DLA Environmental Services
A Pacific Environment company

Detailed Site Investigation

1a Queen St
Auburn NSW 2144

EG

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ABBREVIATIONS

ACM	Asbestos Containing Material
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
AST	Above-ground Storage Tank
ASS	Acid Sulfate Soil
B(a)P	Benzo(a)Pyrene
BGL	Below Ground Level
BH	Borehole
BTEX	Benzene, Toluene, Ethyl Benzene, Xylene
COC	Chain of Custody documentation
CLM	Contaminated Land Management
DA	Development Application
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DECCW	Department of Environment, Climate Change and Water (NSW)
DLA	DLA Environmental Services
DP	Deposited Plan
DQO	Data Quality Objective
EC	Electrical Conductivity
EIL	Ecological Investigation Level
EMP	Environmental Management Plan
EPA	Environment Protection Authority (NSW)
ESL	Ecological Screening Level
HIL	Health-Based Investigation Level
LOR	Limit of Reporting
MW	Monitoring Well
NATA	National Association of Testing Authorities, Australia
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NRMMC	Natural Resource Management Ministerial Council
NSW	New South Wales
OCP	Organochlorine Pesticides
OEH	Office of Environmental and Heritage
OPP	Organophosphorus Pesticides
OH&S	Occupational Health and Safety
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PID	Photo-Ionisation Detector
PQL	Practical Quantification Limit
QA/QC	Quality Assurance and Quality Control
RAP	Remedial Action Plan
RPD	Relative Percentage Difference
SAC	Site Acceptance Criteria
SAQP	Sampling Analysis and Quality Plan
SEPP	State Environmental Planning Policy
SWL	Standing Water Level
TCLP	Toxicity Characteristic Leaching Procedure
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WHS	Work Health Safety

EXECUTIVE SUMMARY

DLA Environmental Services (DLA) was commissioned by EG [Client] to conduct a Detailed Site Investigation (DSI) of the following area:

1a Queen St, Auburn, NSW 2144

The DSI was required to address the requirements of Auburn City Council with regards to Development Approval (DA) submission. The conditions require a comprehensive environment assessment to be submitted to Council characterising potential contamination and the Site, drawing conclusions on the suitability of the Site for its proposed land use and making recommendations to enable such conclusions.

A comprehensive desktop study including a review of the Site history and previous investigations was undertaken by DLA. Aerial photographs commencing in 1943 show the Site has consistently been for commercial land use. The Site has passed under various ownerships since the earliest historical title for the Site in 1919. Historical title searches identified that from 1919 to 1968 the Site was owned by manufacturers however further details of goods produced are unknown.

Although a search of the WorkCover NSW Dangerous Goods database and microfiche records did not identify any Dangerous Goods licences for the premises, anecdotally we are aware that several USTs were located on Site via the Tank Pit Validation Report (Fluor Daniel GTI, 1998, ref: project S9103.R02). According to this document, three UST's were removed from Site in 1997 and the tank pits validated.

Review of available desktop information indicates that the Site is elevated compared to natural topography, particularly in the southern portion of the Site. This area may contain more fill and is considered an area of potential concern along with the vehicle access roads under which it is likely the USTs were located.

The presence of Total Petroleum Hydrocarbons, Benzo(a)Pyrene and lead in concentrations above the HILS Commercial/Industrial D (NEPM; NEPC 2013) were noted during the Report on Phase 1 Contamination Assessment (Douglas Partners, 2007, ref: project 44352). The location of these measured contaminants are unknown, as the executive summary only is available for review.

Potential contaminants of concern at this Site include volatile and semi-volatile hydrocarbons, Benzo(a)Pyrene, lead and asbestos containing materials (ACM). Due to the unknown extent of past commercial usage of the Site, a broad range of chemical contaminants are screened for in targeted fill samples, particularly in areas with extensive fill.

Between the 9th - 16th of November 2015, DLA Environmental Services (DLA) performed comprehensive environmental sampling of the Site. Twenty one boreholes, eight test pits and three groundwater monitoring wells were drilled/excavated in targeted locations to provide sufficient coverage of the available Site area. Field observations indicated four main soil profiles which in summary consisted of a natural clay profile with fine gravels, roadbase, a 100mm ash layer and a general fill layer in portions of the Site consisting of sand, clay and gravel.

Field observations noted that fill was generally shallow across the Site, with refusal in two locations in the roadway due to potential fill. These refusals occurred in Borehole 6 (BH6) which is located in the former tank pit area, and BH7 along the roadway.

No samples measured over the SAC of Residential B (NEPM; NEPC 2013) for BTEX, vTRH, sTRH, Naphthalene, B(a)P, Total PAH, PCB or pesticides. No samples measured above the SAC for heavy metals with the exception of lead in BH4, which after using UCL statistical analyses complied with the HILS Residential B (NEPM; NEPC 2013).

Two locations tested positive for asbestos fibres in what appears to be isolated areas, as sampling in surrounding boreholes and test pits did not identify asbestos.

It appears that there is interfacial flow of groundwater between the clay and bedrock layer with no indication of hydrocarbons present. Groundwater well MW3 did not yield water for sampling. Heavy metal analysis revealed some minor exceedances with relation to zinc and copper, however, none are considered significant in the context of a human or ecological health risk within the urbanised area of the Site.

Limitations of this investigation include inaccessible areas on Site due to operational facilities and tenants at the Site, however the comprehensive sampling strategy employed by DLA addresses these limitations as best as possible.

The sampling regime and subsequent assessment and reporting of the Site are considered to be adequate for assessment purposes to determine the future land use suitability of the Subject Site in accordance with Auburn City Council, relevant Development Consent Conditions and the general requirements of State Environmental Planning Policy No.55 (SEPP 55). All reporting has been undertaken in accordance with the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011) and the *Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2nd ed., 2006).

Concentrations of chemical contaminants and heavy metals across the Site are generally low and compliant with the proposed land use of Residential B (NEPM; NEPC 2013). Heavy metal concentrations, in particular copper and nickel within groundwater exceeded the nominated GILs at the Site, however as there is no apparent anthropological source of contamination.

Two areas on Site; TP4 and BH16, tested positive for the presence of asbestos. These appear to be isolated occurrences however require asbestos clearance and validation to make the Site suitable for proposed land use.

It is therefore the opinion of DLA that the Site assessment objectives of this report have been achieved. The DSI concludes that the Site is considered suitable for the intended land use consistent with NEPM (NEPC, 2013) *Residential B – Residential with minimal access to soil*, with the exception of the two identified areas. These areas of the Site can be made suitable through the removal of the fill materials and a subsequent asbestos clearance / validation report.

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1.0 INTRODUCTION

1.1 General

DLA Environmental Services (DLA) was commissioned by EG [Client] to conduct a Detailed Site Investigation (DSI) of the following area:

1a Queen St, Auburn, NSW 2144

The DSI was required to address the requirements of Auburn City Council with regards to Development Approval (DA) submission. The conditions require a comprehensive environment assessment to be submitted to Council characterising potential contamination and the Site, drawing conclusions on the suitability of the Site for its proposed land use and making recommendations to enable such conclusions.

1.2 Objectives

The project objectives of this Stage II DSI are to satisfy the relevant DA Conditions and the general requirements of State Environmental Planning Policy No.55 (SEPP 55) in accordance with *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011). Specifically, this DSI will consider the potential for suspected historical activities to have caused contamination at the Site and determine the suitability of the land for future land use consistent with *Residential B* in the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No.1) ('NEPM', NEPC, 2013).

1.3 Scope of Works

To achieve this objective, DLA carried out the following works:

- Desktop study including a review of available current and historical information and previous investigation work;
- Systematic & targeted intrusive investigations including the collection of soil samples from twenty one boreholes and eight test pits;
- Installation of three monitoring wells to assess the groundwater quality;
- Data assessment and reporting including comparison with relevant EPA made or endorsed guideline investigation and screening levels;
- Assessment of whether the Site is suitable, from a contamination perspective for its proposed land use;

- Provision of recommendations in the event that remedial and management actions are required to render the Site suitable;
- Development and documentation of a Conceptual Site Model (CSM) based on the available information; and,
- Preparation of this DSI report in accordance with relevant EPA made or endorsed guidelines.

2.0 SITE DESCRIPTION

2.1 Site Identification

The Site is a large, 2.7ha industrial estate on hardstand with no access to soils. Numerous warehousing facilities occupy the estate and are largely vacant of tenants with the exception of beverage storage and document shredding facilities still in operation. Identification details are summarised in **Table 2** below:

Table 2 – Site Identification Summary

ITEMS	DETAILS
Address	1a Queen St Auburn NSW 2144
Local Government Authority	Auburn City Council
Lot and Deposited Plan	Lot 1 & 2 DP 1160950
Development Controls	Auburn Local Environmental Plan 2010
Site Zoning	IN2 Light Industrial
Current Use (NEPM 2013 Table 1A(1))	Commercial/Industrial D
Proposed Use (NEPM 2013 Table 1A(1))	Residential B with minimal soil access
Site Area (approx.)	27 000m^2 (2.7ha)
Locality Map	Refer to **Figure 1** – Site Location
Site Map	Refer to **Figure 2** – Sample Locations

2.2 Boundaries and Surrounding Land Use

As **Table 2b** illustrates, the Site is surrounded by B4 – Mixed Use zoning to the north, occupied by a blend of retail, residential and commercial enterprises and R3 – Medium Density Residential zoning to the west. Along the eastern Site boundary the T1 Western and T2 Inner West & South rail line operates, followed by Light Industrial and Low Density Residential zoned land further east.

Table 2b – Boundaries and Surrounding Land Use

DIRECTION	DETAILS
North	Retail and commercial businesses in addition to residential dwellings.
East	The T1 Western and T2 Inner West & South rail line, followed by light industrial and low density residential dwellings.
South	Light industrial enterprises.
West	Medium density residential dwellings.

2.3 Site Geology and Soils

Review of the Geological Survey map of NSW Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1) indicates that the Site is underlain by Triassic Age Ashfield Shale comprised of black to dark grey shale and laminate. Ashfield Shale forms part of the Wianamatta group that formed in Lacustrine and delta environments.

A review of the NSW soil and land information provided on eSPADE (http://www.environment.nsw.gov.au/eSpadeWebapp/) indicates that the Site is located within the Blacktown Soil Landscape Group. This is characterised by shallow to moderately deep red and brown Podzolic soils on crests and upper slopes and deep, yellow Podzolic soils on lower slopes and areas of poor drainage. Common land uses include residential dwellings and light industry. Limitations of the soils of the Blacktown Soil Landscape Group include moderately reactive highly plastic subsoil, low soil fertility, poor soil drainage.

2.4 Site Topography

The Site has undulating gradual slopes and rises of up to 21m. Overall the Site slopes towards Haslams Creek to the north-east of the Site. The elevation of the site ranges from 21m in the northwest to 19m in the southeast.

2.5 Acid Sulphate Soils

Review of the Auburn LEP's Acid Sulfate Soil Map (Sheet ASS_002) indicated that there are occurrences of acid sulfate soils in the area. No visual indications of acid sulfate soils were observed, however the Site is located on Class 5 ASS. This requires a Planning Instrument for works within 500m of adjacent Class 1, 2, 3 or 4 land which are likely to lower the water table below 1m metre in Class 1, 2, 3 or 4 land. If during excavations ASS are encountered an Acid Sulphate Soils Management Plan (ASSMP) will be implemented to mitigate any risks associated with potential acid generation.

2.6 Salinity and Aggressivity of Soils

Review of the Saline Land map on the NSW Department of Planning and Environment's Planning Portal (maps.planningportal.nsw.gov.au/Map) showed no evidence of salinity hazards or dryland salinity indicators within the Site boundaries or land surrounding the Site.

2.7 Hydrology and Hydrogeology

The Site is comprised of sealed surfaces. As such, rainfall is expected to mainly to flow into the underground stormwater collection system that runs under the Site and to be carried into the municipal stormwater systems on Queen St. Standing water level on Site ranged between 1.23m in MW2(up gradient) and 3.13m at MW1 (down gradient).

A search of the Department of Natural Resources groundwater database was also performed to identify wells in the vicinity of the Site. **Table 2c** summarizes five registered groundwater monitoring wells that are located within 4km of the Site. These are being used for monitoring purposes with standing water levels of groundwater wells in the Site's vicinity ranging between 1.8m to 10m.

