Aargus

Environmental - Remediation - Engineering - Laboratories - Drilling

REMEDIATION ACTION PLAN

225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW

Prepared for:

Medica Properties Pty Ltd

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ABBREVIATIONS

AIP	Australian Institute of Petroleum Ltd
ANZECC	Australian and New Zealand Environment and Conservation Council
AST	Aboveground Storage Tank
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethyl benzene and Xylene
COC	Chain of Custody
DQOs	Data Quality Objectives
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESL	Ecological Screening Level
HIL	Health-Based Soil Investigation Level
HSL	Health Screening Level
LGA	Local Government Area
NEHF	National Environmental Health Forum
NEPC	National Environmental Protection Council
NHMRC	National Health and Medical Research Council
OCP	Organochlorine Pesticides
OPP	Organophosphate Pesticides
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PID	Photo Ionisation Detector
PQL	Practical Quantitation Limit
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance / Quality Control
RAC	Remediation Acceptance Criteria
RAP	Remediation Action Plan
RPD	Relative Percentage Difference
SAC	Site Assessment Criteria
SMP	Site Management Plan
SVC	Site Validation Criteria
TCLP	Toxicity Characteristics Leaching Procedure
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
VHC	Volatile Halogenated Compounds

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EXECUTIVE SUMMARY

Aargus Pty Ltd (Aargus) was appointed by Medica Properties Pty Ltd (the "client") to prepare a Remediation Action Plan (RAP) for the property located at 225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW (the "site"). It is understood that the proposed redevelopment for the site includes five medium density residential buildings with basement car parking, fourteen townhouses, roads and communal open spaces.

A number of previous assessments have been carried out within the site. Aargus is utilising the Environmental Investigation Services *"Stage 2 Environmental Site Assessment, 225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW"* (Report no: E28203Krpt, dated 25th April 2015) as a basis for further works.

The removal of fill material to a licensed landfill (off-site disposal) is the preferred remediation strategy.

Assuming appropriate permits have been granted, the remediation of the site is to take place in the following stages:

- Prepare the site with fences, erosion controls, signage and environmental controls.
- Demolish site structures and concrete slabs to make way for remedial works and under slab observations.
- Undertake validation sampling beneath two the residential dwellings, former service station building, the waste oil drum area and the oil water separator area once the features have been demolished, as stated in Section 17.
- An accredited Occupational Hygienist is to prepare an Asbestos Removal Control Plan (ARCP) which will outline the requirements for the handling, monitoring and contractor disposal requirements for the Fibre Cement Fragments (FCF) noted on the sealed surfaces at FC1 to FC4 and the Special Waste soils in the vicinity of Hotspots BH102 & BH128.

- In the vicinity of BH102, where hydrocarbons (TRH) were detected, excavate a 5m x 5m hotspot area to an initial depth of 0.2m, stockpile and re-classify the soils for off-site disposal. The approximate volume to be disposed of is $5m^3$ or 9T.
- Validate the Hotspot BH102 area by recovering 1 floor and 4 wall samples.
- In the vicinity of BH104, where asbestos was detected, excavate a 10m x 10m hotspot area to an initial depth of 0.2m, and dispose of at an EPA licensed landfill that can accept *Special General Solid Waste (Asbestos)* that can accept this type of waste. The approximate volume to be disposed of is $20m^3$ or 36T.
- Validate the Hotspot BH104 area by recovering 1 floor and 4 wall samples.
- In the vicinity of BH105, where hydrocarbons (TRH) were detected, excavate a 20m x 10m hotspot area to an initial depth of 0.2m, stockpile and re-classify the soils for off-site disposal. The approximate volume to be disposed of is $40m^3$ or 72T.
- Validate the Hotspot BH105 area by recovering 3 floor and 6 wall samples.
- In the vicinity of BH128, where asbestos was detected, excavate a 10m x 10m hotspot area to an initial depth of 0.2m, and dispose of at an EPA licensed landfill that can accept *Special General Solid Waste (Asbestos)* that can accept this type of waste. The approximate volume to be disposed of is $20m^3$ or 36T.
- Validate the Hotspot BH128 area by recovering 1 floor and 4 wall samples.
- In the vicinity of Hotspot Wall-12, where hydrocarbons (TRH & BTEX) were detected, excavate a 5m x 5m hotspot area to an initial depth of 0.5m, stockpile and re-classify the soils for off-site disposal. The approximate volume to be disposed of is $12.5m^3$ or 22.5T.
- Validate the Hotspot Wall-12 area by recovering 1 floor and 4 wall samples.
- All other fill materials / bedding sands to be excavated will be temporarily stockpiled to ensure appropriate sampling of the soil requiring off-site disposal. The stockpiles will be classified according to the NSW EPA "*Waste Classification Guidelines, Part 1: Classifying Waste"* and disposed of to a licensed landfill/facility. If the material has been classified prior to excavation (in-situ), it could be immediately loaded on trucks and removed off-site to the most appropriate licensed facility.
- Samples will be recovered from 12 locations within the proposed communal open space area to determine the suitability of the soils in this area to remain onsite under

