were similar to the 1951 photograph, except for some additional small buildings on the site, additional containers/sheds to the north of the site and additional warehouses in the railyards.

1970 - The site appeared similar to the 1961 photograph. The majority of the railyard was occupied by relatively large warehouses that appeared to be rail storage areas and/or workshops.

1978 - Harbour Street had been realigned to the current alignment to the north from Liverpool Street. The very large warehouse in the central west section and the high rise in the south section remained as in the 1970 photograph. The remainder of the smaller buildings and/or warehouses appeared to have been either altered or demolished. The areas to the east of Harbour Street and south of the site appeared similar to the 1970 photograph. A large arc shaped building was located to the north of the site that extended across Harbour Street. Some of the ship yard areas to the north were vacant and appeared to be areas of exposed soil.

1986 - The site was vacant with exposed soil. The adjacent areas to the west and south were also vacant with exposed soil. Scattered small buildings and/or sheds were located across the vacant areas. A road interchange that appeared consistent with the existing western distributor was located to the north of the site. A large construction site was apparent to the west of the vacant area. The piers had been demolished in Cockle Bay and no large ships were moored in the bay. The unusually large warehouse building to the south of the site had been demolished and replaced by a large building that appeared consistent with the layout of the existing Sydney Entertainment Centre.

1994 - The site was predominantly vacant and grassed, with trees along the Harbour Street frontage. A medium sized building was located in the north section of the site and a small building was located in the south section. The existing artificial lake was located to the west of the site with the playground further west and Tumbalong Park to the south-west. Footbridges bounded the site to the south that extended across Harbour Street and a vegetated area, that appeared consistent with the existing Chinese Gardens, was located further to the south. Paved areas with internal water features were located to the west of the playground and formed part of the Tumbalong Park parkland. Buildings consistent with the existing convention centre and carpark were located to the west of the parkland at the location of the former construction site.

2002 - A building that appeared consistent with the existing building occupied the site. A large building was located to the north of the western distributor and appeared consistent with the existing IMAX Theatre building. A large building was located to the south of Pier Street and north of the entertainment centre.

4.2 Land Title Search

A limited historical land title search was performed on our behalf. Details are presented in Appendix C.

The search indicated that the land currently owned by Sydney Harbour Foreshore Authority has been owned by NSW Government Authorities since at least the early 1900's.

The land search has not indicated any particular land use that may be considered to have resulted in significant contamination of the soil and groundwater at the site.

4.3 Council Records

A search of Development Application (DA) and Building Approval (BA) records held by City of Sydney Council for the site and immediate surrounds was undertaken on behalf of EIS. The results of the search are summarised below:

- 1901 - W. J. Gow. State of Harbour Street and Slipperiness of blocks Liverpool & Sussex Streets.
- 1902 - Railway Dept. Letter about Notice on buildings corner Liverpool and Harbour Streets, Darling Harbour to be taken down.
- 1903 - For extension of time for alteration of drainage and lavatory arrangements to 13 houses at the corner of Liverpool and Harbour Streets.
- 1908 - Water & Sewerage Board - Town Clerk. Broken S.V. casing Harbour Street.
- 1909 - Alderman Cocks - T/C. [Proposals for changes to street lighting in George, Jones, Thomas, Mew and Harbour Streets.]
- 1933 - Harbour Street. Proposed widening. Question of width.
- 1947 - 1/25 Harbour Street, South-West Corner Liverpool Street. Substation & Office Building.
- 1959 - 1 Harbour Street Sydney. Reinstate cold storage building after fire. N.S.W. Fresh Food & Ice Pty Ltd.
- 1959 - 1 Harbour Street, Sydney. Erection of new building
- 1960 - 1 Harbour Street Sydney. Alterations to provide amenities. N S W Fresh Food & Ice Pty Ltd.
- 1960 - 1 Harbour Street Sydney. Alterations to existing Engine Room. Peters (Property Holdings) Pty Ltd.
- 1961 - 1-25 Harbour Street – alterations.
- 1973 - 1 Harbour Street. New Office & Awning.
- 1974 - 1 Harbour Street Sydney. New Roof (over Rail Siding).

- 1975 - 1 Harbour Street. New Concrete Loading Platform.
- 1975 - 1 Harbour Street Sydney (Yoghurt Factory) New Concrete Loading Platform. Property Holdings Pty Limited.
- 1975 - 1 Harbour Street Sydney. Alterations Ground Floor.
- 1976 - 1 Harbour Street Sydney (Yoghurt Factory) Alterations. Property Holdings Pty Limited.
- 1978 - 1 Harbour Street Sydney. Extension.
- 1981 - 1-23 Harbour Street Sydney. Peters Milk. Enclosure of Loading Bay and Removal of Wall.
- 1982 - Peter's Milk. 1-23 Harbour Street, Sydney. Enclosure of loading bay & removal of wall. Property Holdings Pty. Ltd

4.4 Local History Records Search

A search of local history information contained within the Darling Harbour internet page for the Darling Harbour area has indicated the following:

- 1813 - The world's first steam driven factory (the unusually large building from the 1951 aerial photograph) was constructed on the site presently occupied the Sydney Entertainment Centre.
- 1861 - The world's first freezing works were constructed on the south section of the site and the area presently occupied by the Chinese Gardens.
- 1870 - A railway goods yard was constructed on the reclaimed area (Darling Harbour).
- 1874 - The world's first full iron wharf was constructed and is presently buried beneath the area known as 'Tumbalong Park'.
- 1900 - Darling Harbour was reclaimed by the NSW Government.
- 1970's - Darling Harbour was occupied by a series of empty warehouses and rarely used train tracks.
- 1984 - The last train left the railway yard and the area became derelict.
- 1985 - Construction began on the Sydney Exhibition and Convention Centre.

The local history search has indicated that the site is part of a larger area of reclaimed land and was formerly part of an industrial area.

4.5 WorkCover Database Records

A records search for underground storage tanks was undertaken on our behalf by WorkCover. The records did not indicate the existence of any licences for underground storage tanks at this site.

4.6 NSW EPA Records

A search of the NSW EPA on line database did not indicate the existence of any EPA notices for the site under section 58 of the Contaminated Land Management Act (1997).

4.7 Summary of Historical Site Use

The search of historical information has indicated the following:

- The site was likely to have been at least partially used by the adjacent railway yards until at least the 1970's.
- The site has been used for various commercial and industrial purposes that included frozen food storage and railway good yards until approximately 1984.
- From at least 1986 until at least 1994 the site was either vacant and unpaved or vacant and grassed with minor buildings.
- The site has been used for various commercial and retail purposes that include retail, food processing, office space, amusements and pub/nightclub since at least 2002.
- There are no recorded notices listed on the NSW EPA CLM register and WorkCover have no records of underground storage tank licenses issued for the site.

4.8 Potential Contamination Sources

4.8.1 General Contamination Processes

Contamination of surface and subsurface soils generally arises from previous land use that can include petroleum hydrocarbon and warehouse storage, manufacturing processes and pesticide and fertiliser usage. Imported fill soils may contain contaminants derived from unknown sources. Migration of contaminants can occur in permeable subsurface soil or fill materials and via man-made and natural drainage systems. The extent of contamination migration is dependent on the hydrogeological environment and the chemical and physical characteristics of the contaminants. Contamination migration in clayey soils can be expected to be limited, whilst sandy soils are conducive to greater spatial migration.

Backfill to service trenches can form contamination migration pathways via poorly compacted or permeable backfill. Backfill may also be contaminated.

The general history of contamination of sites in the Sydney region indicates that analysis for heavy metals including lead, copper and zinc should be incorporated in the schedule of laboratory testing. In addition screening tests should be performed on selected samples for polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCs), polychlorinated biphenyls (PCBs), petroleum hydrocarbons (TPH), asbestos monocyclic aromatic hydrocarbons (BTEX) and asbestos.

4.8.2 Potential Site Specific Contamination

Contamination at the site is anticipated to be associated with potentially contaminated, imported fill material and former industrial uses associated with the former railway goods yards.

4.9 Potential Receptors

The main potential contamination receptors are considered to include:

- Cockle Bay located approximately 150m to the north-west of the site.
- Site visitors, workers and adjacent property owners, who may come into contact with contaminated soil and/or be exposed to contaminated dust arising from construction activity.
- Future site occupants.

4.10 Contaminant Laydown and Transport Mechanisms

At this site, mobile contaminants would be expected to move down to the rock surface and/or groundwater table and migrate laterally down-slope from the source. The movement of contaminants would be expected to be associated with groundwater flow and seepage at the top of the bedrock and/or within the groundwater table.