Table 2c – Regional Groundwater Summary Data

WELL ID	DISTANCE FROM SITE (km)	PURPOSE	DEPTH (m)	STANDING WATER LEVEL (m)	SALINITY (µS/cm)
GW100684	N – 2	Monitoring	9.5	6.8	No Data
GW114500	W – 2	Monitoring	4.1	3.2	No Data
GW111940	S – 1.4	Monitoring	6.1	2.7	No Data
GW102644	E – 2.5	Monitoring	25	10	No Data
GW102562	NE – 4	Monitoring	4	1.8	No Data

Refer to **Appendix D** – Groundwater Works Database Search.

2.8 Site Meteorology

The Bureau of Meteorology NSW gives the average annual rainfall for the Auburn area at 911.8mm, with an average annual maximum temperature range of 17.6° to 28.4°C, and an average annual minimum temperature range of 16.3°C to 25.4°C.

3.0 DEVELOPMENT CONTROLS

3.1 Section 149 Certificate

A Planning Certificate from the Auburn City Council under Section 149 of *the Environmental Planning and Assessment Act 1979* (NSW) was obtained for both for Lot 1 and 2 DP 1160950 of the Site, stating:

- The zoning and land use provisions of Zone IN2 Light Industrial under the *Auburn Local Environmental Plan 2010* apply to this land;
- The land does not include or comprise critical habitat and is not located in a Conservation Area under the *Auburn Local Environmental Plan 2010*;
- The Site does not contain Aboriginal archaeological sites or items of environmental heritage under the provisions of *Auburn Local Environmental Plan 2010*;
- The State Environmental Planning Policy (Sydney Region Growth Centres) 2006 does not apply to this land;
- The land is not affected by the operation Sections 38 or 39 of the *Coastal Protection Act 1979* (NSW);
- The land has not been proclaimed to be a mine subsidence district under the *Mine Subsidence Compensation Act 1961*;
- The Site is not affected by Local Road Widening under Division 2 of Part 3 of the *Roads Act 1993* or any other planning instrument or council resolution;
- The land is not identified on bush fire prone land for the purposes of the *Environmental Planning and Assessment Act 1979*;
- The land is not affected by a flood control lot under the *Auburn Local Environmental Plan 2010*.
- No part of the land is subject to matters prescribed by section 59 (2) of the *Contaminated Land Management Act* 1997.

An exception to the above is Lot 2 DP 1160950, which is affected by a flood control lot under the *Auburn Local Environmental Plan 2010*.

Refer to **Appendix E** – Auburn City Council Section 149 Certificate.

3.2 WorkCover Dangerous Goods Search

A WorkCover NSW search regarding the Site within their Stored Chemical Information Database indicated that Dangerous Goods Licenses have not been held for the premises.

Refer to **Appendix F** – Dangerous Goods Search.

3.3 Contaminated Land Record Search

A search was conducted of all records pertaining to section 58 of the *Contaminated Land Management Act 1997* (NSW) and revealed that the Site is not encumbered by any notices from the NSW EPA with regard to contaminated land. No sites in the vicinity of the Site were encumbered by any notices.

A search of the NSW EPA online *Protection of the Environment Operations Act 1997* (NSW) public register did not locate any records of licences, applications, notices, audits, or pollution studies/reduction programs for the Site.

4.0 SITE HISTORY

4.1 Aerial Photograph Review

Aerial photographs from 1943 to 2015, available from the NSW Lands Department and Nearmaps, were reviewed by DLA with relevant observations being summarised in **Table 4** below. They indicate that the Site was commercial/industrial since the earliest photographic evidence available.

Table 4a – Aerial Photograph Review

YEAR	DETAILS
1943 maps.au.nearmap.com	At least ten large structures are visible, resembling warehousing facilities or factories. They are built haphazardly and it appears that unsealed tracks allow for vehicle access to each structure within the Site. Varying in size, these structures are larger than the residential houses that border the Site to the north and west. The T1 Western and T2 Inner West & South rail line operates along the eastern border and a vacant block lies to the south.
1951 – Run 12 Sydney	No significant changes are visible.
1961 – Run 33 Cumberland	A structure slightly larger than a residential house is no longer present in the northwest corner of the Site. A new, large elongate structure now runs parallel to the rail line on the south east corner.
1978 – Run 16 County of Cumberland	A singular, long structure occupies the western length of the Site. Two structures, each half the length of the long structure in the west, occupy the area in the north-east of the Site separated by what appears to be an unsealed road. A single large structure occupies the entire southern third of the Site. Large structures are now visible south of the Site.
1986 – Run 22 Sydney	No significant changes are visible.
1994 – Run 10 Sydney	No significant changes are visible.
2005 – Run 10Sydney	No significant changes are visible.
2010 maps.au.nearmap.com	A large structure is added along the eastern boundary, running northwest to southeast abutting the T1 Western Rail Line.
2015 maps.au.nearmap.com	No significant changes are visible.

Refer to **Appendix F** – Aerial Photographs.

4.2 Historical Title Search

Title Search results of Lot 1 & 2 DP 1160950 from 1919 to 2008 were reviewed by DLA with relevant observations being summarised below in **Table 4b:**

Table 4b – Historical Title Search

YEAR	SITE OWNER	LAND USE / OCCUPATION
1919	George H. Ritchie, Sidney Ritchie and Stuart D. Ritchie	Manufacturers
1936	George M. Ritchie, Robert B. Ritchie and Stuart D. Ritchie	Manufacturers
1968	Tattersall Bros. Pty Ltd	No data
1985	State Superannuation Board, now State Authorities Superannuation Board	No data
1991	Orlani Pty Limited, now OPG Pty Limited	No data
2008	# Australian Executor Trustees Limited	No data

Refer to **Appendix G** – Historical Title Search.

4.3 Heritage / Archaeological Items

A review of Auburn LEP Heritage Map (Sheet HER_002) reported no heritage items on Site. A search of the Aboriginal Heritage Information Management System did not identify items of Aboriginal heritage on or within the vicinity of the Site.

Refer **Appendix H** – AHIMS Results.

4.4 Site History Summary

Aerial photographs commencing in 1943 show the Site has consistently been for commercial land use. The Site has passed under various ownerships since the earliest historical title for the Site in 1919. Historical title searches identified that from 1919 to 1968 the Site was owned by manufacturers however further details of goods produced are unknown.

Although a search of the WorkCover NSW Dangerous Goods database and microfiche records did not identify any Dangerous Goods licences for the premises, anecdotally we are aware that several USTs

were located on Site via the *Tank Pit Validation Report* (Fluor Daniel GTI, 1998, ref: project S9103.R02). According to this document, three UST's were removed from Site in 1997 and the tank pits validated.

Review of available desktop information indicates that the Site is elevated compared to natural topography, particularly in the southern portion of the Site. This area may contain more fill and is considered an area of potential concern along with the vehicle access roads under which it is likely the USTs were located.

The presence of Total Petroleum Hydrocarbons, Benzo(a)Pyrene and lead in concentrations above the HILS Commercial/Industrial D (NEPM; NEPC 2013) were noted during the *Report on Phase 1 Contamination Assessment* (Douglas Partners, 2007, ref: project 44352). The location of these measured contaminants are unknown, as the executive summary only is available for review.

Potential contaminants of concern at this Site include volatile and semi-volatile hydrocarbons, Benzo(a)Pyrene, lead and asbestos containing materials (ACM). Due to the unknown extent of past commercial usage of the Site, a broad range of chemical contaminants are screened for in targeted fill samples, particularly in areas with extensive fill.

Appendix I – Underground Storage Locations.

5.0 SUMMARY OF PREVIOUS INVESTIGATIONS

5.1 Report on Phase 1 Contamination Assessment (Douglas Partners, April 2007, ref. project: 44352)

Douglas Partners conducted a Preliminary Site Investigation including supplemented soil sampling in fifteen boreholes and the installation of one groundwater monitoring well in April, 2007.

At the time of assessment the site was operational and generally used for storage/warehousing. The Site history information indicated that the Site was developed for industrial land use (including the manufacture of rolling stock for the railways) in/prior to 1882. Since then a number of companies have occupied parts of the Site with potentially contaminating activities including storage and mixing of chemicals (including 6 USTs) and vehicle maintenance (including fuel storage in approximately 4-6 USTs). An extensive variety of chemicals have been stored at the Site including fuels, oils, pigments, acids, resins, rubbers and xylenes.

Three samples measured above commercial/industrial land use for TPH C_{10}-C_{36} and were associated with the fill layer. Asbestos was identified in one fragment of fibre cement noted at the surface. No fibre cement or asbestos was detected in soils at the Site. Detections of zinc in groundwater analyses exceeded GILs criteria however were within the expected background levels for groundwater in urban areas and not considered a concern.

This report considers that the Site remains suitable for commercial/industrial land use provided it remains capped with limited potential for exposure to detected contaminants. A Detailed Site Assessment is recommended as remedial work is likely to be required when the Site is redeveloped.

5.2 Tank Pit Validation Report (Fluor Daniel GTI (Australia) Pty Ltd, 1998, ref: project S9103.R02)

The aim of these works was to remove potential sources of petroleum hydrocarbon impacts (including three USTs, fuel dispensers and associated fuel and vent lines), to excavate any impacted soil and to validate tank pits. Laboratory analysis of the validation soil samples indicated that TPH and BTEX concentrations were below the Site Validation Criteria.

Remnant hydrocarbon impact exceeded Site Validation Criteria in regions where excavation would disrupt or damage existing underground services. Fluor Daniel GTI (Australia) Pty Ltd concludes that remnant hydrocarbon impacted soil is present in the vicinity of stormwater pipe adjacent to the warehouse. Fluor Daniel GTI (Australia) Pty Ltd further concludes that the Mayne Nickless Auburn fuel

storage and dispensing facility has been decommissioned and the Site is suitable for continued commercial/industrial land use.

6.0 CONCEPTUAL SITE MODEL

6.1 Potential Contaminants

On the basis of the information summarised above, the principal potential contamination sources are associated with fill and the use and storage or petroleum products on-site. Potential Contaminants of Concern (PCOC) therefore include hydrocarbons, in particular Total Recoverable Hydrocarbons (TRH) in underlying soil and groundwater and Polycyclic Aromatic Hydrocarbons (PAH) and heavy metals within fill materials.

6.2 Release and Transport Mechanisms

Contaminants generally migrate from a site via a combination of windblown dusts, rainwater infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and,
- The site topography, geology, hydrology and hydrogeology.

As a significant proportion of the Site is sealed, the potential for windblown dust migration of contamination from the Site was considered to be minimal. The potential for migration of contamination via surface water movement and infiltration of water and subsequent migration through the soil profile was considered generally to be low given the low permeability of the expected soils in the Blacktown landscape group and of the underlying Ashfield Shale. Due to the relatively low permeable nature of the underlying soils, migration of contamination via groundwater movement was also considered to be low.

The vapour generation potential associated with volatile and semi-volatile PCOC (TRH, BTEX and VOCs) was identified as a potential migration pathway. Vapour generation would however be dependent on the presence of a source of vapour generation on or in the vicinity of the Site which was removed and validated during previous environmental investigation and on-site works, thereby reducing this risk.

Moreover, with respect to the identified chemical contaminant impacted soils, benzo(a)pyrene and lead compound impacts fall within Group 2 and Group 10 as listed in Table 1 of the *Guidelines for the Assessment of On-Site Containment of Contaminated Soils* (ANZECC, 1999). For these contaminant groups, inhalation of vapours is not a primary exposure route. Therefore, implementation of a Capping and Containment strategy comprising physical separation via capping as indicated in Table 2, ANZECC

(1999), in conjunction with appropriate control measures, will significantly limit vapour exposure risks at the Site.

6.3 Exposure Pathways

Based on the identified PCOCs, the exposure pathways for the Site's use include:

- Inhalation of PCOC vapours migrating upwards from fill material of unknown origins or impacted surface soils resulting from potential historical activities; and/or
- Potential dermal and oral contact to impacted soils.

6.4 Sensitive Receptors

The potential sensitive receptors of environmental impacts present at the Site include:

- Present and future workers and users of the Site who may potentially be exposed to PCOCs through direct contact with impacted soils and/or inhalation of dusts/vapours associated with impacted soils;
- Maintenance workers conducting activities at the Site, who may potentially be exposed to PCOCs through direct contact with impacted soils present in excavations/boreholes and/or inhalation of dusts associated with impacted soils;
- The freshwater ecosystem of Haslams Creek, located hydro-geologically down gradient of the Site.