the SAC. One uncontaminated deeper natural soil sample will be recovered from this area to determine the site derived EILs.

- Appropriate QA/QC samples.
- Remediation will occur by managing soil for offsite disposal to landfill for contaminated soils and for soil to an offsite soil recycling facility for reuse in the case of clean soil.

It is considered that the site will be suitable for the redevelopment into five medium density residential buildings with basement car parking, fourteen townhouses, roads and communal open spaces subject to the implementation of remediation and validation works in accordance with this RAP.

1 INTRODUCTION

1.1 Background

Aargus Pty Ltd (Aargus) was appointed by Medica Properties Pty Ltd (the "client") to prepare a Remediation Action Plan (RAP) for the property located at 225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW (the "site"). The location of the property is presented in Figure 1 of Appendix A.

It is understood that the proposed redevelopment for the site comprises five medium density residential buildings with basement car parking, fourteen townhouses, roads and communal open spaces. The proposed redevelopment plans can be found in Appendix B.

Based on the findings of the "*Stage 2 Environmental Site Assessment, 225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW"* prepared by Environmental Investigation Services (Report no: E28203Krpt, dated 25th April 2015), a number of data gaps and a number of hotspots of contaminated fill material were identified. It was recommended that these concerns be addressed through additional soil investigations and preparation of a RAP to manage the impacted fill.

This RAP has been prepared to support the Development Application (DA) for this site with reference to the following (but not limited to) guidelines:

- NSW EPA (2011) "*Guidelines for Consultants Reporting on Contaminated Sites*";
- NSW EPA (2006, 2nd Edition) "*Guidelines for the NSW Site Auditor Scheme*".

1.2 RAP Objectives and Roles

The primary objective of the RAP is to provide a detailed list of objectives, planned activities and procedures to ensure the effective and controlled remediation and validation of the site to manage the contamination identified in previous investigations.

However, should the additional soil investigations indicate other areas of concern and the requirement for additional remediation, an addendum or revision to this RAP is required to address these concerns.

It is the responsibility of the remediation contractor to implement all the remediation requirements prescribed in the RAP. The site manager/foreman of the remediation contractor should have a thorough understanding of the contents of the RAP and should ensure that each employee or sub-contractor is familiar with the requirements of the RAP. All works undertaken during the remediation program must be monitored by a suitably qualified person experienced in the assessment and remediation of contaminated sites.

Validation works and additional investigations or field monitoring shall be carried out by a suitably qualified and experienced environmental consultant either engaged directly by the Client or by the remediation contractor.

1.3 Scope

The scope of the RAP comprises the following:

- Provide a summary of site conditions and the surrounding environment;
- Summarise the findings of the previous investigations and the current contamination status of the site;
- Provide an outline of the additional investigations to be carried out in order to address the data gaps identified in the previous investigation;
- Set remediation goals, strategies and methods to ensure that the remediated site will be suitable for the proposed development and will pose no unacceptable risk to human health or the environment;
- Establish appropriate site validation criteria and a validation works programme to ensure that the remediation works carried out meet the remediation goals of the project; and
- Establish a Site Management Plan (SMP), Environmental Management Plan (EMP) and Work Health & Safety Plan (WHSP) to be implemented during remediation and validation works to ensure that statutory requirements for the environment and work health safety are complied with.

2 SUMMARY OF SITE CONDITIONS

2.1 Site Identification and Zoning

Site identification information is summarised in the table below.