5 ACID SULFATE SOIL

Acid sulfate soil is the common term for naturally occurring soil and sediments that contain iron sulfides. These soils were formed from iron rich sediments and sulfate (found in seawater) in the presence of sulfate reducing bacteria and plentiful organic matter. These conditions are generally found in mangroves, salt marsh vegetation or tidal areas and at the bottom of coastal rivers and lakes. Disturbance and the exposure to air of these sulfides, commonly through drainage or excavation, causes oxidation and the eventual production of sulfuric acid. This sulfuric acid can then drain into waterways through groundwater and surface flows. The impacts of acid drainage can include fish kills and disease, oyster damage and mortality, adverse impacts on soil structure and stability and damage to built structures including bridge and building footings and corrosion of drinking water pipes.

The NSW government formed the Acid Sulfate Soils Management Advisory Committee (ASSMAC) in 1994 to coordinate a response to acid sulfate soil issues. In 1998 this group released the Acid Sulfate Soil Manual comprising of best practice advice for planning, assessment, management, laboratory methods, drainage, groundwater and the preparation of acid sulfate soil management plans.

These guidelines replaced the NSW EPA Guidelines for Land Management in NSW Coastal Areas, Assessing and Managing Acid Sulfate Soils (1995) and the Acid Sulfate Soils, Assessment and Management Guidelines, NSW EPA, DUAP and the Acid Sulfate Soils Management Advisory Committee, Draft, November 1997.

The NSW Department of Land and Water Conservation (DLWC) have found acid sulfate soils in every coastal estuary and embayment on the NSW coast and produced a series of maps identifying the landscapes with a high probability of having acid sulfate soils.

The acid sulfate soil risk maps indicate areas of high risk, low risk and no known occurrence of acid sulfate soils. The acid sulfate soil risk map for Darling Harbour (Acid Sulfate Soil Risk Map- 9130S3 edition 2, December 1997, 1:25000, Department of Land and Soil Conservation) indicates that the site is located within an area

disturbed terrain. These areas often consist of dredged estuarine material. Soil investigation is required to assess these areas for acid sulfate soil potential.

6 ASSESSMENT CRITERIA DEVELOPMENT

6.1 Regulatory Background

In 1997 the NSW Government introduced the *Contaminated Land Management Act, 1997* (CLM Act). This act, associated regulations, State Environmental Planning Policy (SEPP) No.55 – Remediation of Land (1998) and associated NSW EPA guidelines, were designed to provide uniform state-wide control of the management, investigation and remediation of contaminated land.

Prior to granting consent for any proposed rezoning or development, SEPP55 requires the consent authority to:

- consider whether the land is contaminated;
- consider whether the site is suitable, or if contaminated, can be made suitable by remediation, for the proposed land use;
- be satisfied that remediation works will be undertaken prior to use of the site for the proposed use.

Should the assessment indicate that the site poses a risk to human health or the environment, remediation of the site is required prior to commencement of the proposed development works. SEPP55 requires that the relevant local council be notified of all remediation works, whether or not development consent is required. Where development consent is not required, 30 days written notice of the proposed works must be provided to council. Details of validation of remediation work must also be submitted to Council within one month of completion of remediation works.

The consent authority may request that a site audit be undertaken during, or following the completion of the site assessment process. Under the terms of the CLM Act the NSW EPA Site Auditor Scheme was developed to provide a system of independent review for assessment reports. An accredited Contaminated Site Auditor is engaged to review reports prepared by suitably qualified consultants to ensure that the investigation has been undertaken in accordance with the guidelines and confirm that the sites are suitable for their intended use.

Section 59(2) of the CLM Act states that specific notation relating to contaminated land issues must be included on S.149 planning certificates prepared by Council where the land to which the certificate relates is:

- within an investigation or remediation area.
- subject to an investigation or remediation order by the EPA.
- the subject of a voluntary investigation or remediation proposal.
- the subject of a site audit statement.

Submission of contaminated site investigation and validation reports to council as part of rezoning or development application submissions may also result in notation of actual or potential site contamination on future S.149 certificates prepared for the site.

Section 60 of the CLM Act sets out a positive duty on an owner, or person whose activities cause contamination, to notify the EPA if they are aware that the contamination presents a significant risk of harm.

Off-site disposal of fill, contaminated material and excess soil/rock excavated as part of the proposed development works is regulated by the provisions of the Protection of the Environment Operations Act (POEO Act 1997) and associated regulations and guidelines including the *NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (1999). All materials should be classified in accordance with these guidelines prior to disposal.

Section 143 of the *Protection of the Environment Operations Act 1997* states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner.

6.2 Soil Contaminant Threshold Concentrations

The soil investigation levels adopted for this investigation are derived from the NSW EPA document *Guidelines for the NSW Site Auditor Scheme (1998)* and the National Environmental Protection Council document *National Environmental Protection (Assessment of Site Contamination) Measure 1999*. The contaminant thresholds listed below are levels at which further investigation and evaluation is required to assess whether the site is considered suitable for the proposed urban land use.

To accommodate the range of human and ecological exposure settings, a number of generic settings are used on which the Health based Investigation Levels (HILs) can be based. Four categories of HILs are adopted for urban site assessments. Contaminant levels for a standard residential site with gardens and accessible soil (Column A in Table A-1) are based on protection of a young child resident at the site. The remaining categories (Columns D to F) present alternative exposure settings where there is reduced access to soil or reduced exposure time. These categories include residential land use with limited soil access, recreational and public open space and commercial/industrial use. Where the proposed land use will include more than one land use category (eg. mixed residential/commercial development) the exposure setting of the most "sensitive" land use is adopted for the site.

Threshold concentrations for petroleum hydrocarbon contaminants including total petroleum hydrocarbons (TPH) and monocyclic aromatic hydrocarbon (BTEX) compounds have previously been established in the *NSW EPA Contaminated Sites: Guidelines for Assessing Service Station Sites* (1994) publication and this document is referenced in the 1998 Site Auditor Guidelines. Heavy fraction petroleum hydrocarbon aliphatic/aromatic component threshold concentrations have also been introduced in the *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (NEPC Guidelines).

The urban interim Ecological Investigation Levels (EILs) are generic values based on phytotoxicity data for plant response to specific contaminants in a sandy loam matrix and are included in the contaminated site assessment where the proposed land use includes gardens and accessible soils.

The *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (NEPC Guidelines) do not provide numeric guidelines for the assessment of asbestos in soil. NSW EPA advice has indicated that based on health concerns there should be no asbestos in soil at the surface, however the NSW EPA have not published numerical guidelines for the assessment of asbestos in subsurface soils.

The WorkCover publication *Your Guide to Working with Asbestos: Safety Guidelines and Requirements for Work Involving Asbestos* (NSW WorkCover 2003) indicates that inappropriately buried asbestos materials are considered to be friable asbestos material. "Any asbestos cement product, which has been subjected to weathering, severely damaged by hail, damaged by heat/fire or other mechanical action, or illegal water blasting is (also defined as) a friable asbestos product". Under the *NSW Occupational Health and Safety (OHS) Regulations 2001* and WorkCover requirements all necessary disturbance works associated with asbestos containing materials must be conducted by a licensed AS-1 Asbestos Removal Contractor.

6.2.1 Site Assessment Criteria for Soil Contaminants

The commercial/industrial exposure setting has been adopted for this assessment and the appropriate soil criteria are listed in the following table:

Site Soil Assessment Criteria (mg/kg)			
Contaminant	**HIL Column F Exposure Setting**	**Guidelines for Assessing Service Station Sites (1994)**	**Ecological Investigation Levels**
Inorganics			
Arsenic (total)	500		20
Cadmium	100		3
Chromium (III)	60%		400
Copper	5000		100
Lead	1500		600
Mercury (inorganic)	75		1
Nickel	3000		60
Zinc	35000		200
Organic Contaminants			
TPH (C_6-C_9)		65	
TPH (C_{10}-C_{36})		1000	
Benzene		1	
Toluene		1.4	
Ethylbenzene		3.1	
Total Xylenes		14	
Total PAHs	100		
Benzo(a)pyrene	5		
Aldrin + Dieldrin	50		
Chlordane	250		
DDT+ DDD + DDE	1000		
Heptachlor	50		
PCBs (Total)	50		

For the purpose of off-site disposal, the classification of soil into 'inert', 'solid', 'industrial' and 'hazardous' waste categories is defined by chemical contaminant criteria outlined in the *NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes - 1999.* These chemical contaminant criteria are summarised in Table A-2.

6.3 Evaluation of Soil Analysis Data and Contaminant Threshold Concentrations

Assessment of the soil analytical data using the soil contaminant threshold concentrations has been undertaken in accordance with the methodology outlined in the *National Environmental Protection (Assessment of Site Contamination) Measure (1999) Schedule 7(a) Soil Investigation Levels* and the statistical analysis methods outlined in the *NSW EPA Contaminated Sites Sampling Design Guidelines (1995).*

The data has been assessed by comparison with the adopted assessment criteria. For a site to be considered suitable for the proposed land use the individual contaminant concentrations should be less than the applicable contaminant threshold concentration.