7.0 SAMPLING AND ANALYSIS PLAN

7.1 Field Investigation Procedure

The sampling regime for the DSI of the Site was in accordance with the requirements of the *Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011) and the *Sampling Design Guidelines* (NSW EPA, 1995) taking into consideration the requirements of the *Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2nd ed., 2006) and the NEPM (NEPC, 2013).

The likelihood of contamination was assessed by comparison of assessment results with NSW EPA produced or endorsed criteria available at the time this report was published. Sampling was performed on a systematic and targeted basis and included any areas identified as potential high risk for contamination. The justification of the sampling point regime for the assessment was based on the investigator's knowledge, operational requirements, experience and history of the Site. All historical investigations and anecdotal evidence supported the sampling approach adopted and provided for samples to be collected in an unbiased manner. Field investigation comprised of the following:

- 21 borehole locations extended to natural soils;
- Collection of 55 primary soil samples;
- Collection of 6 secondary and 3 tertiary samples;
- Installation and development of three ground water monitoring wells;
- Collection of 2 groundwater samples from onsite wells;
- Delineation of identified fill and natural material areas.

Refer to **Figure 2** –Sampling Locations.

7.1.1 Soil Collection

Soil samples for chemical analyses were generally collected in accordance with the *Sampling Design Guidelines* (NSW EPA, 1995), NEPM (NEPC, 2013) and AS4482.1-2005. Samples were obtained using a decontaminated trowel and immediately transferred to sample containers of appropriate composition (glass jars for chemical analysis, plastic bags for asbestos). Job number; sample identification number; sampler's initials and date of sampling were recorded on sample labels affixed to the sample containers.

Chemical samples were then placed immediately into a chilled esky to prevent the loss of potential volatile components. The samples were transported under standard DLA chain-of-custody protocols to the NATA accredited laboratories –SGS and Australian Safer Environment & Technology Pty Ltd. All chemical samples were stored and transported at temperatures below 4°C.

All samples were collected by DLA staff who are specifically trained in hazardous waste field investigation techniques and health and safety procedures. All techniques used are specified in DLA Field Manual for Contaminated Sites, which are based on methods specified by the United States Environment Protection Agency (US EPA) and NEPM (NEPC, 2013).

7.1.2 Groundwater Collection

Groundwater samples were collected from two wells, one up-gradient and one down gradient well. Purging and sampling of monitoring wells was conducted in accordance with the NEPM (NEPC, 2013), the *Guidelines for the Assessment and Management of Groundwater Contamination* (NSW DEC, 2007) and the *Murray-Darling Basin Groundwater Quality Sampling Guidelines*.

Wells were purged with a steel bailer and samples were obtained using a sterile disposable bailer. Groundwater samples were collected into laboratory prepared sample containers for specific analytes, i.e. into a combination of plastic unpreserved, plastic preserved, glass amber unpreserved and preserved glass vials.

All samples were collected and filled into the respective sample containers so no head space remained in the sample container, with no loss of any preservation agents, where present. Groundwater samples for metals were field filtered prior to placement into acid preserved plastic containers. All samples were then placed immediately into a chilled esky to prevent the loss of potential volatile components.

7.2 Analytical Strategy

Samples were analysed for listed chemicals based on potential contamination in the area and to allow confident assessment of all representative areas of the Site. Samples were analysed for the following parameters:

7.2.1 Inorganic

- Heavy metals: arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), and zinc (Zn); and,
- Asbestos (in soils).

7.2.2 Organic

- Total Recoverable Hydrocarbons (TRH);
- Monocyclic Aromatic Hydrocarbons (BTEX);
- Volatile TRH (vTRH);
- Organochlorine Pesticides (OCs);
- Organophosphorus Pesticides (OPs);
- Polycyclic Aromatic Hydrocarbons (PAHs); and,
- Polychlorinated Biphenyls (PCBs).

7.3 Data Quality Objectives

The NEPM (NEPC, 2013) and Australian Standard (AS) 4482.1-2005 recommend that data quality objectives (DQOs) be implemented during the investigation of potentially contaminated sites. The DQO process described in AS 4482.1-2005 *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil Part 1: Non-Volatile and Semi-Volatile Compounds* outlines seven distinct steps to outline the project goals, decisions, constraints and an assessment of the project uncertainties and how to address these when they arise. The DQOs have been summarised in the table below:

Table 7a – Summary of DQOs

1	State the Problem	Have previous land uses affected the suitability of the Site for Residential B as defined by NEPM (NEPC, 2013)?
2	Identify the Decisions	– Do contaminant concentrations in the soil and groundwater comply with the stated screening levels? – Do soils and/or groundwater on the Site currently require any remedial action or implementation of risk management? – Have the previous land uses affected the environmental quality of the land? – Are there any identifiable risks to human health or the environment on Site?
3	Identify Inputs to Decisions	– Systematic / representative soil sampling across the Site. – The proposed land use. – Determination of the general concentrations of heavy metals, hydrocarbons, pesticides, PCBs, ACM and other chemicals across the Site. – Identifying current and future potential receptors and the likelihood of exposure to unacceptable levels of contamination both on and off the Site.
4	Define Study Boundaries	The physical study will focus on fill materials, natural soils and groundwater within the confines of the proposed Site boundary.
5	Develop Decision Rule	The Site will be considered suitable for its intended land use if concentrations of soils and groundwater comply with the screening levels provided in NEPM (NEPC, 2013), as determined by the following Site Assessment Criteria (SAC) being applied to the data: – The 95% Upper Confidence Limit (UCL) of the arithmetic mean for each Contaminant of Concern must comply with the respective screening level; – The individual contaminant concentration should not exceed the screening level by more than 250%, and; – The standard deviation of individual contaminants should not exceed 50% of the HIL.
6	Specify Limits on Decision Errors	Field and laboratory quality controls are implemented to avoid error and to ensure the action levels exceed the measurement detection limits. The performance of decision making inputs will be enhanced through the application of Data Quality Indicators (DQI), defined in **Table 7b** below.
7	Optimise Design for Obtaining Data	– Ensure access to all relevant and previous environmental data. – Identify the most resource-effective sampling and analysis design for general data that are expected to satisfy the DQOs.

Table 7b – Summary of DQIs

DATA PRECISION AND ACCURACY	
Acceptable Relative Percentage Difference (RPD)	>10 x LOR: 30% inorganics; 50% organics (Field) <10 x LOR: Assessed on individual basis (Field) >5 x LOR: 50% (laboratory) <5 x LOR: No Limit (laboratory)
Adequate Laboratory Performance	Based on acceptance criteria of laboratory as specified on certificate of analysis, includes: blank samples, matrix spikes, control samples, and surrogate spike samples. Use of analytical laboratories with adequately trained and experienced testing staff experienced in the analyses undertaken, with appropriate NATA certification.
DATA REPRESENTATIVENESS	
Sample and Analysis Selection	Representativeness of all contaminants of concern.
Trip Blanks	No detection above LOR.
Trip Spikes	Recoverable concentrations of volatiles between 60 – 140%.
Laboratory Selection	Adequate laboratory internal quality control and quality assurance methods, complying with the NEPM (NEPC, 2013).
DOCUMENTATION COMPLETENESS	
Chain of Custody Records	Laboratory sample receipt information received confirming receipt of samples intact and appropriate chain of custody.
	NATA registered laboratory results certificates provided.
DATA COMPLETENESS	
	Analysis for all contaminants of concern.
	Field duplicate sample numbers complying with NEPM (NEPC, 2013)
	Trip spike samples prepared and sent with field samples regularly.
COMPARABILITY	
	Use of NATA registered laboratories.
	Detailed logs of all sample locations recorded.
	Test methods comparable between primary and secondary laboratory
	Acceptable RPD's between original samples and field duplicates and inter-laboratory triplicate samples.

7.4 Assessment Criteria

The assessment criteria have been chosen in accordance with current Australian and NSW EPA guidelines. Australian Guidelines have been used in preference to international guidelines where available, however in some instances, US EPA Regional Screening Levels (RSL) have been referenced. The criteria provided are the most current and widely accepted for Tier 1 assessment of land use suitability at present in Australia, and have generally been developed using a risk-based approach.

7.4.1 Soil Criteria

Criteria from the NEPM (NEPC, 2013) Schedule B1 were utilised for this assessment. Soil HSLs for vapour intrusion were used for volatile petroleum contaminants, whilst the US EPA Regional Screening levels were cited to extrapolate criteria for volatile halogenated compounds.

With regard to the vapour intrusion criteria, the NEPM (NEPC, 2013) provides Health Screening Levels (HSLs), Ecological Screening Levels (ESLs) and Management Limits (MLs) for TRH fractions in soil and groundwater based on concerns regarding ecological impacts, inhalation of vapours and direct contact with contaminant sources. The material type of 'clay' (or 'fine') has been used as it offers to most similar correlation to the condition of soils at the Site.

Table 7c –TRH Soil Criteria for Vapour Intrusion (mg/kg) [CLAY]

ANALYTES	HSL-B (Clay) 0 to 1.0m	HSL-B (Clay) 1.0 to <2.0m	HSL-B (Clay) 2.0 to <4.0m	Direct Contact HSL-B
Benzene	0.7	1	2	140
Toluene	480	NL	NL	21,000
Ethylbenzene	NL	NL	NL	5,900
Xylenes	110	310	NL	17,000
Naphthalene	5	NL	NL	2,200
F1: C_6-C_{10}	50	90	150	5,600
F2: C_{10}-C_{16}	280	NL	NL	4,200
F3: C_{16}-C_{34}	NA	NA	NA	5,800
F4: C_{34}-C_{40}	NA	NA	NA	8,100

NL = Not Limiting (i.e. the soil vapour concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario).

NA = Not Applicable (i.e. NEPM (NEPC, 2013) does not provide HSLs for the F3 and F4 hydrocarbon fractions).

Vapour Intrusion Criteria sourced from NEPM (NEPC, 2013) *Table 1A (3) – Soil HSLs for vapour intrusion.*
Direct Contact Criteria sourced from Friebel and Nadebaum 2011, Health Screening Levels for petroleum Hydrocarbons in Soil and Groundwater, Part 1: Technical Development Document, *Table A4 – Soil Health Screening Levels for Direct Contact.*

Table 7d – Criteria for Total Recoverable Hydrocarbons ESL and ML (mg/kg) [FINE]

ANALYTES	ML (Fine) Urban Residential and Public Open Space
Benzene	--
Toluene	--
Ethylbenzene	--
Xylenes	--
Benzo(a)Pyrene	--
F1: C_6-C_{10}	800
F2: C_{10}-C_{16}	1,000
F3: C_{16}-C_{34}	3,500
F4: C_{34}-C_{40}	10,000

ESLs obtained from NEPM (NEPC, 2013) *Table 1B(6)* – ESLs for TPH fractions, BTEX and benzo(a)pyrene in soil.
MLs obtained from NEPM (NEPC, 2013) Table 1B(7) – Management Limits for TPH fractions F1-F4 in soil.

Table 7e – Site Assessment Criteria for Soils (mg/kg)

	ANALYTES	HIL-B
HEAVY METALS	**Arsenic**	500
	Cadmium	150
	Chromium	500
	Copper	30,000
	Lead	1,200
	Mercury	120
	Nickel	1,200
	Zinc	60,000
PAH	**BaP TEQ**	4
	Total PAHs	400
PCB	**PCB**	1
PESTICIDES	**Aldrin/Dieldrin**	10
	Chlordane	90
	DDT+DDE+DDD	600
	Heptachlor	10
ASBESTOS	**Bonded ACM**	0.04% w/w
	Friable Asbestos/Asbestos Fines	0.001% w/w
	Surface Asbestos (0.1m)	No Visible

Health Investigation Levels soured from NEPM (NEPC, 2013) Table 1A(1)
Asbestos Health Screening Levels sourced from NEPM (NEPC, 2013) Table 7.

7.4.2 Groundwater Criteria

Criteria for groundwater were obtained from various sources. Where available, trigger levels provided by NEPM (NEPC, 2013) or ANZECC (2000) have been referenced in preference to overseas criteria, however these are limited. The most reliable guideline relative to soil vapour risk of chlorinated compounds was found to be provided by the New Jersey Department of Environmental Protection (NJDEP). The Validation Criteria for groundwater are provided in below.