Table 1: Site Identification

Street Address **(Lot and DP Number)**	225-227 Hume Highway (Lot 100 in DP718210) 229-233 Hume Highway (Lot 345 in DP713612) 235-239 Hume Highway (Lot 2 in DP12521) 241 Hume Highway (Lot 1 in DP217766) 241a Hume Highway (Lot 1 in DP103526 & Lot 2 in DP12521) 112 Northcote Road (Lot 1 in DP310593) 24 Hillcrest Avenue (Lot 21 in DP12521)
Coordinates (NW corner)*	Latitude: -33.899421, Longitude: 151.047284
Approx. Site Area	18,756m^2
Local Government Area	Bankstown City Council
Current Land Zoning	225-241a Hume Highway - B6 Enterprise Corridor 112 Northcote Road – B6 Enterprise Corridor 24 Hillcrest Avenue – R2 Low Density Residential
Proposed Land Use	Commercial/residential
Current Site Owner	Medica Properties Pty Ltd
Site End Users	Residents (adults & children), workers

Notes: * refer to http://maps.six.nsw.gov.au/

The site boundary and Lot and DP numbers are presented in Figures 2 & 3 of Appendix A. A survey plan provided by the client is included in Appendix B.

2.2 Site Description

A walkover inspection of the site was undertaken by EIS on 16 March 2015. The inspection was limited to accessible areas of the site and immediate surrounds.

At the time of the inspection the majority of the site was occupied by various commercial businesses as summarised below:

- The north-west section of the site was occupied by a boat sales businesses and associated boating and fishing store building adjacent and to the east. A vacant building was located further to the north;
- The south-west section of the site was occupied by a pot sales business;
- A large warehouse occupied the central section of the site. The warehouse was constructed of brick and corrugated metal. The ware house was occupied by various business including tile sales/ dispatch. The east section of the warehouse was not accessible at this time of the investigation. Buses were evident to the south of this section of the warehouse and it appeared that this section of the site was occupied by a transport company; and
- Various construction materials (tiles, scaffolding etc) trucks, machinery, machinery parts, boats, shipping containers, were stored in the central, south and east sections of the site.
- Some staining was evident on the surface of the site.
- A single level residential premise (112 Northcote Road) constructed of timber, brick and fibre cement sheeting was located in the north-east section of the site.
- A single level residential premise (24 Hillcrest Avenue) constructed of brick and fibre cement sheeting was located in the east section of the site.
- Fibre cement fragments (FCF) were noted at the surface of the site. The fragment locations are shown in Figure 4.

2.3 Topography

The site is located within a gently undulating topographic setting and on the side of a hill slope which generally falls to the south at approximately 2-4°. The topography of the site overall slopes to the south at 2-4°. Sections of the site have been levelled to accommodate the existing structures. Filling was evident at the site, particularly in the south, south east and east sections of the site.

2.4 Surrounding Land Uses

The surrounding land uses identified are described in the table below:

Table 2: Surrounding Land Uses

Orientation	Description
North	Northcote Road, then motel and residential
South	Residential
East	Hillcrest Avenue & Residential
West	Hume Highway, then commercial

In summary, the properties surrounding the vicinity of the site comprised of a mixture of commercial and residential properties.

3 LOCAL GEOLOGY AND HYDROGEOLOGY

3.1 Geology

A review of the regional geological map of Sydney (19858) indicates that the site is underlain by Bringelly Shale of the Wianamatta Group, which typically consists of shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff.

3.2 Acid Sulphate Soils

A review of the NSW Department of Land & Water Conservation (DLWC) *Acid Sulphate Soil Risk Maps* (Edition Two, December 1997, Scale 1:250,000), indicated that site is not located in an ASS risk area.

3.3 Hydrogeology

3.3.1 Desktop

A review of groundwater bore records available on the NSW Office of Water (NOW) online database was undertaken. The search was limited to registered bores located within a radius of approximately 0.5km of the site. The search did not identify any registered bores within the search area.

A review of the regional geology and groundwater bore information indicates that the subsurface condition at the site is expected to consist of residual soils overlying relatively shallow bedrock. The occurrence of groundwater that could be utilised as a resource for beneficial use is considered to be relatively low under such conditions. A perched aquifer in the subsurface may be present.

3.3.2 Groundwater Observations during Drilling

Groundwater seepage was encountered in borehole BH104 at a depth of approximately 2.1m during drilling. Groundwater standing water level (SWL) was measured in borehole BH116 at depth of approximately 1.0m a short time after completion of drilling. All of the remaining boreholes were dry during drilling and on completion of drilling.

3.3.3 Groundwater Observations during Monitoring

Groundwater monitoring wells (MW) were installed in boreholes BH102, BH108, BH121 and BH123. SWL measured in the monitoring wells installed at the site ranged from 2.63m BGL to 6.68m BGL.