Concentrations of contaminants above the guideline levels are a trigger for further assessment. If the individual concentrations are below the guideline levels, the site can be considered to be suitable for the intended use.

Assessment of contamination results with respect to the ecological assessment criteria or phyto-toxicity based investigation levels (PPILs) are undertaken against individual

data points rather than contamination concentrations across the site. These values have been adopted as a preliminary screening tool where exceedence of threshold concentrations warrants additional site specific assessment of contaminants and ecological communities.

6.4 Acid Sulfate soil

The NSW government formed the Acid Sulfate Soils Management Advisory Committee (ASSMAC) in 1994 to coordinate a response to acid sulfate soil issues. In 1998 this group released the Acid Sulfate Soil Manual comprising of best practice advice for planning, assessment, management, laboratory methods, drainage, groundwater and the preparation of acid sulfate soil management plans.

In order to assess the presence of actual or potential acid sulfate soils, the laboratory Peroxide Oxidation-Combined Acidity and Sulfate (POCAS) methods will be used to analyses samples that are considered to be potential acid sulfate soil. The laboratory results will be compared to the action criteria presented in the Acid Sulfate Soil Manual (ASSMAC, 1998). The action criteria for broad soil categories are provided in the following table:

Type of material		Action Criteria	
Texture	**Clay Content %**	**TAA/TSA/TPA (mol H^+/tonne)**	**Sulfur Trail S_{pos} %**
Coarse	< 5	18	0.03
Medium #	5 - 40	36	0.06
Fine #	> 40	62	0.1

For disturbance of greater than 1000 tonnes of soil the coarse texture action criteria apply for all soil types.

7 ASSESSMENT PLAN AND METHODOLOGY

The *NSW EPA Sampling Design Guidelines (1995)* for contaminated site investigations state a minimum of 21 evenly spaced sampling points should be undertaken for a site of this size (approximately 10,000m^2). Six sampling locations have been undertaken for this investigation. This density is approximately 30% of the minimum sampling density.

The boreholes were drilled on a systematic sampling plan with a spacing of up to 55m between sampling points. A systematic/judgemental sampling plan was considered most appropriate for this investigation as:

- no specific potential contaminant point sources were identified by the available site history.
- the distribution of contamination is expected to be associated with imported potentially contaminated fill material and is therefore likely to be random.

Sampling was not undertaken beneath the existing buildings at the site as access was not possible during the field investigation. Sampling depth was restricted at some locations by subsurface obstructions encountered during drilling.

8 INVESTIGATION PROCEDURE

8.1 Subsurface Investigation and Soil Sampling Methods

Subsurface investigations were undertaken using a track mounted hydraulically operated drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler.

The SPT sampler was washed with phosphate free detergent and rinsed following each sampling event. The spiral flight augers were decontaminated using a scrubbing brush and potable water and Decon 90 solution (phosphate free detergent) followed by rinsing with potable water. Sampling personnel used disposable Nylex gloves during sampling activities.

Soil and rock samples were obtained at various depths, based on observations made during the field investigation. All samples were placed in glass jars with plastic caps and teflon seals with minimal headspace. During the investigation, samples were preserved by immediate storage in an insulated sample container with ice. Each sample was labelled with a unique job number, the sampling location, sampling depth and date. All samples were recorded on the borehole logs presented in Appendix A and on the chain of custody (COC) record presented in Appendix B.

On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody procedures. Detailed EIS field sampling protocols are included in Appendix D.

8.1.1 Photoionisation Detector (PID) Screening

A portable PID was used in this investigation to assist with selection of samples for laboratory hydrocarbon (TPH/BTEX) analysis. The PID is sensitive to volatile organic compounds. The sensitivity of the PID is dependent on the organic compound and varies for different mixtures of hydrocarbons. Some compounds give relatively high readings and some can be undetectable even though present in identical concentrations. The portable PID is best used semi-quantitatively to compare samples contaminated by the same hydrocarbon source.

The PID is calibrated before use by measurement of an isobutylene standard gas. All the PID measurements are quoted as parts per million (ppm) isobutylene equivalents.

Photoionisation detector (PID) screening of detectable volatile organic compounds (VOC) was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled glass jar samples following equilibration of the headspace gases. The PID headspace data is included on the COC documents.

8.2 Laboratory Analysis

8.2.1 Soil Samples

Analysis of soil samples was undertaken by NATA registered laboratories using analytical methods detailed in the Schedule B(3) NEPC (1999) Guideline on Laboratory Analysis of Potentially Contaminated Soils. Laboratory analysis was undertaken by Envirolab Services Pty Ltd (NATA Accreditation No. 2901).

For this investigation selected soil samples were analysed for contaminants using the following laboratory techniques:

- Heavy metals – Nitric acid digestion. Analysis by ICP.
- Low level mercury – cold vapour AAS.
- OC pesticides and PCBs – Extracted with acetone/hexane. Analysis by GC/ECD.
- PAHs – Soil extracted with dichloromethane/acetone. Analysis by GC/MS.
- TPH (volatile) – Soil extracted with methanol. Analysis by P&T GC/PID.
- TPH – Soil extracted with dichloromethane/acetone. Analysis by GC/FID.
- BTEX – Soil extracted with methanol. Analysis by P&T PID. Confirmed with column flame ionisation detection.
- Asbestos – Polarizing light microscopy.

Toxicity characteristic leaching procedure (TCLP) leachates were prepared by rotating soil samples in a mild acid solution for 18 hours (NSW EPA WD-3 Method). Leachates were analysed using the analytical procedures outlined above.

9 RESULTS OF INVESTIGATION

9.1 Subsurface Conditions

Site details and borehole locations are shown on Figure 2. For details of the subsurface soil profile reference should be made to the borehole logs in Appendix A. A summary of the subsurface conditions encountered by the boreholes is presented below:

Pavement

Pavers were encountered at the surface in all boreholes, except BH4, and generally included a graded sand sub-base to a depth of approximately 0.1m. Asphaltic concrete was encountered at the surface in BH4 and extended to a depth of approximately 0.05m. Concrete was encountered beneath the pavers in BH6 and an electrical conduit was encountered within the concrete. The borehole was subsequently terminated.

Fill

Fill material was encountered beneath the pavement in all boreholes (except BH6) and extended to the termination of BH3, BH4 and BH7 at depths of approximately 1m to 2.4m. The fill material extended to depths of

approximately 3.5m to 4.5m in BH1, BH2 and BH5. The fill material typically consisted of silty sand, silty clayey sand, clayey sand or sand. The silty sand and silty clayey sand was typically brown or dark brown with inclusions of sandstone and igneous gravel. The clayey sand and sand was typically orange-brown and appeared to be consistent with crushed sandstone. Where refusal was encountered in fill material (BH3, BH4 and BH7) the material typically contained metal fragments (bolts) and refusal was generally encountered on inferred concrete.

Natural Soils

Natural silty sand was encountered beneath the fill material in BH1 and BH5 and extended to depths of approximately 4.5m and 4.7m, respectively. Clayey sand was encountered beneath the silty sand in BH5 and extended to the termination of the borehole at a depth of approximately 7.5m. The silty sand was typically fine to coarse grained and grey. The clayey sand was typically fine to medium grained and orange-brown or light grey.

Bedrock

Sandstone was encountered beneath the fill material in BH1 and BH2 and extended to the termination of each borehole at depths of approximately 6m and 4.7m, respectively. The sandstone in BH2 could not be penetrated further than 0.7m and may have been a boulder. The sandstone in BH1 was considered to be bedrock and was medium to coarse grained and orange-brown or light grey.

Groundwater

Immediate groundwater seepage was encountered in BH1 and BH5 at a depth of approximately 3.5m. The standing water levels in each on completion of drilling were approximately 5m and 4m, respectively. No long-term groundwater monitoring was undertaken.

9.2 Laboratory Results - Soil

The laboratory analysis results for soil samples are summarised in Table B to Table E inclusive and analysis reports are presented in Appendix B. The site soil assessment criteria for this investigation are specified in the "Site Assessment Criteria for Soil Contaminants" section earlier in this report. The results of the analyses are summarised below.

Heavy Metals

Twelve individual soil samples were analysed for heavy metals. A nickel concentration of 86mg/kg was encountered in the surficial fill sample from BH7 above the ecological investigation level of 60mg/kg. The remaining results of the analyses were below the site assessment criteria.

The results of all analyses were less than the SCC1 criteria for 'inert' waste, outlined in the *NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes - 1999*.

TCLP analyses were undertaken for the classification for off-site disposal on six fill samples for arsenic, cadmium, chromium, lead, mercury and nickel. The results of the analyses were less than the TCLP1 criteria for 'inert'.