Table 7f – Groundwater Investigation Levels (µg/L)

	ANALYTES	NEPM HSL[1] 2 to <4m	ANZECC[2] 95% Fresh Water	NJDEP
BTEX	Benzene	800	950	44
	Toluene	NL	--	NL
	Ethylbenzene	NL	--	700
	m+p-Xylene	NL	200	--
	o-Xylene	NL	350	--
	Total Xylene	NL	--	19,000
TRH	$C_6 - C_{10}$	1,000[1]	--	--
	$C_{10} - C_{14}$	1,000[1]	--	--
HEAVY METALS	Arsenic (III)	--	24	--
	Arsenic (V)	--	13	--
	Cadmium	--	0.2	--
	Chromium (III)	--	--	--
	Chromium (VI)	--	1	--
	Copper	--	1.4	--
	Lead	3.4	3.4	--
	Mercury	--	0.6	--
	Nickel	--	11	--
PAH	B(a)P	--	0.2*	--

NL = If the derived groundwater HSL exceeds the water solubility limit, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or NL.

* ANZECC (2000) low or moderate reliability trigger values are provided where possible as an indicative guideline only in the absence of a high reliability 95% value.

\+ Derived from the US EPA Regional Screening Levels.

1 – NEPM (NEPC, 2013) Table 1C – Groundwater Investigation Levels (GILs).

2 – Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000).

7.4.3 Ecological Criteria

According to NEPM (NEPC, 2013), Schedule B (5a) – *Guideline on Ecological Risk Assessment*, factors that may influence a Risk Management Decision (and therefore determine Ecological Risk Assessment outcomes) are generally based on economic, ecological or societal considerations.

Examples include:

- The size of the site, land value, cost of remediation (economic);
- The type of contaminants present, current and potential site land use, surrounding land use (societal); and,

- The ecological significance (e.g. a rare and endangered species or a species that supports a valued ecological process or a sensitive introduced species of low ecological significance) of the values identified in the Receptor Identification component of Ecological Risk Assessment (ERA) to be protected.

EILs have been implemented to environmentally manage the effect of contaminants on terrestrial ecosystems and species sensitivity. The Site is currently capped with a concrete slab with minimal vegetation adjacent to the Queen St curb.

EILs are not relevant to the current land use, and it is considered that they will not be relevant to the proposed land use due the Site being underlain by heavy clays that do not foster plant growth. It is expected that topsoil will have to be imported to Site for any future garden beds. Garden beds in high-density residential dwelling typically tend to be small plants and shrubberies with small root bases that do not extend far into the soil. Therefore, it is considered that EILs are not applicable in this instance.

8.0 RESULTS

8.1 Field Observations

8.1.1 General

The Site is a largely vacant industrial estate comprised of warehousing facilities on hardstand with minimal soil access. The hardstand concrete is in average condition with numerous cracks and joins. No staining or odours were detected during inspection, however fibre-cement roofing containing asbestos was observed in one warehouse along the eastern Site boundary. The Site is elevated compared to the natural topography, particularly in the south and east, with fill present up to 3.5m in the southeast corner.

Fifty five soil samples were obtained from twenty one borehole and eight test pit locations on these grounds using a drill rig, hand auger or excavator. Two large warehouses are still operational and were inaccessible at the time of investigation. Sub-slab materials included natural clays with small gravel, and fill comprised of clay, sand and medium gravel. A fine ash layer (approx. 100mm) was observed in the south and east. Little to no fill was present under the slab in the north west of the Site.

Building rubble including bricks was observed in one test pit, whilst another had sand fill with geofabric and a hydrocarbon odour. These fill types were not observed anywhere else on Site and were both located along the roadway.

Refer to **Figure 2** – Sampling Locations; **Appendix J** –Borelogs; and **Appendix K** – Cross Sections.

8.1.2 Fill Materials

Sub-slab materials included natural clays with small gravel, and fill comprised of clay, sand and medium gravel. A fine ash layer (approx. 100mm) was observed in the south and east. Little to no fill was present under the slab in the north west of the Site.

Roadbase was observed in several boreholes and test pits within the centre of the Site. Building rubble including bricks was observed in one test pit, whilst another had sand fill with geofabric and a hydrocarbon odour. These fill types were not observed anywhere else on Site and were both located along the roadway.

Two small ACM fragments were identified in two test pit locations directly under the slab along the roadways.

8.2 Soil Results

The sampling regime involved the collection of representative surface samples and subsurface samples where possible. A total of fifty five soil samples were submitted to SGS undergoing a range of laboratory analyses. The results of the assessments conducted at the Site are summarised below.

8.2.1 Monocyclic Aromatic Hydrocarbons, Volatile Total Recoverable Hydrocarbons and Semi Volatile Total Recoverable Hydrocarbons

All fifty five samples from the Site were analysed for Monocyclic Aromatic Hydrocarbons (BTEX fractions), Volatile Total Recoverable Hydrocarbons (vTRH) and Semi Volatile Total Recoverable Hydrocarbons (TRH). No samples measured concentrations of BTEX above the laboratory Limit of Reporting (LOR). No samples measured concentrations of the F1 or F4 fraction hydrocarbon above the laboratory LOR.

Five samples measured detections of the F2 fraction of hydrocarbon, the highest being 110mg/kg in BH10_1.5. Five samples measured detections of the F3 fraction of hydrocarbon, the highest being 420mg/kg in TP4_0.6.

Table 8a – Hydrocarbons in Soil (mg/kg)

SAMPLE	DATE	DEPTH (m)	BTEX	Napth	F1	F2	F3	F4	PAH	BaP (TEQ)
BH1_0.5	9/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
BH1_1.4	9/11/15	1.4	nd	nd	nd	nd	nd	nd	nd	nd
BH2_0.5	9/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
BH2_0.7	9/11/15	0.7	nd	nd	nd	nd	nd	nd	nd	nd
BH3_0.4	9/11/15	0.4	nd	nd	nd	nd	nd	nd	nd	nd
BH3_1.5	9/11/15	1.5	nd	nd	nd	nd	nd	nd	nd	nd
BH4_0.3	10/11/15	0.3	nd	nd	nd	nd	nd	nd	13	1.2
BH4_1.5	10/11/15	1.5	nd	nd	nd	nd	nd	nd	nd	nd
BH5_0.3	9/11/15	0.3	nd	nd	nd	nd	nd	nd	nd	nd
BH5_0.5	9/11/15	0.5	nd	nd	nd	98	310	nd	8.9	0.5
BH5_0.6	9/11/15	0.6	nd	nd	nd	nd	nd	nd	nd	nd
BH6_0.5	9/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
BH6_1.5	9/11/15	1.5	nd	nd	nd	42	nd	nd	nd	nd
BH6_2.0	9/11/15	2.0	nd	nd	nd	41	nd	nd	nd	nd
BH7_0.5	9/11/15	0.5	nd	nd	nd	nd	nd	nd	5.4	0.5

SAMPLE	DATE	DEPTH (m)	BTEX	Napth	F1	F2	F3	F4	PAH	BaP (TEQ)
BH7_0.7	9/11/15	0.7	nd	nd	nd	nd	nd	nd	3.1	0.2
BH7_1.5	9/11/15	1.5	nd	nd	nd	nd	nd	nd	nd	nd
BH7_2.1	9/11/15	2.1	nd	nd	nd	nd	nd	nd	nd	nd
BH8_0.5	10/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
BH8_1.0	10/11/15	1.0	nd	nd	nd	nd	nd	nd	nd	nd
BH9_0.5	10/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
BH9_1.5	10/11/15	1.5	nd	nd	nd	nd	nd	nd	nd	nd
BH10_0.	10/11/15	0.6	nd	nd	nd	nd	nd	nd	nd	nd
BH10_1.	10/11/15	1.5	nd	nd	nd	110	nd	nd	1.3	nd
BH11_0.	9/11/15	0.3	nd	nd	nd	nd	nd	nd	nd	nd
BH12_0.	9/11/15	0.3	nd	nd	nd	nd	nd	nd	nd	nd
BH12_1.	9/11/15	1.8	nd	nd	nd	nd	nd	nd	nd	nd
BH13_0.	10/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
BH14_0.	10/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
BH14_0.	10/11/15	0.6	nd	nd	nd	nd	nd	nd	nd	nd
BH15_0.	10/11/15	0.5	nd	nd	nd	nd	nd	nd	1.5	0.3
BH16_0.	16/11/15	0.4	nd	nd	nd	nd	100	nd	15	1.7
BH16_2.	16/11/15	2.3	nd	nd	nd	nd	nd	nd	nd	nd
BH17_0.	16/11/15	0.3	nd	nd	nd	nd	nd	nd	2.5	nd
BH17_4.	16/11/15	4.0	nd	nd	nd	nd	nd	nd	nd	nd
BH18_0.	18/11/15	0.25	nd	nd	nd	nd	nd	nd	nd	nd
BH19_0.	18/11/15	0.2	nd	nd	nd	nd	nd	nd	3.4	0.4
BH20_0.	18/11/15	0.25	nd	nd	nd	75	190	nd	17	1.9
BH21_0.	18/11/15	0.2	nd	nd	nd	nd	nd	nd	8.8	1.1
TP1_0.2	11/11/15	0.2	nd	nd	nd	nd	nd	nd	nd	nd
TP1_0.5	11/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
TP2_0.3	11/11/15	0.3	nd	nd	nd	nd	nd	nd	nd	nd
TP2_1.1	11/11/15	1.1	nd	nd	nd	nd	nd	nd	nd	nd
TP3_0.4	11/11/15	0.4	nd	nd	nd	nd	nd	nd	nd	nd
TP3-0.7	11/11/15	0.7	nd	nd	nd	nd	nd	nd	nd	nd
TP4_0.3	11/11/15	0.3	nd	nd	nd	nd	140	nd	16	3.1
TP4_0.6	11/11/15	0.6	nd	nd	nd	nd	420	nd	6.0	0.9
TP5_0.2	11/11/15	0.25	nd	nd	nd	nd	nd	nd	nd	nd
TP5_0.5	11/11/15	0.5	nd	nd	nd	nd	nd	nd	nd	nd
TP6_0.2	11/11/15	0.2	nd	nd	nd	nd	nd	nd	nd	nd
TP6_0.4	11/11/15	0.4	nd	nd	nd	nd	nd	nd	nd	nd
TP7_0.2	11/11/15	0.2	nd	nd	nd	nd	nd	nd	nd	nd
TP7_0.4	11/11/15	0.4	nd	nd	nd	nd	nd	nd	nd	nd
TP8_0.1	11/11/15	0.15	nd	nd	nd	nd	nd	nd	nd	nd
TP8_0.4	11/11/15	0.4	nd	nd	nd	nd	nd	nd	nd	Nd

nd = Not detected above the laboratory LOR
BOLD = Exceeds assessment criteria

8.2.2 Polycyclic Aromatic Hydrocarbons

All samples from the Site were analysed for Polycyclic Aromatic Hydrocarbons (PAH). Of the twelve samples that measured detections above the laboratory LOR for Benzo(a)pyrene TEQ (BaP TEQ), 3.1mg/kg was the highest measurement located in TP4_0.3. Thirteen samples had detections of Total PAH the highest of which was measured in BH20_0.25 (17mg/kg).

8.2.3 Pesticides

15 samples from the Site were analysed for Organochlorine (OC) and Organophosphate (OP) pesticides. There were no concentrations of OC of OP pesticides recorded above the laboratory LOR.

8.2.4 Polychlorinated Biphenyls

15 samples from the Site were analysed for Polychlorinated Biphenyls (PCB). There were no concentrations of PCB above the laboratory LOR.

8.2.5 Heavy Metals

All fifty five soil samples from the Site were analysed for eight heavy metals. As table 8b illustrates, detections were observed for all eight heavy metals. TP4_0.6 measured detections of lead at 1400mg/kg, exceeding the Site Assessment Criteria (SAC).