Groundwater RLs calculated on these measurements ranged from approximately RL 48.43 to RL 52.07. The groundwater RLs indicate that excavation for the proposed second level of basement (RL 49.50) may intercept groundwater.

Based on the groundwater levels and site topography groundwater flow is generally anticipated to flow from the north-west section of the site to the south-east section of the site.

Free phase LNAPLs were not detected using the interphase probe during groundwater sampling.

3.3.4 Groundwater Monitoring Results

The following measurements and observations were made during previous groundwater monitoring events (GMEs):

- pH ranged from 6.63 to 7.27
- EC ranged from 4,295µS/cm to 16,648µS/cm
- Eh ranged from 134.9mV to 186.8mV
- DO ranged from 1.7ppm to 7.2ppm

3.4 Sensitive Water Receptors

Surface water bodies were not identified in the immediate vicinity of the site. The closest surface water body is Salt Pan Creek located approximately 4km to the south-east of the site. Due to the distance to Salt Pan Creek it is not considered to be a potential receptor.

4 SUMMARY OF SITE HISTORY

4.1 Land Titles Review

The title records indicate the following:

- The north-west corner section of the site (Lot 100 DP718210) was occupied by various service station companies (7-Eleven Stores Pty Ltd, Pacific-Seven Pty Limited and The Shell Company of Australia) between 1953 and 1994. This section of the site was also owned by various individuals between 1949 and 1951 with the owners occupation was listed as garage proprietors;
- The north-west and west section of the site (Lot 100 DP718210 & Lot 345 DP713612) is currently owned by Bernies Auto Sales (Distribution) Pty Limited. This company also owned various other section of the site from time to time. The site was also owned by Alexander Smith between 1952 and 1957 with the owners occupation listed as a motor trader;
- The west section of the site (Lot 345 DP713612) was owned by a motor mechanic between 1946 and 1952;
- The south-west (Lot 1 & 2 DP12521), south (Lot 1 DP217766), central and east (Lot 1 DP103526) sections of the site were either owned by S.A.W. Pty Limited (presumed to be an abbreviation for Smiths Auto Wreckers Pty Limited) or has previously been owned by Smiths Auto Wreckers Pty Limited since ; and
- The south-west (Lot 1 & 2 DP12521), south (Lot 1 DP217766), central and east (Lot 1 DP103526) sections of the site were owned by owned by various individuals between 1927 and 1952 with the owners occupation listed as a dairyman.

4.2 Aerial Photography Review

A summary of the relevant information is presented below:

1930

The site was occupied by a small building located in the north-east corner of the site (the building appears to be similar to the existing residential building known as 112 Northcote Road). The remainder of the site appeared vacant.

The immediate surrounds generally appeared to be occupied for residential land use. Evidence of commercial/industrial landuse was evident to the north-west of the site beyond the Hume Highway although the particulars of site activities were unclear from the aerial photograph.

1943

The site and immediate surrounding area generally appeared similar to the 1930 photograph.

1951

A rectangular shaped building was located in the north-west corner section of the site (cnr of Hume Highway and Northcote Road). What appeared to be cars were parked in this section of the site. The building appeared to be consistent with a car workshop and service station. A number of buildings which appeared to be occupied for residential purposes were located in the west section of the site and a building was located in the central section of the site. A number of smaller buildings (possible sheds) were detached from the larger buildings. What appeared to be a residential building was located in the east section of the site (No 24 Hillcrest Avenue).

The immediate surrounds generally appeared similar to the 1943 aerial photograph. However, the residential landuse of the surrounding areas appeared to have increased. A large area of what appeared to be tents were set out on a regular grid to the west and north-west of the site beyond the Hume Highway. EIS understand that the temporary accommodation was provided for migrants working on the Sydney railway system.

1970

The building located in the north-west corner section of the site appeared to have been demolished. A new building appeared to have been constructed slightly to the south of the former building. This section of the site appeared to have been covered by hardstand. This building also appeared to be occupied as a car workshop and service station. A number of parked cars were located to the south of the service station. This section of the site appeared to be occupied as a car sales yard. One of the residential buildings and a number of the site sheds formerly located in the west section of the site appeared to have been demolished. The central section of the site appeared to be occupied by cars, spare parts and general equipment/machinery.

The immediate surrounds generally appeared similar to the 1951 aerial photograph. However, the residential landuse of the surrounding areas to the north, east and south of the site appeared to have increased. The temporary accommodation to the west of the site appeared to have been demolished. The commercial/industrial landuse to the west of the site (beyond Hume Highway) appeared to have increased.