Petroleum Hydrocarbons (TPH) and Monocyclic Aromatic Hydrocarbons (BTEX)

PID soil sample headspace readings were all zero ppm equivalent isobutylene. These results indicate a lack of PID detectable volatile organic contaminants. Twelve selected samples were analysed for petroleum hydrocarbons and BTEX compounds. The results of the analyses were below the site assessment criteria.

The results of all analyses were within the 'inert' waste criteria specified in the *NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes - 1999.*

Polycyclic Aromatic Hydrocarbons (PAHs)

Twelve selected samples were analysed for a range of PAHs including benzo(a)pyrene. A concentration of benzo(a)pyrene of 5.6mg/kg was encountered in the sample BH3 (1.1-1.4m), above the guideline concentration of 5mg/kg. The remaining results of the analyses were less than the site assessment criteria.

The results of the analyses on the samples from BH3 (1.1-1.4m) and BH5 (1.6-1.85m) were less than the SCC2 criteria for 'solid' waste, outlined in the *NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes - 1999.* The results of the analyses on the remaining samples were less than the SCC1 criteria for 'inert' waste.

TCLP analyses were undertaken for the classification for off-site disposal on six fill samples for PAHs. The results of the TCLP analyses were less than the TCLP1 criteria for 'inert' waste.

Organochlorine (OC) Pesticides and Polychlorinated Biphenyls (PCBs)

Twelve selected samples were analysed for a range of OC pesticides and PCBs. The results of the analyses were less than the site assessment criteria.

The results of the analysis on the sample from BH3 (1.1-1.4m) was less than the SCC2 criteria for 'solid' waste, outlined in the *NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes - 1999*. The results of the analyses on the remaining samples were less than the SCC1 criteria for 'inert' waste.

Asbestos

The twelve samples were screened for the presence of asbestos in soil. The results of the analyses indicated that no asbestos fragments were present and no respirable fibres were detected.

9.3 Laboratory Results – Acid Sulfate Soil Assessment

In order to assess the presence of actual or potential acid sulfate soil, Peroxide Oxidation-Combined Acidity and Sulfate (POCAS) analyses was undertaken on five soil samples. The samples analysed were from:

- BH1 from 2m to 2.5 and 3.5m to 4m; and
- BH5 from 2.5m to 2.6m, 3.5m to 4m and 4.5m to 4.7m.

The results were compared to the action criteria presented in section 6.4 of this report. The action criteria for coarse textured soils were adopted for the assessment. The results are summarised below:

- The pH_{KCl} results for the soil samples obtained from BH1 from 2m to 2.5 and 3.5m to 4m and BH5 from 2.5m to 2.6m, 3.5m to 4m and 4.5m to 4.7m prior to oxidation were 8.1, 7.3, 8.7, 8.1 and 9.52 respectively. The total actual acidity (TAA) results for the samples were less than the method detection limits and less than the site assessment criteria of 18 mol H^+/tonne. These results indicate that actual acid sulfate soil conditions were not present prior to disturbance of the soils.
- Following oxidation the pH_{ox} results for the samples obtained from BH1 from 2m to 2.5 and 3.5m to 4m and BH5 from 2.5m to 2.6m, 3.5m to 4m and 4.5m to 4.7m were 7.3, 2.4, 6.6, 2.9 and 6.5 respectively. The total potential acidity (TPA) results for the samples obtained from BH1 from 2m to 2.5 and 3.5m to 4m and BH5 from 3.5m to 4m were 5 mol H^+/tonne, 313 mol H^+/tonne and 25 mol H^+/tonne, respectively. The results of the remaining samples were less than the method detection limits. The results for the silty sand samples obtained from BH1 from 3.5m to 4m and BH5 from 3.5m to 4m were greater than the TPA site action criteria of 18 mol H^+/tonne.
- The Spos% results for the samples obtained from BH1 from 2m to 2.5 and 3.5m to 4m and BH5 from 2.5m to 2.6m, 3.5m to 4m and 4.5m to 4.7m were 0.039%, 0.52%, 0.069%, 0.066% and 0.036%, respectively compared to the site assessment criteria of 0.03%.
- Based on the above laboratory results the natural silty sand at the site is considered to be potential acid sulfate soils. Lime addition to soil will be required to stabilise the acid sulfate soil material following disturbance. Preliminary calculations indicate that the liming rate will be approximately 24kg/tonne.

9.4 Assessment of Analytical QA/QC

The objective of the assessment of the laboratory QA/QC is to ensure that the sample data is reliable. All laboratory reports for project E21073F have been checked and issued as final by Envirolab Services Pty Ltd, NATA Accreditation No. 2901, Report number: 10350.

Chain of custody documentation and/or sample receipt advice notices were signed and dated by Envirolab Services laboratories stating that all samples were received cool, in good order and in suitable containers. Compliance of holding times was met for all

analyses undertaken by the above laboratory. EIS and laboratory QA/QC procedures for the site screening are summarised in the following table:

Contaminant	QA/QC Procedure						
	Total no. of Samples	Intra-lab Duplicate	Repeat Analysis	Matrix Spike	Lab Blank	Surrogate Spike	Field Blank
Heavy metals	12	2	2	-	1	-	-
TPH	12	2	2	2	1	12	1
BTEX	12	2	2	2	1	12	1
PAH	12	2	2	2	1	12	-
OC/PCB	12	2	2	2	1	12	-
TCLP PAH	6	-	-	1	1	6	-
TCLP Metals	6	-	-	1	1	-	-

Field QA/QC samples are specified below:
Intra-laboratory duplicates - Dup 3 is BH3 (0.1-0.4), Dup 5 is BH5 (0.1-0.4)
Field blank - FB

The RPD results for the field QA/QC duplicate samples are summarised in Tables G-1 and G-2. The following comments are an overall summary of the quality of the analytical component of the project:

1. Sample integrity and container requirements were documented as satisfactory.
2. All sample extraction analyses were performed within the required holding times.
3. Matrix spike, laboratory control sample and surrogate recovery values indicated that the laboratory accuracy was very good, and that no outliers were reported.
4. Laboratory duplicate RPD results indicated that the sample precision was acceptable.
5. All method and field blanks were found to be free of analyte concentrations above the PQLs.
6. The intra -laboratory RPD values indicated that field precision was acceptable.

The QA/QC data reported by Envirolab Services laboratories for the documented soil samples were assessed to be of sufficient quality to be considered acceptable for the environmental assessment of EIS project E21073F.

The QA/QC data including the RPD results are considered to meet the Data Quality Objectives developed for this project.

10 COMMENTS AND RECOMMENDATIONS

The environmental site assessment undertaken for the proposed commercial development at 'Darling Walk', Darling Harbour was designed to assess the suitability of the site for the proposed land use. The proposed development includes demolition of the existing building and construction of a new commercial building with up to three basement levels.

10.1 Acid Sulfate Soils

The preliminary acid sulfate soil assessment undertaken for the proposed development has indicated that potential acid sulphate soil conditions are present in the natural soils at the site. The proposed development may include excavation for a basement that may disturb the natural soils at the site and therefore an acid sulfate soil management plan is considered necessary.

10.2 Contamination Assessment

The site assessment included performance of a site inspection, review of historical site use, including examination of regional aerial photographs and review of geology and groundwater conditions. Historical information and inspection of the site and surrounding areas did not indicate any obvious on-site or nearby off-site activity that could be expected to generate significant soil or groundwater contamination apart from potentially contaminated, imported fill material and industrial activities associated with the former railway goods yards. The site soil/fill sampling was subsequently undertaken on the basis of a relatively uniform exploration spacing.

Elevated levels of contaminants were encountered in fill soil samples during this investigation. A summary of the elevated results are presented in the table below:

Summary of Contamination Data in Fill Soil (mg/kg)

Contaminant	EIL*	HIL+	No. of Samples Analysed	No. of Results above the EIL	No. of Results above the HIL	Maximum Value	Mean Value	95% UCL
Nickel	60	3000	12	1	0	86	18	NC
B(a)P	-	5	12	-	1	5.6	0.7	NC

Guideline Levels:
* Ecological Investigation Level - *National Environment Protection (Assessment of Site Contamination) Measure 1999*
\+ Health-Based investigation Level - *National Environment Protection (Assessment of Site Contamination) Measure 1999 "Commercial/Industrial"*

Explanation:

95%UCL	95% Upper level confidence limit on the mean
B(a)P	Benzo(a)pyrene
NC	Not Calculated

The elevated levels of benzo(a)pyrene and nickel were encountered in the samples from BH3 (1.1-1.4) and BH7 (0.1-0.4) respectively. Elevated levels of contaminants were not detected in the remaining samples analysed. All remaining results were less than the Ecological Investigation Levels and the appropriate Health Investigation Levels.

EIS consider that the contamination at the site is in isolated hotspots. As the minimum sampling density was not met by this investigation further investigation should be undertaken following demolition of the existing building at the site to meet minimum sampling density. This will include drilling of an additional 16 boreholes across the site.