Table 8b – Heavy Metals in Soil – Basement Area (mg/kg)

SAMPLE	DATE	DEPTH (m)	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
BH1_0.5	9/11/15	0.5	nd	0.5	11	67	5	nd	77	58
BH1_1.4	9/11/15	1.4	18	0.4	19	20	40	0.02	13	55
BH2_0.5	9/11/15	0.5	9	0.4	9.8	25	140	0.02	12	150
BH2_0.7	9/11/15	0.7	130	nd	5.7	34	51	0.01	3.4	48
BH3_0.4	9/11/15	0.4	9	nd	12	24	20	nd	13	72
BH3_1.5	9/11/15	1.5	9	0.4	5.3	32	17	0.12	64	160
BH4_0.3	10/11/15	0.3	14	0.4	7.1	51	360	0.07	12	87
BH4_1.5	10/11/15	1.5	10	0.6	14	19	22	nd	2.0	19
BH5_0.3	9/11/15	0.3	nd	0.6	15	61	4	nd	140	64
BH5_0.5	9/11/15	0.5	11	0.6	7.0	73	340	0.02	36	350
BH5_0.6	9/11/15	0.6	10	nd	11	10	12	0.01	12	60

SAMPLE	DATE	DEPTH (m)	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
BH6_0.5	9/11/15	0.5	5	nd	8.4	14	28	0.02	11	49
BH6_1.5	9/11/15	1.5	5	nd	9.0	35	40	0.03	13	65
BH6_2.0	9/11/15	2.0	7	nd	6.8	29	42	0.03	10	54
BH7_0.5	9/11/15	0.5	9	0.3	9.1	35	240	0.02	8.0	130
BH7_0.7	9/11/15	0.7	4	nd	8.4	30	94	nd	4.6	85
BH7_1.5	9/11/15	1.5	nd	nd	1.7	7.6	12	nd	3.7	33
BH7_2.1	9/11/15	2.15	200	0.4	5.7	41	20	0.30	65	220
BH8_0.5	10/11/15	0.5	8	0.7	10	46	16	0.02	120	230
BH8_1.0	10/11/15	1.0	9	0.4	7.8	29	16	0.05	26	88
BH9_0.5	10/11/15	0.5	4	nd	13	28	17	nd	46	120
BH9_1.5	10/11/15	1.5	8	1.0	5.1	34	15	0.11	29	97
BH10_0.	10/11/15	0.6	8	nd	5.4	38	13	0.02	9.9	82
BH10_1.	10/11/15	1.5	3	nd	4.0	23	12	0.02	24	120
BH11_0.	9/11/15	0.3	10	nd	7.8	21	20	nd	2.9	44
BH12_0.	9/11/15	0.3	nd	nd	5.8	24	13	nd	6.0	59
BH12_1.	9/11/15	1.8	nd	nd	3.9	19	9	0.07	29	140
BH13_0.	10/11/15	0.5	5	0.4	17	35	15	0.03	51	180
BH14_0.	10/11/15	0.5	8	nd	13	25	17	0.03	21	66
BH14_0.	10/11/15	0.6	6	0.3	9.7	34	16	0.04	15	85
BH15_0.	10/11/15	0.5	6	0.5	56	44	64	0.04	73	140
BH16_0.	16/11/15	0.4	22	3.8	24	1100	950	0.23	46	550
BH16_2.	16/11/15	2.3	5	nd	11	16	14	nd	1.3	13
BH17_0.	16/11/15	0.3	5	nd	14	32	45	0.05	11	120
BH17_4.	16/11/15	4.0	12	nd	4.2	12	20	0.02	0.8	13
BH18_0.	18/11/15	0.25	nd	0.3	5.8	22	31	nd	3.4	120
BH19_0.	18/11/15	0.2	5	0.3	17	29	130	0.04	16	73
BH20_0.	18/11/15	0.25	4	nd	8.7	27	150	0.05	24	68
BH21_0.	18/11/15	0.2	4	nd	11	33	130	0.03	23	65
TP1_0.2	11/11/15	0.2	9	nd	7.6	10	66	0.04	4.4	57
TP1_0.5	11/11/15	0.5	7	0.5	20	13	15	0.03	10	43
TP2_0.3	11/11/15	0.3	nd	0.6	16	65	6	nd	160	81
TP2_1.1	11/11/15	1.1	17	nd	9.0	8.7	15	0.02	11	64
TP3_0.4	11/11/15	0.4	nd	0.4	13	58	5	nd	120	64
TP3-0.7	11/11/15	0.7	8	0.3	16	15	14	nd	6.6	26
TP4_0.3	11/11/15	0.3	23	0.9	23	110	750	0.06	25	310
TP4_0.6	11/11/15	0.6	25	2.1	24	98	**1400**	0.17	20	470
TP5_0.2	11/11/15	0.25	nd	0.5	110	30	14	0.01	95	79
TP5_0.5	11/11/15	0.5	8	nd	3.5	20	12	nd	1.8	14
TP6_0.2	11/11/15	0.2	6	nd	18	10	3	nd	17	16
TP6_0.4	11/11/15	0.4	7	nd	14	16	20	nd	4.8	26

SAMPLE	DATE	DEPTH (m)	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
TP7_0.2	11/11/15	0.2	5	nd	31	8.8	3	nd	29	22
TP7_0.4	11/11/15	0.4	15	0.3	5.6	23	13	nd	1.3	49
TP8_0.1	11/11/15	0.15	nd	0.5	91	30	22	0.01	84	82
TP8_0.4	11/11/15	0.40	3	nd	5.3	14	14	0.03	7.2	47

nd = Not detected above the laboratory LOR
BOLD = Exceeds assessment criteria

8.2.6 Asbestos

Bonded ACM fragments were visually identified and confirmed by laboratory analysis in one location (TP4_0.3). Analysis of asbestos in soils was undertaken in 13 samples. Two locations measured the presence of asbestos fines/fibrous asbestos (AF/FA). TP4_03 and TP4_0.6 measured 0.007% and 0.2% AF/FA respectively. BH16_0.4 measured 0.0016% AF/FA.

8.3 Groundwater Results

8.3.1 Groundwater Quality Parameters

Groundwater (GW) Quality Parameters were collected prior to collection of groundwater samples. Purging was carried out until the well became dry and sampling was undertaken following recharge from the aquifer.

Table 8c – Groundwater Physiochemical Properties

PARAMETER	MW1	MW2
Date (2015)	18 Nov	18 Nov
Temp (°C)	23.2	24.2
DO (%)	48.5	42.7
Conduct ($\mu S\ cm^{-1}$)	1081	629
pH	6.59	7.9
Redox (mV)	65.6	76.7

Refer to **Appendix L** – Groundwater Field Data Sheet

8.3.2 Groundwater Chemical Results

Table 8d indicates that there were no detections of petroleum hydrocarbons measured in the up and down gradient groundwater monitoring wells on Site.

Table 8d - Petroleum Hydrocarbon Concentrations in Groundwater (µg/L)

ANALYTE	MW1	MW2
Benzene	nd	nd
Toluene	nd	nd
Ethylbenzene	nd	nd
Xylene	nd	nd
TRH F1	nd	nd
TRH: C_{10}-C_{36}	nd	nd

nd = Not detected above the laboratory LOR
BOLD = Exceeds assessment criteria

Heavy metal analysis revealed some minor exceedances with relation to copper and nickel, however, none are considered significant in the context of a human or ecological health risk within the urbanised area of the Site.

Table 8e – Groundwater Heavy Metals Analytical Results (µg/L)

ANALYTE	MW1	MW2
Arsenic	1	nd
Cadmium	nd	nd
Chromium	nd	nd
Copper	**2**	nd
Lead	nd	nd
Mercury	nd	nd
Nickel	8	**18**
Zinc	11	12

nd = Not detected above the laboratory LOR
BOLD = Exceeds assessment criteria

Refer to **Appendix A –** Data Summary Table and **Appendix B** – NATA Certified Analytical Results

8.4 QA/QC Comments

Laboratory QA/QC on all samples analysed included calculation of %RPD, matrix spike recovery and blank determinations. All matrix spike recovery and blank determinations were within acceptable limits. Therefore, it is considered that sampling techniques and transportation of samples were appropriate. An intra-laboratory duplicate rate of 10.9% was achieved, greater than the 10% required by the Field Quality Plan. An inter-laboratory duplicate rate of 5.45% was achieved, greater than the 5% required by the Field Quality Plan. Laboratory Duplicates were tested to ensure the results meet the requirements of QA/QC. The %RPD for the majority of intra-laboratory and inter-laboratory duplicates had concentrations that complied with the criteria set for acceptable RPDs and where

exceedances were noted, the heterogeneity observed in the duplicate samples was not deemed significant enough to diminish confidence in the sampling technique or laboratory results.

Refer to **Appendix C** – Quality Assurance and Quality Control.

9.0 DISCUSSION

A comprehensive desktop study including a review of the Site history and previous investigations was undertaken by DLA. Aerial photographs commencing in 1943 show the Site has consistently been for commercial land use. The Site has passed under various ownerships since the earliest historical title for the Site in 1919. Historical title searches identified that from 1919 to 1968 the Site was owned by manufacturers however further details of goods produced are unknown.

Although a search of the WorkCover NSW Dangerous Goods database and microfiche records did not identify any Dangerous Goods licences for the premises, anecdotally we are aware that several USTs were located on Site via the Tank Pit Validation Report (Fluor Daniel GTI, 1998, ref: project S9103.R02). According to this document, three UST's were removed from Site in 1997 and the tank pits validated.

Review of available desktop information indicates that the Site is elevated compared to natural topography, particularly in the southern portion of the Site. This area may contain more fill and is considered an area of potential concern along with the vehicle access roads under which it is likely the USTs were located.

The presence of Total Petroleum Hydrocarbons, Benzo(a)Pyrene and lead in concentrations above the HILS Commercial/Industrial D (NEPM; NEPC 2013) were noted during the Report on Phase 1 Contamination Assessment (Douglas Partners, 2007, ref: project 44352). The location of these measured contaminants are unknown, as the executive summary only is available for review.

Potential contaminants of concern at this Site include volatile and semi-volatile hydrocarbons, Benzo(a)Pyrene, lead and asbestos containing materials (ACM). Due to the unknown extent of past commercial usage of the Site, a broad range of chemical contaminants are screened for in targeted fill samples, particularly in areas with extensive fill.

Between the 9th - 16th of November 2015, DLA Environmental Services (DLA) performed comprehensive environmental sampling of the Site. Twenty one boreholes, eight test pits and three groundwater monitoring wells were drilled/excavated in targeted locations to provide sufficient coverage of the available Site area. Field observations indicated four main soil profiles which in summary consisted of a natural clay profile with fine gravels, roadbase, a 100mm ash layer and a general fill layer in portions of the Site consisting of sand, clay and gravel.

Field observations noted that fill was generally shallow across the Site, with refusal in two locations in the roadway due to potential fill. These refusals occurred in Borehole 6 (BH6) which is located in the former tank pit area, and BH7 along the roadway.

No samples measured over the SAC of Residential B (NEPM; NEPC 2013) for BTEX, vTRH, sTRH, Naphthalene, B(a)P, Total PAH, PCB or pesticides. No samples measured above the SAC for heavy metals with the exception of lead in BH4, which after using UCL statistical analyses complied with the HILS Residential B (NEPM; NEPC 2013).

Two locations tested positive for asbestos fibres in what appears to be isolated areas, as sampling in surrounding boreholes and test pits did not identify asbestos.

It appears that there is interfacial flow of groundwater between the clay and bedrock layer with no indication of hydrocarbons present. Groundwater well MW3 did not yield water for sampling. Heavy metal analysis revealed some minor exceedances with relation to zinc and copper, however, none are considered significant in the context of a human or ecological health risk within the urbanised area of the Site.

Limitations of this investigation include inaccessible areas on Site due to operational facilities and tenants at the Site, however the comprehensive sampling strategy employed by DLA addresses these limitations as best as possible.

10.0 CONCLUSIONS

The sampling regime and subsequent assessment and reporting of the Site are considered to be adequate for assessment purposes to determine the future land use suitability of the Subject Site in accordance with Auburn City Council, relevant Development Consent Conditions and the general requirements of State Environmental Planning Policy No.55 (SEPP 55). All reporting has been undertaken in accordance with the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011) and the *Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2nd ed., 2006).

Concentrations of chemical contaminants and heavy metals across the Site are generally low and compliant with the proposed land use of Residential B (NEPM; NEPC 2013). Heavy metal concentrations, in particular copper and nickel within groundwater exceeded the nominated GILs at the Site, however as there is no apparent anthropological source of contamination.