1978

The site and immediate surrounding area generally appeared similar to the 1970 photograph.

1986

Buildings appeared to have been demolished in the north-west, west and central section of the site. What appeared to be a service station canopy area was located in the north-west corner section of the site. A large warehouse building (constructed in two distinct segments) was located in the central section of the site. The west segment of the warehouse may have been constructed as a saw tooth roofed structure. Cars, trucks and other material were stored in the south and east sections of the site.

The immediate surrounding area generally appeared similar to the 1978 photograph.

1994

A building in the west section of the site appeared to have been demolished. The west section of the warehouse in the central section of the site appeared to have been demolished and reconstructed in the same location. The warehouse also appeared to have been extended to the east.

The immediate surrounding area generally appeared similar to the 1986 photograph.

2005

The site and immediate surrounding area generally appeared similar to the 1994 photograph. However, what appear to be large pots were stored in the west section of the site.

2014

The site and immediate surrounding area generally appeared similar to the 2005 photograph. However, what appeared to be cars and boats associated with a sale yard were located in the north-west section of the site. The service station canopy in this section of the site appeared to have been demolished. Boats, storage containers, machinery and other vehicles were stored in the south and east sections of the site.

4.3 NSW EPA Records

4.3.1 CLM Act 1997

A search of the EPA database revealed that the site is not listed.

4.3.2 POEO Register

A search of the POEO Register revealed no licenses, applications, notices, penalty policies, prosecutions and civil proceedings relating to the site. No discharges to land, water or air were recorded.

4.4 WorkCover NSW Records

A search of the Stored Chemical Information Database (SCID) for licences to keep dangerous goods at the site was conducted by the Work Cover NSW and indicated the following for 225 Hume Highway, Greenacre NSW.

35/025203 (dated 25 September 2003)

Amendment application prepared by E & C Doro Pty Ltd for the storage of Liquid Petroleum Gas (LPG) cylinders at the north-west corner of the service station office/shop.

35/025203 (dated 5 February 1997)

Application from Euphoric Pty Ltd for renewal for the storage of 2 x 35,000L petrol USTs and 1 x 35,000L diesel UST. The supplied plans indicate that the 3 USTs were located generally in line with the service station office/shop and the bowsers and canopy are located to the west of the bowsers (adjacent to the Hume Highway).

35/025203 (dated 27 March 1986)

Application from Nemer Antoun (7-Eleven) for storage of 3 x 33,000L USTs. The supplied plans indicate that the 3 USTs were located in the west section of No 225 Hume Highway, Greenacre. The plans also indicated that at least 4 former USTs were to be water filled.

Unknown (dated between 1976 and 1984)

Application and renewals from various individuals/companies (Shell Greenacre Service centre and Conroy Investments Pty Ltd) for the storage of 5 USTs (2 x 58,200L, 1 x 55,600L, 1 x 14,300L and 1 x 10,000L). The supplied plan indicated that the 5 USTs were located in the east section of the site identified as 225 Hume Highway, Greenacre. EIS note that this area is likely to be located beneath the existing building in this section of the site.

4.5 Section 149 Certificates

The Planning Certificate – Section 149 (2) of the Environmental Planning & Assessment Act 1979 for the site was obtained by the client and provided to Aargus for review. A summary of the information pertaining to the site is provided below:

- a) The site is located in an area of ecological significance (eg. Biodiversity Certified land, conservation area etc.).
- b) The Section 149 (2 and 5) planning certificate does not indicate that the site is deemed to be:
    - significantly contaminated;
    - subject to a management order;
    - subject of an approved voluntary management proposal; or
    - subject to an on-going management order under the provisions of the CLM Act 1997;
    - subject to a Site Audit Statement (SAS);
- c) Lot 1 DP103526 is identified as a flood control lot and considered a medium risk to flooding under the Bankstown Development Control Plan, Part B12 – Flood Management Risk and Part 6.4 – Flood Planning of the LEP 2015.

The Section 149 (2) planning certificates indicate that the land is affected by a resolution of Council adopting a policy concerning the management of contaminated land. That policy applies to all land in the City of Bankstown and will restrict development of the land if circumstances set out in the policy prevail.