The investigation has shown that the fill material encountered at the site contains inclusions of charcoal and ash. Significant amounts of waste ash and gravely slag were available in the late nineteenth and early twentieth century as a result of the use of coal for industrial and domestic heating purposes. Widespread use of ash waste (either as ash or mixed with other soil and waste materials) as fill material was common in the inner suburbs of Sydney at this time.

The *"General Approvals of Immobilisation"* published in the NSW Government gazette on 16 July 1999 includes an immobilisation approval for metallurgical furnace slag contaminated materials (approval number 1999/07) and ash contaminated materials (approval number 1999/05). The *"General Approvals of Immobilisation"* states that metallurgical furnace slag and ash contaminated materials *"..can be classified according to their leachable concentration (TCLP) values alone."*, however, disposal restrictions indicate that the ash contaminated material can only be disposed of to a "Solid Waste" landfill with a leachate monitoring system. Treatment of this waste stream is not considered to be an economical option. Such fill material is not suitable for reuse on another site.

Analysis of the fill soils in BH3 has indicated that, due to the presence of scheduled chemicals (aldrin, dieldrin and heptachlor) and benzo(a)pyrene, for the purposes of off-site disposal, the fill soils are classified as 'solid' waste according to the criteria outlined in *NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes - 1999.* Any excess excavated soils should be disposed of to a suitable NSW EPA licensed "solid" waste landfill. Should significant quantities of fill material require disposal, additional analysis including TCLP testing in the vicinity of BH3 is recommended to confirm this classification.

TCLP analysis of the remaining fill soils has indicated that for the purposes of off-site disposal, these fill soils are classified as 'inert' waste according to the criteria outlined in *NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes - 1999.* However, the classification of the soils at BH5 is based on the "general approvals of immobilisation" criteria and therefore any excess excavated soils from the vicinity of BH5 should be disposed of as 'inert' waste to a suitable NSW EPA licensed "solid" waste landfill. The remainder of the fill soils can be disposed as 'inert' waste to any NSW EPA licensed landfill. Should significant quantities of fill material require disposal, additional analysis including TCLP testing is recommended to confirm this classification.

EIS consider that the extent of contamination associated with BH3 and BH5 should be investigated further as part of any subsequent investigations.

Immediate groundwater seepage was encountered in BH1 and BH5 at a depth of approximately 3.5m. The standing water levels in each of the boreholes on completion of drilling were approximately 5m and 4m, respectively. Due to unforeseen subsurface conditions encountered during the investigation no groundwater monitoring wells were installed and therefore no long-term groundwater monitoring was undertaken. TCLP analysis indicated that there was potential for relatively minor concentrations of

copper, lead and nickel to leach from the fill soils. The next phase of investigations should include installation of monitoring wells and analysis of groundwater samples to assess the impact of these contaminants on the groundwater.

The investigation undertaken by EIS included the analysis of 12 fill soil samples for the presence of asbestos fibres using NATA accredited microscopic screening techniques. Asbestos, neither apparent to the naked eye nor apparent using microscopic techniques was detected within the samples. The scope of work undertaken was designed to assess widespread surficial contamination and has not included an exhaustive assessment of the site for the presence of small scale asbestos contamination. EIS adopts no responsibility for small scale or buried asbestos features at the site which may be encountered during future earth or construction works at the site.

The boreholes drilled for the investigation have enabled an assessment to be made of the existence of significant, large quantities of contaminated soils. The conclusions based on this investigation are that, while major contamination of the site is not apparent, problems may be encountered with smaller scale features between boreholes. EIS adopts no responsibility whatsoever for any problems such as underground storage tanks, buried items or contaminated material that may be encountered between sampling locations at the site. The proposed construction activities at the site should be planned on this basis, and any unexpected problem areas that are encountered between boreholes should be immediately inspected by experienced environmental personnel. This should ensure that such problems are dealt with in an appropriate manner, with minimal disruption to the project timetable and budget.

During demolition and excavation works, the site should be inspected by experienced environmental personnel to assess any unexpected conditions or subsurface facilities that may be discovered between investigation locations. This should facilitate appropriate adjustment of the works programme and schedule in relation to the changed site conditions.

Based on the scope of work undertaken for this assessment EIS consider that the site can be made suitable for the proposed development provided that further investigation is undertaken that includes sampling and analysis from at least an additional 16 boreholes across the site together with sampling and analysis from three groundwater monitoring wells across the site. As part of the additional investigation, analysis of samples for contaminants including cyanide, phenolic compounds, cobalt, manganese, vanadium and boron may be required to assess the impact of former industrial uses at the site. Normal good engineering site management practice including control of run-off and dust suppression is recommended during earthworks and construction. An appropriate occupational health and safety plan should be prepared for the contaminants encountered at this site.

11 LIMITATIONS

The conclusions developed in this report are based on site conditions which existed at the time of the site assessment. They are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, and visual observations of the site and vicinity, together with the interpretation of available historical information and documents reviewed as described in this report.

Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes.

Previous industrial use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work.

During construction at the site, soil, fill and any unsuspected materials that are encountered should be monitored by qualified environmental and geotechnical engineers to confirm assumptions made on the basis of the limited investigation data, and possible changes in site level and other conditions since the investigation. Soil materials considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. Copyright in this report is the property of EIS. EIS has used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report.

Should you require any further information regarding the above, please do not hesitate to contact us.

Yours faithfully
For and on behalf of
ENVIRONMENTAL INVESTIGATION SERVICES

Todd Hore
Environmental Engineer

for E H Fletcher
Principal Engineer

ABBREVIATIONS

AAS	Atomic Absorption Spectrometry
ADWG	Australian Drinking Water Guidelines
AGST	Above Ground Storage Tank
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment Conservation Council
ASS	Acid Sulfate Soil
B(a)P	Benzo(a)pyrene
BH	Borehole
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
COC	Chain of Custody documentation
CLM	Contaminated Land Management
DEC	Department of Environment and Conservation
DIPNR	NSW Department of Infrastructure, Planning and Natural Resources (now DNR)
DNR	NSW Department of Natural Resources
DP	Deposited Plan
DQO	Data Quality Objective
EC	Electrical Conductivity
EIL	Ecological Investigation Level
EPA NSW	Environment Protection Authority, New South Wales (part of DEC)
GC-ECD	Gas Chromatograph-Electron Capture Detector
GC-FID	Gas Chromatograph-Flame Ionisation Detector
GC-MS	Gas Chromatograph-Mass Spectrometer
HIL	Health Based Investigation Level
HM	Heavy Metals
ICP-AES	Inductively Couple Plasma – Atomic Emission Spectra
NATA	National Association of Testing Authorities, Australia
NEPC.	National Environmental Protection Council
NHMRC	National Health and Medical Research Council
OCPs	Organochlorine Pesticides
OHS (OH&S)	Occupational Health and Safety
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photo-ionisation Detector
PPIL	Provisional Phyto-toxicity Investigation Levels
PQL	Practical Quantitation Limit
P&T	Purge & Trap
RAP	Remedial Action Plan
QA/QC	Quality Assurance and Quality Control
RPD	Relative Percentage Difference
SEPP	State Environmental Planning Policy
sPOCAS	Suspension Peroxide Oxidation Combined Acidity and Sulfate
SPT	Standard Penetration Test
SWL	Standing Water Level
TCLP	Toxicity Characteristic Leaching Procedure
TP	Test Pit
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
UCL	Upper Confidence Limit
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WP	Work Plan

REFERENCE DOCUMENTS

- ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality (and updates).
- ASSMAC (1998) (Acid Sulfate Soils Management Advisory Committee) Acid Sulfate Soil Manual.
- Australian Government, National Occupational Health and Safety Commission (2005) Code of Practice for the Safe Removal of Asbestos.
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- Australian Petroleum Institute Code of Practice (CP22) Removal and Disposal of Underground Storage Tanks.
- Australian Standard (2004) Storage and Handling of Flammable and Combustible Liquids. AS1940-2004.
- DUAP/NSW EPA (1998) (now NSW Department of Planning / NSW Department of Environment and Conservation (DEC) incorporating the EPA) Managing Land Contamination: Planning Guidelines SEPP 55 - Remediation of Land.
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- NSW EPA (1994) (now NSW DEC) Contaminated Sites: Guidelines for Assessing Service Station Sites.
- NSW EPA (1995) (now NSW DEC) Contaminated Sites: Sampling Design Guidelines.
- NSW EPA (1996) (now NSW DEC) Guidelines for Solid Waste Landfills.
- NSW EPA (1997) (now NSW DEC) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.
- NSW EPA (1998) [name since changed to Department of Environment and Conservation (NSW)] Contaminated Sites: Guidelines for the NSW Site Auditor Scheme.
- NSW EPA (1999) (now NSW DEC) Contaminated Sites: Guideline son Significant Risk of Harm and the Duty to Report.
- NSW EPA (1999) (now NSW DEC) Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes.
- NSW Legislation (1948) Rivers and Foreshores Improvement Act.
- NSW Legislation (1975) Dangerous Goods Act.
- NSW Legislation (1994) Environmental Planning and Assessment Act (EP&AA) and associated Regulations.
- NSW Legislation (1997) Contaminated Land Management Act.
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- NSW WorkCover (2003) Your Guide to Working With Asbestos: Safety Guidelines and Requirements for Work Involving Asbestos.
- NSW WorkCover Code of Practice (2005) Storage and Handling of Dangerous Goods.
- US EPA (2004) Region 9 Preliminary Remediation Goals.