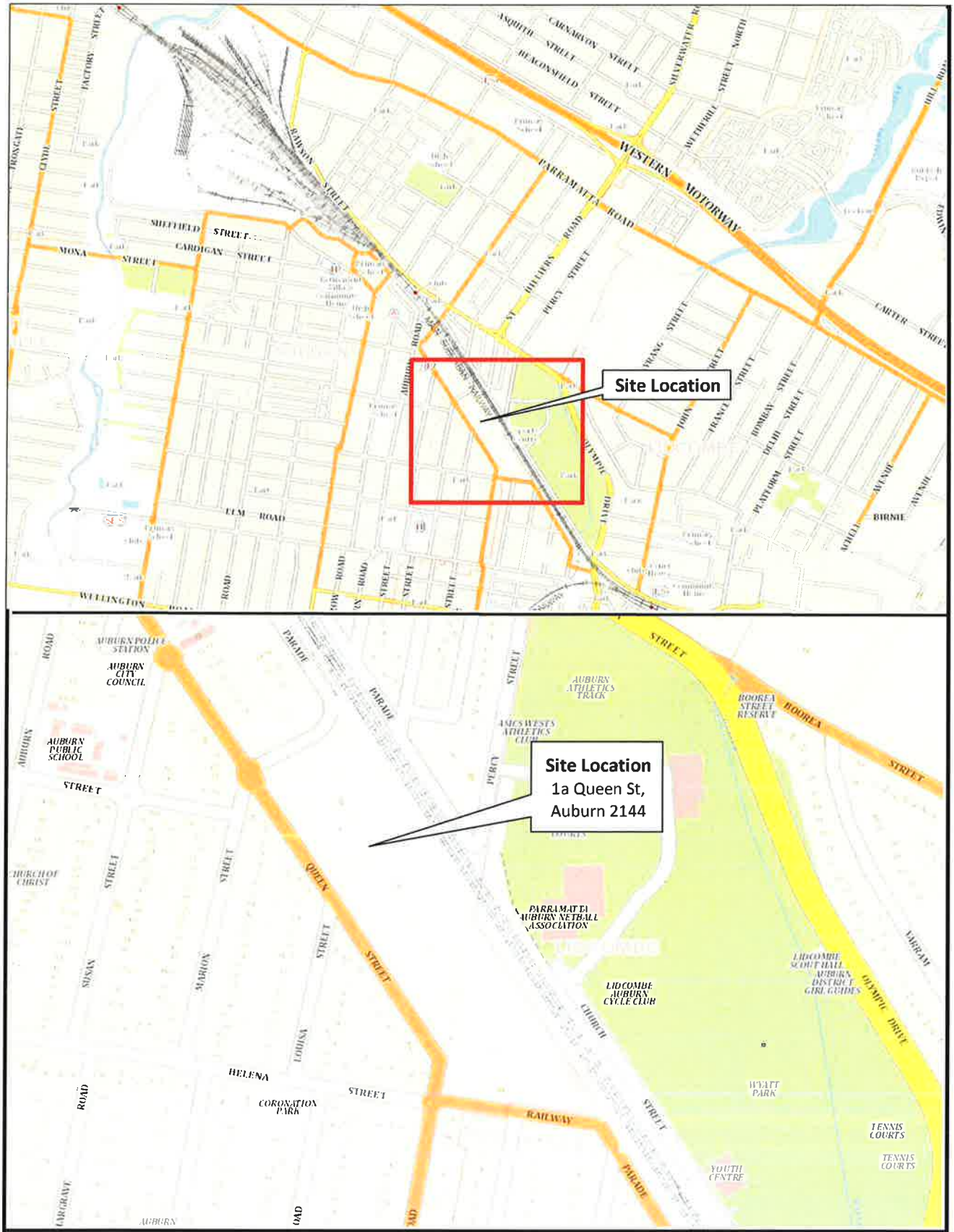
Two areas on Site; TP4 and BH16, tested positive for the presence of asbestos. These appear to be isolated occurrences however require asbestos clearance and validation to make the Site suitable for proposed land use.

It is therefore the opinion of DLA that the Site assessment objectives of this report have been achieved. The DSI concludes that the Site is considered suitable for the intended land use consistent with NEPM (NEPC, 2013) *Residential B – Residential with minimal access to soil*, with the exception of the two identified areas. These areas of the Site can be made suitable through the removal of the fill materials and a subsequent asbestos clearance / validation report.

11.0 REFERENCES

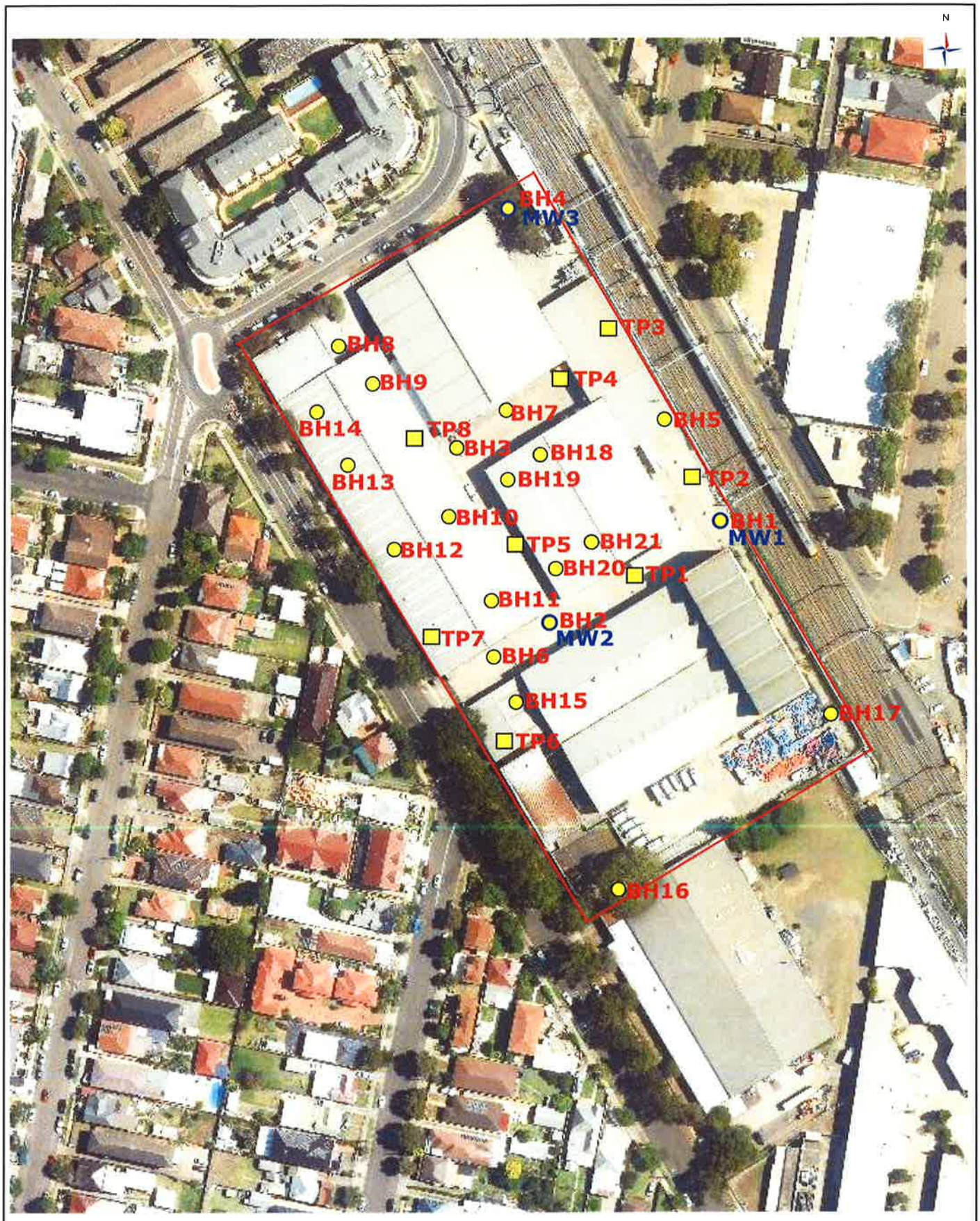
- *Australian and New Zealand Guidelines for the Management of Contaminated Sites* (ANZECC/NHMRC 1992);
- *Australia and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000);
- *Australian Drinking Water Guidelines, National Water Quality Management Strategy* 2011;
- Chapman, G A, Murphy, C L, Tille, P J, Atkinson, G and Morse, R J, *Sydney Soil Landscapes Map*, Series 9130 (1989);
- *Code of Practice for the Safe Removal of Asbestos* (NOHSC, 2nd eds, 2005);
- *Contaminated Land Management Act 1997* (NSW);
- *Contaminated Sites: Assessing Service Station Sites, 1994* (NSW EPA, 1994);
- *Contaminated Site: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011);
- *Contaminates Sites: Guidelines on Duty to Report Contamination under the Contamination Land Management Act 1997* (NSW DECC, 2009);
- *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination* (NSW DEC, 2007);
- *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2nd ed., 2006);
- *Contaminated Sites: Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report* (NSW EPA 1999);
- *Contaminated Sites: Sampling Design Guidelines* (NSW EPA 1995);
- *Environmental Guidelines: Solid Waste Landfills* (NSW EPA, 1996);
- *Guidelines for the Assessment of On-Site Containment of Contaminated Soil* (ANZECC, 1999).
- *Health - Based Soil Investigation Levels, Imray, P & Langley, A, National Environmental Health Forum Monographs, Soil Series No. 2 (2nd Ed), South Australian Health Commission* (NEHF 1998b);
- *How to Safely Remove Asbestos: Code of Practice* (WorkCover, 2011);
- *National Environment Protection (Assessment of Site Contamination) Measure (No.1)* (NEPC, 2013);
- *Managing Land Contamination: Planning Guidelines, SEPP 55 - Remediation of Land* (DUAP, 1998);
- *Storage and Handling of Dangerous Goods Code of Practice 2005*;
- Pacific Southwest, Region 9 Regional Screening Levels (US EPA, 2014);
- *Waste Avoidance and Resource Recovery Act 2001* (NSW);
- *Waste Classification Guidelines* (NSW EPA, 2014); and,
- *Work Health and Safety Act 2011* (NSW) and associated regulations.

FIGURE 1 – SITE LOCATION



DLA environmental Unit 3 38 Leighton Place Hornsby, NSW 2077	DESIGNED: DLA	SITE LOCATION	
	COMPILED: LV	CLIENT: EG	DRAWING: 20/11/2015
	PROJ. No. DL3724	LOCATION: 1a Queen St, Auburn New South Wales 2144	FIGURE: 1

FIGURE 2 – SAMPLE LOCATIONS



Legend

Approximate Scale

0m 25m 50m 75m

- Borehole Locations
- Groundwater Monitoring Well Locations
- Test Pit Locations
- Approx Site Boundary