ENVIRONMENTAL INVESTIGATION SERVICES

IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL SITE ASSESSMENT

These notes have been prepared by Environmental Investigation Services (EIS) to assist with the assessment and interpretation of this assessment report.

An Environmental Assessment Report is Based on a Unique Set of Project Specific Factors
This assessment report has been prepared in response to specific project requirements as stated in the EIS proposed document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- the proposed land use is altered;
- the defined subject site is increased or subdivided;
- the proposed development details including size, configuration, location, orientation of the structures are modified;
- the proposed development levels are altered, eg addition of basement levels; or
- ownership of the site changes.

EIS/J&K will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by EIS to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (eg. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Assessment is Based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the

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impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Environmental Site Assessment Limitations
Although information provided by an environmental site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Environmental Site Assessments by Design Professionals
Costly problems can occur when other design professionals develop plans based on misinterpretation of an environmental assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs should not be Separated from the Environmental Assessment Report
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problems, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the test of the report to obtain a proper understanding of the assessment.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely
Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

TABLE A-1
ENVIRONMENTAL AND HEALTH-BASED SOIL INVESTIGATION LEVELS (mg/kg)

Substances	Health Investigation Levels (HILs)[1]				Interim Urban Ecological Investigation Levels (EILs)[1]	NSW EPA Guidelines for Assessing Service Station Sites[2]	Back-ground Ranges[1]
	A	D	E	F			
	'Standard' residential with garden/ accessible soil (home-grown produce contributing less than 10% of vegetable and fruit intake; no poultry); includes children's day-care centres, kindergartens, preschools and primary schools	Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise apartments and flats	Parks, recreational open space and playing fields; includes secondary schools	Commercial/Industrial; includes premises such as shops and offices as well as factories and industrial sites			
METALS/METALLOIDS							
Arsenic (total)	100	400	200	500	20		1-50
Barium					300		100-3000
Beryllium	20	80	40	100			
Cadmium	20	80	40	100	3		1
Chromium(III)	12%	48%	24%	60%	400		
Chromium(VI)	100	400	200	500	1		
Chromium (total)							5-1000
Cobalt	100	400	200	500			1-40
Copper	1000	4000	2000	5000	100		2-100
Lead	300	1200	600	1500	600		2-200
Manganese	1500	6000	3000	7500	500		850
Methyl mercury	10	40	20	50			
Mercury (inorganic)	15	60	30	75	1		0.03
Nickel	600	2400	600	3000	60		5-500
Vanadium					50		20-500
Zinc	7000	28000	14000	35000	200		10-300
ORGANICS							
Aldrin + Dieldrin	10	40	20	50			
Chlordane	50	200	100	250			
DDT + DDD + DDE	200	800	400	1000			
Heptachlor	10	40	20	50			
Polycyclic aromatic hydrocarbons (PAHs)	20	80	40	100			
Benzo(a)pyrene	1	4	2	5			
Phenol	8500	34000	17000	42500			
PCBs (total)	10	40	20	50			
Petroleum Hydrocarbon Components (constituents):							
>C16 - C35 Aromatics	90	360	180	450			
>C16 - C35 Aliphatics	5600	22400	11200	28000			
>C35 Aliphatics	56000	224000	112000	280000			
C6-C9						65	
C10-C40						1000	
Benzene						1	
Toluene						1.4	
Ethyl Benzene						3.1	
Total Xylenes						14	
OTHER							
Boron	3000	12000	6000	15000			
Cyanides (complexed)	500	2000	1000	2500			
Cyanides (free)	250	1000	500	1250			
Phosphorus					2000		
Sulfur					600		
Sulfate					2000		

Reference should be made to the following guidelines for further details (as referenced in the above table):

1 National Environment Protection (Assessment of Site Contamination) Measure - 1999, National Environment Protection Council. Human exposure settings based on land use have been established for HILs and details are outlined in Taylor and Langley 1998.

2 NSW EPA Guidelines for Assessing Service station Sites - 1994.

TABLE A - 2
CHEMICAL CONTAMINANT CRITERIA FOR WASTE CLASSIFICATION
ENVIRONMENTAL GUIDELINES: ASSESSMENT, CLASSIFICATION AND MANAGEMENT OF LIQUID AND NON-LIQUID WASTES - NSW EPA 1999

INERT WASTE	SOLID WASTE	INDUSTRIAL WASTE	HAZARDOUS WASTE
IF SCC ≤ CT1, TCLP NOT NEEDED	IF SCC ≤ CT2, TCLP NOT NEEDED	IF SCC ≤ CT3, TCLP NOT NEEDED	IF TCLP > TCLP3 STORE OR TREAT AS APPROPRIATE
IF TCLP ≤ TCLP1 AND SCC ≤ SCC1 TREAT AS INERT WASTE	IF TCLP1 < TCLP ≤ TCLP2 AND SCC ≤ SCC2 TREAT AS SOLID WASTE	IF TCLP2 < TCLP ≤ TCLP3 AND SCC ≤ SCC3 OR IF TCLP ≤ TCLP3 AND SCC2 < SCC ≤ SCC3 TREAT AS INDUSTRIAL WASTE	
IF TCLP ≤ TCLP1 AND SCC > SCC1, IMMOBILISE (EPA APPROVED METHOD) OR RECLASSIFY WASTE	IF TCLP1 < TCLP ≤ TCLP2 AND SCC > SCC2, IMMOBILISE (EPA APPROVED METHOD) OR RECLASSIFY WASTE	IF TCLP2 < TCLP ≤ TCLP3 AND SCC > SCC3, IMMOBILISE (EPA APPROVED METHOD) OR RECLASSIFY WASTE	IF TCLP ≤ TCLP3 AND SCC > SCC3 AND IMMOBILISATION NOT EPA APPROVED, STORE OF TREAT WASTE AS APPROPRIATE

	INERT WASTE			SOLID WASTE			INDUSTRIAL WASTE		
CONTAMINANT	CT1 (mg/kg)	TCLP1 (mg/L)	SCC1 (mg/kg)	CT2 (mg/kg)	TCLP2 (mg/L)	SCC2 (mg/kg)	CT3 (mg/kg)	TCLP3 (mg/L)	SCC3 (mg/kg)
Arsenic	10	0.5	500	100	5[3]	500	400	20	2,000
Beryllium	2	0.1	100	20	1.0[10]	100	80	4	400
Cadmium	2	0.1	100	20	1.0[3]	100	80	4	400
Chromium (total)[5]	10	0.5	1,900	100	5[3]	1,900	400	20	7,600
Cyanide (total)[6]	32[2]	1.6	5,900	320	16	5,900	1280	64	23,600
Cyanide (Amenable)[6,8]	7[7]	0.35	300	70	3.5	300	280	14	1,200
Fluoride	300	15	10,000	3,000	150[4]	10,000	12,000	600	40,000
Lead	10	0.5	1,500	100	5[3]	1,500	400	20	6,000
Mercury	0.4	0.02	50	4	0.2[3]	50	16	0.8	200
Molybdenum	10	0.5	1,000	100	5[4]	1,000	400	20	4,000
Nickel	4	0.2	1,050	40	2[4]	1,050	160	8	4,200
Selenium	2	0.1	50	20	1[3]	50	80	4	200
Silver	10	0.5	180	100	5.0[3]	180	400	20	720
Benzene	1.0	0.05	18	10	0.5[3]	18	40	2	72
Toluene	28.8	1.44	518	288	14.4[3]	518	1,152	57.6	2,073
Ethylbenzene	60	3	1,080	600	30[6]	1,080	2,400	120	4,320
Total xylenes	100	5	1,800	1,000	50[14]	1,800	4,000	200	7,200
Total petroleum hydrocarbons (C6-C9)[11,13]	-	-	650	-	-	650	-	-	2,600
Total petroleum hydrocarbons (C10-C36)[11,13] (C10-C14, C15-C28, C29-C36)	-	-	5,000	-	-	10,000	-	-	40,000
Benzo(a)pyrene[4]	0.08	0.004	1	0.8	0.04[5]	10	3.2	0.16	23
Polycyclic aromatic hydrocarbons (Total)[4,11,12]	-	-	200	-	-	200	-	-	800
Polychlorinated biphenyls[9]	-	-	2	-	-	<50	-	-	<50
Phenol (nonhalogenated)	28.8	1.44	518	288	14.4[13]	518	1,152	57.6	2,073
Scheduled chemicals[7,8]	-	-	1	-	-	<50	-	-	<50