Sydney Office
Phone (02) 9476 1765
Fax (02) 9476 1557

Maitland Office
Phone (02) 4933 0001

Title: Site Layout & Sample Locations

Client	Figure No	Date
EG	2	17/11/2015

Project No.	Scale	Compiled	Revision
DL3724	As Shown	LV	R00

APPENDIX A – DATA SUMMARY TABLE

				NEPM (NEPC, 2013) Residential B Land Use Criteria (mg/kg)		HSL: 0.04%	HSL: 0.001%	HSL: 0.7; ESL: 65	HSL: 480; ESL: 105	HSL: NL; ESL: 125	HSL: 110; ESL: 45	5	C6-C10 HSL: 50; ESL: 180; ML: 800	>C10-C16 HSL: 260; ESL: 120; ML: 2,000	>C16-C34 HSL: NL; ESL: 1,300; ML: 3,500	>C34-C40 HSL: NL; ESL: 5,600; ML: 10,000	HIL: 4; ESL: 0.7
						Asbestos		BTEX - Clay soils					TRH - Clay soils				PAH
Sample ID	Depth (m)	Date	Chemical Report	Soil Description	Comment	ACM	FA & AF	Benz	Toluen	EthylBe	Xylene	Naph	F1	F2	F3	F4	BaP TEQ
BH1_0.5	0.50	9/11/2015	SE145945	Fill, sand and gravels		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH1_1.4	1.40	9/11/2015	SE145945	Silty clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH2_0.5	0.50	9/11/2015	SE145945	Fill with foreign materials		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH2_0.7	0.70	9/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH3_0.4	0.40	9/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH3_1.5	1.51	9/11/2015	SE145945	Clayey sand		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH4_0.3	0.30	10/11/2015	SE145945	Fill, sand and gravels		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH4_1.5	1.51	10/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	1.2
BH5_0.3	0.30	9/11/2015	SE145945	Fill, sand and gravels		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH5_0.5	0.50	9/11/2015	SE145945	Ash layer		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH5_0.6	0.60	9/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	98	310	<120	0.5
BH6_0.5	0.50	9/11/2015	SE145945	Fill, sand and gravels		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH6_1.5	1.51	9/11/2015	SE145945	Fill, sand and gravels	Light hydrocarbon odour with geofabric	–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH6_2.0	2.00	9/11/2015	SE145945	Fill, sand and gravels	Moderate hydrocarbon odour	–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	42	<90	<120	<0.2
BH7_0.5	0.50	9/11/2015	SE145945	Fill, sand and gravels		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	41	<90	<120	<0.2
BH7_0.7	0.70	9/11/2015	SE145945	Silty clay with gravel	Light solvent odour	–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.5
BH7_1.5	1.51	9/11/2015	SE145945	Clay	Strong solvent odour	–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.2
BH7_2.15	2.15	9/11/2015	SE145945	Clay	Ash present	–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH8_0.5	0.50	10/11/2015	SE145945	Sandy clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH8_1.0	1.01	10/11/2015	SE145945	Weathered rock		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH9_0.5	0.50	10/11/2015	SE145945	Silty clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH9_1.5	1.51	10/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH10_0.6	0.60	10/11/2015	SE145945	Silty clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH10_1.5	1.51	10/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	110	<90	<120	<0.2
BH11_0.3	0.30	9/11/2015	SE145945	Silty clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH17_0.3	0.30	9/11/2015	SE145945	Silty clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH12_1.8	1.81	9/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH13_0.5	0.50	10/11/2015	SE145945	Silty clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH14_0.5	0.50	10/11/2015	SE145945	Clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH14_0.6	0.60	10/11/2015	SE145945	Weathered rock		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH15_0.5	0.50	10/11/2015	SE145945	Fill, clayey sand with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH16_0.4	0.40	16/11/2015	SE146086/ASET47442	Fill, clay and top soil		nd	0.0016%	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	100	<120	1.7
BH16_2.3	2.30	16/11/2015	SE146086/ASET47442	Clay with gravel				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH17_0.3	0.30	16/11/2015	SE146086/ASET47442	Fill, clay with gravel		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.3
BH17_4.0	4.00	16/11/2015	SE146086/ASET47442	Clay with gravel				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH18_0.25	0.25	18/11/2015	SE146161	Clay with gravel				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH18_0.2	0.20	18/11/2015	SE146161	Stabilised roadbase				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.4
BH20_0.25	0.25	18/11/2015	SE146161	Fill, sand and gravels				<0.1	<0.1	<0.1	<0.3	<0.1	<20	75	190	<120	1.9
BH21_0.2	0.20	18/11/2015	SE146161	Fill, sand, clay and gravels				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	1.1
TP1_0.2	0.20	11/11/2015	SE145945/ASET47362	Fill, sand and gravels	Concrete present	nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP1_0.5	0.50	11/11/2015	SE145945	Clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP2_0.3	0.30	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP2_1.1	1.11	11/11/2015	SE145945	Clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP3_0.4	0.40	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP3-0.7	0.70	11/11/2015	SE145945	Clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP4_0.3	0.30	11/11/2015	SE145945/ASET47361	Fill, roadbase	Building rubble, glass and bricks present	14%	0.007%	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	140	<120	3.1
TP4_0.6	0.60	11/11/2015	SE145945/ASET47362	Fill, roadbase	Ash present	nd	0.2%	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	420	<120	0.9
TP5_0.25	0.25	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP5_0.5	0.50	11/11/2015	SE145945	Clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP6_0.2	0.20	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP6_0.4	0.40	11/11/2015	SE145945	Clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP7_0.2	0.20	11/11/2015	SE145945/ASET47362	Fill, sand		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP7_0.4	0.40	11/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP8_0.15	0.15	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP8_0.4	0.40	11/11/2015	SE145945	Clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
INTRA-LABORATORY DUPLICATES																	
BH1_1.4a	1.4a	9/11/2015	SE145945	Silty clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH3_1.5a	1.5a	9/11/2015	SE145945	Clayey sand		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH4_1.5a	1.5a	10/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH11_0.3a	0.3a	11/11/2015	SE145945	Silty clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP7_0.4a	0.4a	11/11/2015	SE145945	Clay		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP8_0.4a	0.4a	11/11/2015	SE145945	Clay with gravel		–	–	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
INTER-LABORATORY DUPLICATES																	
BH1b	1.40	9/11/2015	137301	Silty clay		–	–	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5
BH11b	0.30	9/11/2015	137301	Silty clay		–	–	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5
BH14b	0.50	10/11/2015	137301	Clay with gravel		–	–	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5
STATISTICAL ANALYSIS																	
Min								-	-	-	-	-	-	-	41.0	100.0	-	0.2
Max								-	-	-	-	-	-	-	110.0	420.0	-	3.1
Avg								-	-	-	-	-	-	-	73.2	232.0	-	1.0
Stdev								-	-	-	-	-	-	-	31.6	131.4	-	0.9
Procedure B Calculation								-	-	-	-	-	-	-	-	-	-	-
95% UCL								-	-	-	-	-	-	-	-	-	-	-

* Depth relates to Depth Below Surface Level | – Not Tested | nd = Not Detected Above Laboratory LOR | NL = Not Limiting | Bold = Detected Above Laboratory LOR | N.S. = Exceeds HIL Criteria | * Depth relat

				PAH	Pesticides											Heavy Metals							
Sample ID	Depth (m)	Date	Chemical Report	Total	OC								OP	PCB	As	Cd	Cr VI	Cu	Pb	Hg	Ni	Zn
BH1_0.5	0.50	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	<3	0.5	11	67	5	<0.01	77	58
BH1_1.4	1.43	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	16	0.4	19	20	40	0.02	13	55
BH2_0.5	0.50	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	9	0.4	9.8	25	140	0.02	12	150
BH2_0.7	0.70	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	130	<0.3	5.7	34	51	0.01	3.4	48
BH3_0.4	0.40	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	9	<0.3	12	24	20	<0.01	13	72
BH3_1.5	1.51	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	9	0.4	5.3	32	17	0.12	64	160
BH4_0.3	0.30	10/11/2015	SE145945	13	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	14	0.4	7.1	51	380	0.07	12	87
BH4_1.5	1.51	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	10	0.6	14	19	22	<0.01	2.0	19
BH5_0.3	0.30	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	<3	0.6	15	61	4	<0.01	140	64
BH5_0.5	0.50	9/11/2015	SE145945	8.9	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	11	0.6	7.0	73	340	0.02	36	350
BH5_0.6	0.60	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	10	<0.3	11	10	12	0.01	12	60
BH6_0.5	0.50	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	5	<0.3	8.4	14	28	0.02	11	49
BH6_1.5	1.51	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	5	<0.3	9.0	35	40	0.03	13	65
BH6_2.0	2.02	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	7	<0.3	6.8	29	42	0.03	10	54
BH7_0.5	0.50	9/11/2015	SE145945	5.4	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	9	0.3	9.1	35	240	0.02	8.0	130
BH7_0.7	0.70	9/11/2015	SE145945	3.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	4	<0.3	8.4	30	94	<0.01	4.6	85
BH7_1.5	1.51	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	<3	<0.3	1.7	7.6	12	<0.01	3.7	33
BH7_2.15	2.15	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	200	0.4	5.7	41	20	0.30	65	220
BH8_0.5	0.50	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	8	0.7	10	46	16	0.02	120	230
BH8_1.0	1.01	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	9	0.4	7.8	29	16	0.05	26	88
BH9_0.5	0.50	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	4	<0.3	13	28	17	<0.01	46	120
BH9_1.5	1.51	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	8	1.0	5.1	34	15	0.11	29	97
BH10_0.6	0.60	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	8	<0.3	5.4	38	13	0.02	9.9	82
BH10_1.5	1.51	10/11/2015	SE145945	1.3	–	–	–	–	–	–	–	–	–	–	3	<0.3	4.0	23	12	0.02	24	120
BH11_0.3	0.30	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	10	<0.3	7.6	21	20	<0.01	2.9	44
BH12_0.3	0.30	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	<3	<0.3	5.8	24	13	<0.01	6.0	59
BH12_1.8	1.81	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	<3	<0.3	3.9	19	9	0.07	29	140
BH13_0.5	0.50	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	5	0.4	17	35	15	0.03	51	180
BH14_0.5	0.50	10/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	8	<0.3	13	25	17	0.03	21	66
BH14_0.6	0.60	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	6	0.3	9.7	34	16	0.04	15	85
BH15_0.5	0.50	10/11/2015	SE145945	1.5	–	–	–	–	–	–	–	–	–	–	6	0.5	56	44	64	0.04	73	140
BH16_0.4	0.40	10/11/2015	SE146096/ASET47442	15	–	–	–	–	–	–	–	–	–	–	22	3.8	24	1100	950	0.23	46	550
BH16_2.3	2.30	10/11/2015	SE146096/ASET47442	<0.8	–	–	–	–	–	–	–	–	–	–	5	<0.3	11	16	14	<0.01	1.3	13
BH17_0.3	0.30	10/11/2015	SE146096/ASET47442	2.5	–	–	–	–	–	–	–	–	–	–	5	<0.3	14	32	45	0.05	11	120
BH17_4.0	4.00	10/11/2015	SE146096/ASET47442	<0.8	–	–	–	–	–	–	–	–	–	–	12	<0.3	4.2	12	20	0.02	0.8	13
BH18_0.25	0.25	10/11/2015	SE146161	<0.8	–	–	–	–	–	–	–	–	–	–	<3	0.3	5.8	22	31	<0.01	3.4	120
BH19_0.2	0.20	10/11/2015	SE146161	3.4	–	–	–	–	–	–	–	–	–	–	5	0.3	17	29	130	0.04	16	73
BH20_0.25	0.25	10/11/2015	SE146161	17	–	–	–	–	–	–	–	–	–	–	4	<0.3	6.7	27	150	0.05	24	88
BH21_0.2	0.20	10/11/2015	SE146161	8.8	–	–	–	–	–	–	–	–	–	–	4	<0.3	11	33	130	0.03	23	65
TP1_0.2	0.20	11/11/2015	SE145945/ASET47362	<0.8	–	–	–	–	–	–	–	–	–	–	9	<0.3	7.6	10	66	0.04	4.4	57
TP1_0.5	0.50	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	7	0.5	20	13	15	0.03	10	43
TP2_0.3	0.30	11/11/2015	SE145945/ASET47362	<0.8	–	–	–	–	–	–	–	–	–	–	<3	0.6	16	65	6	<0.01	160	81
TP2_1.1	1.11	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	17	<0.3	9.0	8.7	15	0.02	11	64
TP3_0.4	0.40	11/11/2015	SE145945/ASET47362	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	<3	0.4	13	58	5	<0.01	120	64
TP3-0.7	0.70	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	8	0.3	16	15	14	<0.01	6.6	26
TP4_0.3	0.30	11/11/2015	SE145945/ASET47361	16	–	–	–	–	–	–	–	–	–	–	23	0.9	23	110	750	0.06	25	310
TP4_0.6	0.60	11/11/2015	SE145945/ASET47362	6.0	–	–	–	–	–	–	–	–	–	–	25	2.1	24	98	1400	0.17	20	470
TP5_0.25	0.25	11/11/2015	SE145945/ASET47362	<0.8	–	–	–	–	–	–	–	–	–	–	<3	0.5	110	30	14	0.01	95	79
TP5_0.5	0.50	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	8	<0.3	3.5	20	12	<0.01	1.8	14
TP6_0.2	0.20	11/11/2015	SE145945/ASET47362	<0.8	–	–	–	–	–	–	–	–	–	–	6	<0.3	16	10	3	<0.01	17	16
TP6_0.4	0.40	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	7	<0.3	14	16	20	<0.01	4.8	26
TP7_0.2	0.20	11/11/2015	SE145945/ASET47362	<0.8	–	–	–	–	–	–	–	–	–	–	5	<0.3	31	8.8	3	<0.01	29	22
TP7_0.4	0.40	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	15	0.3	5.6	23	13	<0.01	1.3	49
TP8_0.15	0.15	11/11/2015	SE145945/ASET47362	<0.8	–	–	–	–	–	–	–	–	–	–	<3	0.5	91	30	22	0.01	84	82
TP8_0.4	0.40	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	3	<0.3	5.3	14	14	0.03	7.2	47
INTRA-LABORATORY DUPLICATES																							
BH1_1.4a	1.4a	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	13	<0.3	16	11	12	0.04	2.9	31
BH3_1.5a	1.5a	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	11	0.5	5.2	30	20	0.13	67	180
BH4_1.5a	1.5a	10/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	9	0.6	14	19	21	<0.01	1.8	20
BH11_0.3a	0.3a	9/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	13	<0.3	7.5	17	19	<0.01	2.7	45
TP7_0.4a	0.4a	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	5	<0.3	5.1	19	11	<0.01	0.9	32
TP8_0.4a	0.4a	11/11/2015	SE145945	<0.8	–	–	–	–	–	–	–	–	–	–	5	<0.3	7.8	20	73	0.01	11	94
INTER-LABORATORY DUPLICATES																							
BH1b	1.40	9/11/2015	137301	NIL (+)VE	–	–	–	–	–	–	–	–	–	–	11	<0.4	19	14	12	<0.1	5	36
BH11b	0.30	9/11/2015	137301	NIL (+)VE	–	–	–	–	–	–	–	–	–	–	8	<0.4	9	23	18	<0.1	7	56
BH14b	0.50	10/11/2015	137301	NIL (+)VE	–	–	–	–	–	–	–	–	–	–	8	<0.4	21	24	16	<0.1	27	65
STATISTICAL ANALYSIS																							
Min				1.3	-	-	-	-	-	-	-	-	-	-	3.0	0.3	1.7	7.6	3.0	0.0	0.8	13.0
Max				17.0	-	-	-	-	-	-	-	-	-	-	200.0	3.8	110.0	1100.0	1400.0	0.3	160.0	550.0
Avg				7.8	-	-	-	-	-	-	-	-	-	-	15.9	0.7	15.0	51.1	101.3	0.1	30.5	103.3
Stdev				5.7	-	-	-	-	-	-	-	-	-	-	33.8	0.7	18.9	145.6	246.3	0.1	37.5	104.8
Procedure B Calculation				-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
95% UCL																			246.1				