TABLE B
SUMMARY OF LABORATORY TEST DATA
HEAVY METALS - FILL SOILS
All data in mg/kg unless stated otherwise

ANALYTE	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
PQL - Envirolab Services	4.0	1.0	1.0	1.0	1.0	0.1	1.0	1.0
Guideline concentration-HIL *	500	100	60%	5000	1500	75	3000	35000
Guideline concentration -EIL *	20	3	400	100	600	1	60	200
SAMPLE (Depth in metres)								
BH1 (0.1-0.3)	LPQL	LPQL	10	30	14	0.2	33	39
BH1 (3.0-3.45)	LPQL	LPQL	7.8	LPQL	4.5	LPQL	LPQL	7.8
BH2 (0.5-0.95)	LPQL	LPQL	8.5	6.1	17	0.23	1.1	9.2
BH2 (3.0-3.45)	LPQL	LPQL	12	27	78	0.55	9.2	120
BH3 (0.1-0.4)	LPQL	LPQL	12	1.3	12	LPQL	3	22
BH3 (1.1-1.4)	4.2	LPQL	16	47	53	0.11	14	59
BH4 (0.1-0.5)	4.5	LPQL	22	23	47	LPQL	9.4	40
BH4 (0.5-0.65)	4.7	LPQL	8.3	6.3	6.9	LPQL	4.8	14
BH5 (0.1-0.4)	LPQL	LPQL	27	21	25	LPQL	28	65
BH5 (1.6-1.85)	9.5	LPQL	12	70	98	0.44	15	120
BH7 (0.1-0.4)	LPQL	LPQL	15	48	10	LPQL	***86***	45
BH7 (1.5-1.95)	4.6	LPQL	7.6	22	47	LPQL	11	95
Total no. of samples	12	12	12	12	12	12	12	12
Maximum Value	9.5	0	27	70	98	0.55	86	120
Mean Value	nc	nc	13	27	34	nc	18	53

EXPLANATION:
*: National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC Guidelines)
HIL - Column F, Commercial/Industrial

Concentration above HIL **100**

PQL: Practical Quantitation Limit
LPQL: Less than PQL
NA: Not Analysed
nc: Not Calculated

TABLE C
SUMMARY OF LABORATORY TEST DATA
ORGANICS - FILL SOILS
All data in mg/kg unless stated otherwise

ORGANICS	Total PAHs	B(a)P	Aldrin and Dieldrin	Chlordane	DDT & DDD & DDE	Heptachlor	PCBs
PQL - Envirolab	-	0.05	0.1	0.1	0.1	0.1	0.1
Guideline concentration *	100	5	50	250	1000	50	50
SAMPLE (Depth in metres)							
BH1 (0.1-0.3)	5	0.5	LPQL	LPQL	LPQL	LPQL	LPQL
BH1 (3.0-3.45)	2.1	0.1	LPQL	LPQL	LPQL	LPQL	LPQL
BH2 (0.5-0.95)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH2 (3.0-3.45)	0.16	0.06	LPQL	LPQL	LPQL	LPQL	LPQL
BH3 (0.1-0.4)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH3 (1.1-1.4)	84.2	**5.6**	0.6	LPQL	LPQL	0.7	LPQL
BH4 (0.1-0.5)	4.8	0.4	LPQL	LPQL	LPQL	LPQL	LPQL
BH4 (0.5-0.65)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH5 (0.1-0.4)	3	0.3	LPQL	LPQL	LPQL	LPQL	LPQL
BH5 (1.6-1.85)	13.7	1.3	LPQL	LPQL	LPQL	LPQL	LPQL
BH7 (0.1-0.4)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH7 (1.5-1.95)	0.8	0.1	LPQL	LPQL	LPQL	LPQL	LPQL
Total no. of samples	12	12	12	12	12	12	12
Maximum Value	84.2	5.6	0.6	0	0	0.7	0
Mean Value	14.2	0.7	nc	nc	nc	nc	nc

EXPLANATION:
*: National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC Guidelines) Column F, Commercial/Industrial

Concentration above guideline level

ABBREVIATIONS:
PCBs: Polychlorinated Biphenyls
PAH: Polycyclic aromatic hydrocarbons
B(a)P: Benzo(a)pyrene
PQL: Practical Quantitation Limit
LPQL: Less than PQL
nc: Not Calculated

TABLE D
SUMMARY OF LABORATORY TEST DATA
PETROLEUM HYDROCARBONS
All data in mg/kg unless stated otherwise

	PETROLEUM HYDROCARBONS								
	Total Petroleum Hydrocarbons				Benzene	Toluene	Ethyl Benzene	Total Xylenes	PID Reading
	C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}					
PQL - Envirolab	25	100	100	100	1.0	1.0	1.0	3.0	
Guideline concentration *	65	1000			1	1.4	3.1	14	
SAMPLE (Depth in metres)									
BH1 (0.1-0.3)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH1 (3.0-3.45)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH2 (0.5-0.95)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH2 (3.0-3.45)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH3 (0.1-0.4)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH3 (1.1-1.4)	LPQL	LPQL	210	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH4 (0.1-0.5)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH4 (0.5-0.65)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH5 (0.1-0.4)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH5 (1.6-1.85)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH7 (0.1-0.4)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH7 (1.5-1.95)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
Total no. of samples	12	12	12	12	12	12	12	12	12
Maximum Value	0	0	210	0	0	0	0	0	0

EXPLANATION:
* EPA Guidelines for Assessing Service Station Sites - 1994

Concentration above Guideline Level
PQL: Practical Quantitation Limit
LPQL: - Less than Practical QuantitationLimit
NOTE: Statistical analysis only shown where appropriate

TABLE E
SUMMARY OF LABORATORY TEST DATA
ASBESTOS IN SOIL

ANALYTE	Asbestos Identification	Respirable Fibre Content
SAMPLE (Depth in metres)		
BH1 (0.1-0.3)	No asbestos detected	Respirable Fibres Not Detected
BH1 (3.0-3.45)	No asbestos detected	Respirable Fibres Not Detected
BH2 (0.5-0.95)	No asbestos detected	Respirable Fibres Not Detected
BH2 (3.0-3.45)	No asbestos detected	Respirable Fibres Not Detected
BH3 (0.1-0.4)	No asbestos detected	Respirable Fibres Not Detected
BH3 (1.1-1.4)	No asbestos detected	Respirable Fibres Not Detected
BH4 (0.1-0.5)	No asbestos detected	Respirable Fibres Not Detected
BH4 (0.5-0.65)	No asbestos detected	Respirable Fibres Not Detected
BH5 (0.1-0.4)	No asbestos detected	Respirable Fibres Not Detected
BH5 (1.6-1.85)	No asbestos detected	Respirable Fibres Not Detected
BH7 (0.1-0.4)	No asbestos detected	Respirable Fibres Not Detected
BH7 (1.5-1.95)	No asbestos detected	Respirable Fibres Not Detected

TABLE F
SUMMARY OF LABORATORY TEST DATA
TOXICITY CHARACTERISTICS LEACHING PROCEDURE (TCLP)
All data in mg/L unless stated otherwise

ANALYTE	As	Cd	Cr	Pb	Hg	Ni	B(a)P
PQL - Envirolab	0.05	0.01	0.01	0.03	0.0005	0.02	0.001
Guideline concentration * TCLP1 Inert	0.5	0.1	0.5	0.5	0.02	0.2	0.004
SAMPLE							
BH1 (3.0-3.45)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH2 (3.0-3.45)	LPQL	LPQL	LPQL	LPQL	LPQL	0.04	LPQL
BH3 (1.1-1.4)	LPQL	LPQL	LPQL	LPQL	LPQL	0.03	LPQL
BH4 (0.5-0.65)	LPQL	LPQL	0.05	LPQL	LPQL	LPQL	LPQL
BH5 (0.1-0.4)	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH7 (1.5-1.95)	LPQL	LPQL	LPQL	0.03	LPQL	0.03	LPQL
Total no. of samples	6	6	6	6	6	6	6
Maximum Value	0	0	0.05	0.03	0	0.04	0

EXPLANATION:
* Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid wastes (NSW EPA 1999)
Further reference should be made to Table A-2 for waste classification criteria

Value above guideline level

TABLE G-1
QA/QC - RELATIVE PERCENTAGE DIFFERENCES

SAMPLE	ANALYSIS	INITIAL (mg/kg)	REPEAT (mg/kg)	MEAN (mg/kg)	RPD %
Intra-laboratory Soil BH3 (0.1-0.4) = Dup 3	Arsenic	LPQL	LPQL	LPQL	0
	Cadmium	LPQL	LPQL	LPQL	0
	Chromium	12	11	11.5	9
	Copper	1.3	1.2	1.25	8
	Lead	12	13	12.5	8
	Mercury	LPQL	LPQL	LPQL	0
	Nickel	3	2.6	2.8	14
	Zinc	22	23	22.5	4
	Naphthalene	LPQL	LPQL	LPQL	0
	Acenaphthylene	LPQL	LPQL	LPQL	0
	Acenaphthene	LPQL	LPQL	LPQL	0
	Fluorene	LPQL	LPQL	LPQL	0
	Phenanthrene	LPQL	LPQL	LPQL	0
	Anthracene	LPQL	LPQL	LPQL	0
	Fluoranthene	LPQL	LPQL	LPQL	0
	Pyrene	LPQL	LPQL	LPQL	0
	Benzo(a)anthracene	LPQL	LPQL	LPQL	0
	Chrysene	LPQL	LPQL	LPQL	0
	Benzo(b)&(k)fluorant	LPQL	LPQL	LPQL	0
	Benzo(a)pyrene	LPQL	LPQL	LPQL	0
	Indeno(123-cd)pyrene	LPQL	LPQL	LPQL	0
	Dibenzo(ah)anthracene	LPQL	LPQL	LPQL	0
	Benzo(ghi)perylene	LPQL	LPQL	LPQL	0
	Total PAHs	LPQL	LPQL	LPQL	0
	Total OC Pesticides	LPQL	LPQL	LPQL	0
	Total PCBs	LPQL	LPQL	LPQL	0
	C_6-C_9 TPH	LPQL	LPQL	LPQL	0
	C_{10}-C_{14} TPH	LPQL	LPQL	LPQL	0
	C_{15}-C_{28} TPH	LPQL	LPQL	LPQL	0
	C_{29}-C_{36} TPH	LPQL	LPQL	LPQL	0
	Benzene	LPQL	LPQL	LPQL	0
	Toluene	LPQL	LPQL	LPQL	0
	Ethylbenzene	LPQL	LPQL	LPQL	0
	Total Xylenes	LPQL	LPQL	LPQL	0

Explanation

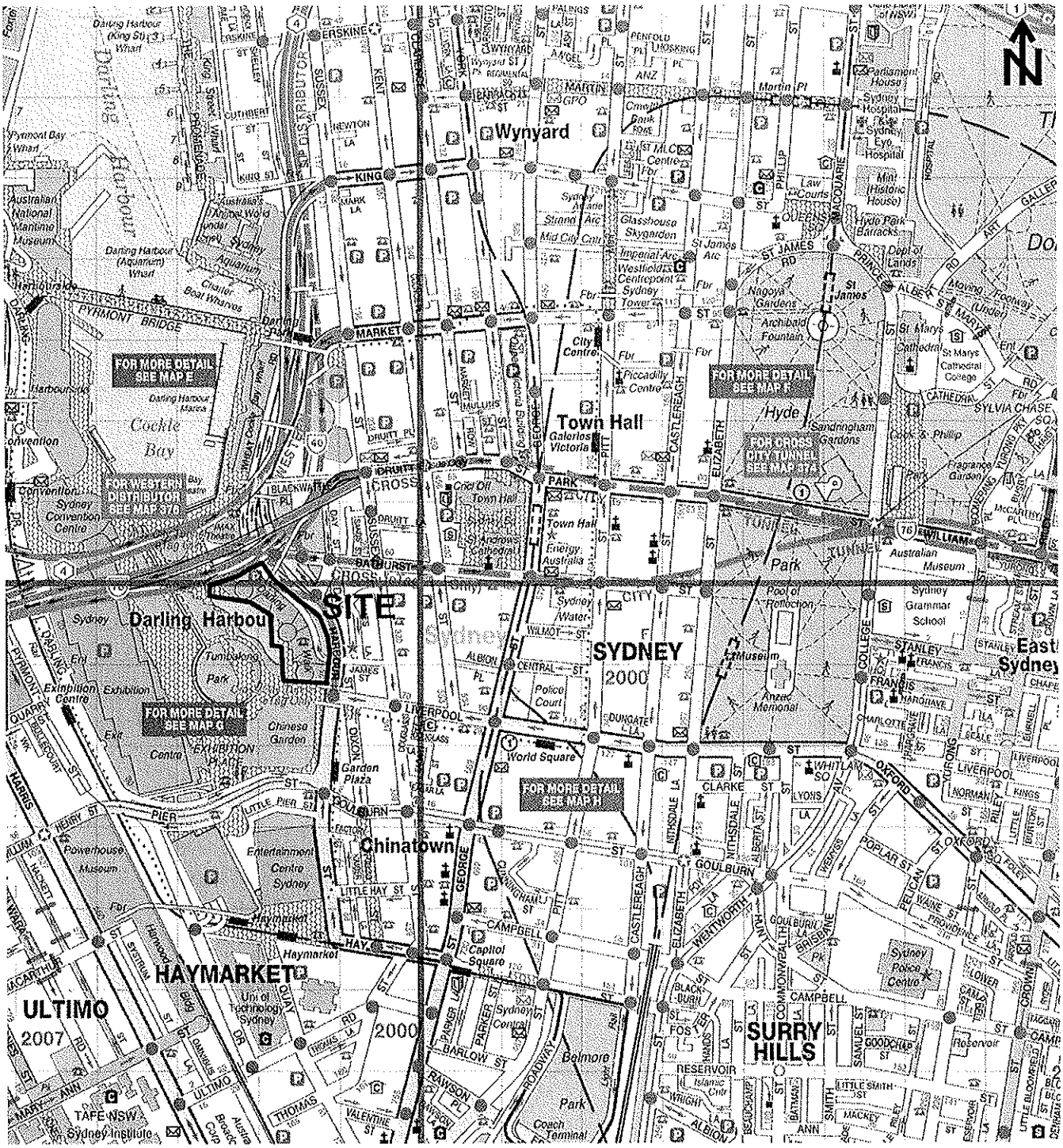
RPD : Relative Percentage Difference
nc : Not calculated

TABLE G-2
QA/QC - RELATIVE PERCENTAGE DIFFERENCES

SAMPLE	ANALYSIS	INITIAL (mg/kg)	REPEAT (mg/kg)	MEAN (mg/kg)	RPD %
Intra-laboratory Soil BH5 (0.1-0.4) = Dup 5	Arsenic	LPQL	4.6	3.3	79
	Cadmium	LPQL	LPQL	LPQL	0
	Chromium	27	34	30.5	23
	Copper	21	24	22.5	13
	Lead	25	31	28	21
	Mercury	LPQL	LPQL	LPQL	0
	Nickel	28	32	30	13
	Zinc	65	71	68	9
	Naphthalene	LPQL	LPQL	LPQL	0
	Acenaphthylene	LPQL	LPQL	LPQL	0
	Acenaphthene	LPQL	LPQL	LPQL	0
	Fluorene	LPQL	LPQL	LPQL	0
	Phenanthrene	0.2	0.2	0.2	0
	Anthracene	LPQL	LPQL	LPQL	0
	Fluoranthene	0.6	0.5	0.55	18
	Pyrene	0.6	0.5	0.55	18
	Benzo(a)anthracene	0.3	0.3	0.3	0
	Chrysene	0.3	0.3	0.3	0
	Benzo(b)&(k)fluorant	0.5	0.4	0.45	22
	Benzo(a)pyrene	0.3	0.3	0.3	0
	Indeno(123-cd)pyrene	0.1	0.1	0.1	0
	Dibenzo(ah)anthracene	LPQL	LPQL	LPQL	0
	Benzo(ghi)perylene	0.1	0.1	0.1	0
	Total PAHs	3	2.7	2.85	11
	Total OC Pesticides	LPQL	LPQL	LPQL	0
	Total PCBs	LPQL	LPQL	LPQL	0
	C_6-C_9 TPH	LPQL	LPQL	LPQL	0
	C_{10}-C_{14} TPH	LPQL	LPQL	LPQL	0
	C_{15}-C_{28} TPH	LPQL	LPQL	LPQL	0
	C_{29}-C_{36} TPH	LPQL	LPQL	LPQL	0
	Benzene	LPQL	LPQL	LPQL	0
	Toluene	LPQL	LPQL	LPQL	0
	Ethylbenzene	LPQL	LPQL	LPQL	0
	Total Xylenes	LPQL	LPQL	LPQL	0

Explanation

RPD : Relative Percentage Difference
nc : Not calculated



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SITE LOCATION PLAN

'DARLING WALK', DARLING HARBOUR

NOTE: Reference should be made to the text for a full understanding of this plan.

ENVIRONMENTAL INVESTIGATION SERVICES

Report No. E21073F
Figure: 1