* Depth relates to Depth Below Surface Level — Not Tested — m bgl Depth Below Surface Level — Not Tested/Not Detected Above Laboratory LOR — NIL = Not Limit/gold = Detected Above Laboratory LOR — RED = Exceeds NEPM Criteria

DLA Environmental Services

Groundwater Monitoring Summary Table

Sample ID	Date	Report	Depth (m)	Heavy Metals (µg/L)								PAH (µg/L)		BTEX (µg/L)				TRH (µg/L)				pH	EC (µS cm-1)
				As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Naph	BaP	Benz	Toluen	EthylBe	Xylene	C_6-C_{10} F1	C_{10}-C_{16} F2	C_{16}-C_{34} F3	C_{34}-C_{40} F4	pH	EC
MW1	18/11/2015	137596	4.15	**1**	nd	nd	**2**	nd	nd	**8**	**11**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	**6.4**	**1200**
MW2	18/11/2015	137596	1.72	nd	nd	nd	nd	nd	nd	**18**	**12**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	**7.1**	**630**
MW3	23/11/2015	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INTRA-LABORATORY DUPLICATES																							
MW2-A	18/11/2015	137596		nd	nd	nd	nd	nd	nd	17	12	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	7.6	680
GROUNDWATER INVESTIGATION LEVELS																							
ANZECC (2000)	Fresh Waters			13	0.2	1	1.4	3.4	0.6	11	--	16	--	950	--	--	200	--	--	--	--	--	--
HSL (NEPM2013)	Commercial/Industrial			--	--	--	--	--	--	--	--	NL	--	30,000	NL	NL	NL	NL	NL	--	--	--	--
REFERENCE LEVELS																							
Fresh - Low Reliability (ANZECC (2000)				13	--	--	--	--	--	--	--	--	0.2	--	--	--	--	--	--	--	--	--	--

Bold= Detected Above Laboratory LOR **RED** = Value Detected Above GILs nd = Not Detected above Laboratory LOR -- Not Tested NL = Not Limiting

APPENDIX B – NATA CERTIFIED ANALYTICAL DATA

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 137301

Client:
DLA Environmental Services Pty Ltd
Unit 3, 38 Leighton Pl
Hornsby
NSW 2077

Attention: Loretta

Sample log in details:

Your Reference:	**DL3724 - Auburn**		
No. of samples:	3 Soils 2 waters		
Date samples received / completed instructions received	12/11/15	/	12/11/15

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

Report Details:

Date results requested by: / Issue Date:	19/11/15	/	18/11/15
Date of Preliminary Report:	Not Issued		

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

ACCREDITED FOR TECHNICAL COMPETENCE

vTRH(C6-C10)/BTEXN in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ---------- 	137301-1 BH1b 1.4 09/11/2015 Soil	137301-2 BH11b 0.3 09/11/2015 Soil	137301-3 BH14b 0.5 10/11/2015 Soil
Date extracted	-	13/11/2015	13/11/2015	13/11/2015
Date analysed	-	13/11/2015	13/11/2015	13/11/2015
TRHC6 - C9	mg/kg	<25	<25	<25
TRHC6 - C10	mg/kg	<25	<25	<25
vTPHC6 - C10 less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	84	87	87

svTRH (C10-C40) in Soil				
Our Reference:	UNITS	137301-1	137301-2	137301-3
Your Reference	----------	BH1b	BH11b	BH14b
Depth	----------	1.4	0.3	0.5
Date Sampled		09/11/2015	09/11/2015	10/11/2015
Type of sample		Soil	Soil	Soil
Date extracted	-	13/11/2015	13/11/2015	13/11/2015
Date analysed	-	14/11/2015	14/11/2015	14/11/2015
TRHC$_{10}$ - C$_{14}$	mg/kg	<50	<50	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	<100	<100	<100
TRHC$_{29}$ - C$_{36}$	mg/kg	<100	<100	<100
TRH>C$_{10}$-C$_{16}$	mg/kg	<50	<50	<50
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH>C$_{16}$-C$_{34}$	mg/kg	<100	<100	<100
TRH>C$_{34}$-C$_{40}$	mg/kg	<100	<100	<100
Surrogate o-Terphenyl	%	78	77	80

PAHs in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ---------- 	137301-1 BH1b 1.4 09/11/2015 Soil	137301-2 BH11b 0.3 09/11/2015 Soil	137301-3 BH14b 0.5 10/11/2015 Soil
Date extracted	-	13/11/2015	13/11/2015	13/11/2015
Date analysed	-	14/11/2015	14/11/2015	14/11/2015
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Total Positive PAHs	mg/kg	NIL(+)VE	NIL(+)VE	NIL(+)VE
Surrogate p-Terphenyl-d14	%	90	101	91

Acid Extractable metals in soil				
Our Reference:	UNITS	137301-1	137301-2	137301-3
Your Reference	----------	BH1b	BH11b	BH14b
Depth	----------	1.4	0.3	0.5
Date Sampled		09/11/2015	09/11/2015	10/11/2015
Type of sample		Soil	Soil	Soil
Date prepared	-	13/11/2015	13/11/2015	13/11/2015
Date analysed	-	13/11/2015	13/11/2015	13/11/2015
Arsenic	mg/kg	11	8	8
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	19	9	21
Copper	mg/kg	14	23	24
Lead	mg/kg	12	18	16
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	5	7	27
Zinc	mg/kg	36	58	65

Moisture				
Our Reference:	UNITS	137301-1	137301-2	137301-3
Your Reference	----------	BH1b	BH11b	BH14b
Depth	----------	1.4	0.3	0.5
Date Sampled		09/11/2015	09/11/2015	10/11/2015
Type of sample		Soil	Soil	Soil
Date prepared	-	13/11/2015	13/11/2015	13/11/2015
Date analysed	-	16/11/2015	16/11/2015	16/11/2015
Moisture	%	21	22	20

BTEX in Water			
Our Reference:	UNITS	137301-4	137301-5
Your Reference	----------	TS	TB
Depth	----------	-	-
Date Sampled		10/11/2015	10/11/2015
Type of sample		Water	Water
Date extracted	-	13/11/2015	13/11/2015
Date analysed	-	13/11/2015	13/11/2015
Benzene	µg/L	92%	<1
Toluene	µg/L	95%	<1
Ethylbenzene	µg/L	95%	<1
m+p-xylene	µg/L	94%	<2
o-xylene	µg/L	95%	<1
Surrogate Dibromofluoromethane	%	103	103
Surrogate toluene-d8	%	101	103
Surrogate 4-BFB	%	103	104

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PAHs" is simply a sum of the positive individual PAHs.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.

Client Reference: DL3724 - Auburn

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			13/11/2015	137301-3	13/11/2015 || 13/11/2015	LCS-9	13/11/2015
Date analysed	-			13/11/2015	137301-3	13/11/2015 || 13/11/2015	LCS-9	13/11/2015
TRHC6 - C9	mg/kg	25	Org-016	<25	137301-3	<25 || <25	LCS-9	107%
TRHC6 - C10	mg/kg	25	Org-016	<25	137301-3	<25 || <25	LCS-9	107%
Benzene	mg/kg	0.2	Org-016	<0.2	137301-3	<0.2 || <0.2	LCS-9	88%
Toluene	mg/kg	0.5	Org-016	<0.5	137301-3	<0.5 || <0.5	LCS-9	86%
Ethylbenzene	mg/kg	1	Org-016	<1	137301-3	<1 || <1	LCS-9	113%
m+p-xylene	mg/kg	2	Org-016	<2	137301-3	<2 || <2	LCS-9	125%
o-Xylene	mg/kg	1	Org-016	<1	137301-3	<1 || <1	LCS-9	118%
naphthalene	mg/kg	1	Org-014	<1	137301-3	<1 || <1	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	87	137301-3	87 || 88 || RPD: 1	LCS-9	75%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			13/11/2015	137301-3	13/11/2015 || 13/11/2015	LCS-9	13/11/2015
Date analysed	-			14/11/2015	137301-3	14/11/2015 || 14/11/2015	LCS-9	14/11/2015
TRHC10 - C14	mg/kg	50	Org-003	<50	137301-3	<50 || <50	LCS-9	122%
TRHC15 - C28	mg/kg	100	Org-003	<100	137301-3	<100 || <100	LCS-9	105%
TRHC29 - C36	mg/kg	100	Org-003	<100	137301-3	<100 || <100	LCS-9	120%
TRH>C10-C16	mg/kg	50	Org-003	<50	137301-3	<50 || <50	LCS-9	122%
TRH>C16-C34	mg/kg	100	Org-003	<100	137301-3	<100 || <100	LCS-9	105%
TRH>C34-C40	mg/kg	100	Org-003	<100	137301-3	<100 || <100	LCS-9	120%
Surrogate o-Terphenyl	%		Org-003	78	137301-3	80 || 82 || RPD: 2	LCS-9	97%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			13/11/2015	137301-3	13/11/2015 || 13/11/2015	LCS-9	13/11/2015
Date analysed	-			14/11/2015	137301-3	14/11/2015 || 14/11/2015	LCS-9	14/11/2015
Naphthalene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	LCS-9	112%
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	LCS-9	119%
Phenanthrene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	LCS-9	98%
Anthracene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	LCS-9	101%
Pyrene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	LCS-9	107%
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	LCS-9	120%
Benzo(b,j+k) fluoranthene	mg/kg	0.2	Org-012	<0.2	137301-3	<0.2 || <0.2	[NR]	[NR]

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	137301-3	<0.05 || <0.05	LCS-9	108%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	137301-3	<0.1 || <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	95	137301-3	91 || 93 || RPD: 2	LCS-9	121%
QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			13/11/2015	137301-3	13/11/2015 || 13/11/2015	LCS-3	13/11/2015
Date analysed	-			13/11/2015	137301-3	13/11/2015 || 13/11/2015	LCS-3	13/11/2015
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	137301-3	8 || 7 || RPD: 13	LCS-3	108%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	137301-3	<0.4 || <0.4	LCS-3	105%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	137301-3	21 || 20 || RPD: 5	LCS-3	108%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	137301-3	24 || 19 || RPD: 23	LCS-3	107%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	137301-3	16 || 15 || RPD: 6	LCS-3	101%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	137301-3	<0.1 || <0.1	LCS-3	89%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	137301-3	27 || 23 || RPD: 16	LCS-3	102%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	137301-3	65 || 55 || RPD: 17	LCS-3	115%

Client Reference: DL3724 - Auburn

QUALITY CONTROL BTEX in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			13/11/2015	[NT]	[NT]	LCS-W1	13/11/2015
Date analysed	-			13/11/2015	[NT]	[NT]	LCS-W1	13/11/2015
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	96%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	99%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	101%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	101%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	101%
Surrogate Dibromofluoromethane	%		Org-016	105	[NT]	[NT]	LCS-W1	102%
Surrogate toluene-d8	%		Org-016	101	[NT]	[NT]	LCS-W1	100%
Surrogate 4-BFB	%		Org-016	104	[NT]	[NT]	LCS-W1	103%

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

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

Quality Control Definitions

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

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

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

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

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

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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