4.6 Council Search Records

The Bankstown council database was accessed in order to disclose file records relating to the site. The search of the records revealed the following:

- BA156/68 - Council approval granted to Bernies Auto Sales for the construction of an office building.
- DA231/84 - Council approval granted to Bernies Auto Sales for the construction of spare parts warehouse and sales building.
- DA426/85 Council approval granted to Bernies Auto Sales for the importation of fill onto the site identified 231 Hume Highway property for the purposes of levelling. A diagram showed that the filling was proposed in the south-east corner section of the site.
- DA154/85 Council approval granted for rebuilding of the existing service station at 225 Hume Highway Greenacre.
- DA128/86 - Council approval granted for the construction of an additional storage and warehouse ancillary to the sale of motor parts.
- DA114/90 - Council approval granted for the construction of a car park and interior alterations associated with the sale of motor spare parts.
- DA66/92 Council approval granted for the storage of motor parts over the majority if the south, central and south-east section of the site.
- BA1895/96 - Council approval granted for the modification of the driveways, increase parking and open the existing motor parts and tyre sales shown room.
- Council order no 9730, dated 2001 - Letter to Smith Auto Wreckers P/L requesting that they remove all excess fill from the site (234 Hume Highway).
- DA75/03 Council approval granted for the addition of the workshop and convenience store to a service station shop front.
- DA1041/2005 Council approval granted for use of part of the site for sale of furniture.
- DA981/2011/1 Council approval granted for the consolidation of allotments, boundary adjustments, demolition of structures and drainage realignment.

4.7 Industrial Processes and Products Manufactured

A review of the industrial processes and/or products manufactured at the site was conducted, and a summary of the information pertaining to the site is provided below:

- 1927 to 1952 - Dairy farm: The 1930 and 1943 aerial photograph indicated that the site was predominantly grassed. The land title records indicated that the site was owned by a dairy man between 1927 and 1952.
- 1949 to 1994 - Petrol station: The aerial photographs, land title records and WorkCover records indicated that the north-west section of the site was formerly occupied as a service station and a mechanics workshop. Anecdotal evidence suggested that at least eleven USTs were removed from this section of the site in 2006.
- 2002 to present - Car wreckers: The aerial photographs and land title records indicated that the south, central and south-east section of the site was occupied by a car wreckers. The site inspection did not suggest that this section of the site was currently operating as a car wreckers. However, equipment and machinery was stored in this section of the site and may have been stored as spare parts.
- 1952 to present - Car sales/servicing: The aerial photographs and land titles records indicated the site was formerly occupied by car sales (presumed with associated car servicing).

4.8 Anecdotal Evidence

EIS held discussions with the current site owner, who indicated that at least eleven USTs were removed in 2006 from the former service station location in the north-west section of the site (No 225 Hume Highway, Greenacre). EIS understand that a Validation report was prepared documenting the successful removal of the USTs. However, a copy of the validation was not available to EIS at the time of reporting.

5 SUMMARY OF PREVIOUS ENVIRONMENTAL REPORTS

5.1 General

The following previous site investigations were undertaken for the site and are summarised in the following sub-sections:

- Environmental Investigation Services (2002) - "*Environmental Site Screening, 213-241A Hume Highway, Greenacre NSW*" (Report Ref: E16518FRPTK, dated 22 January 2002).
- Environmental Investigation Services (2015) - "*Stage 2 Environmental Site Assessment, 225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW*" (Report no: E28203Krpt, dated 25th April 2015).
- Environmental Investigations (2006) - "*Site Contamination Assessment and Tank Pit Validation, at 225 Hume Highway, Greenacre*" (Report no: E561.1 AAKrpt, dated 3 May 2006).

5.2 EIS - Environmental Site Screening (2002)

Introduction, purpose and scope of works

Vandermade and Associates Architects on behalf of SMS Diesel Spares Pty Ltd, commissioned EIS to undertake a limited environmental site screening to assess the likelihood of contamination of the subsurface soils and groundwater for a proposed commercial/industrial development at 231-241A Hume Highway, Greenacre (referred to as the site within this summary). The site investigation was specifically limited by SMS Diesel Spares Pty Ltd to the wreckers yard at the rear of the site. The vehicle display area, the workshop and warehouse at the west and north-west of the site were excluded from the investigation.

The scope of work undertaken to achieve the objective included:

1. Site history assessment, including review of aerial photographs, land title search, deposited plan and development applications/building approvals held by Council;
2. Review of regional geology and groundwater conditions;
3. Review of major underground services at the site and the location of groundwater bores in the vicinity.
4. Review of WorkCover records in relation to the presence of underground fuel storage tanks (USTs); and
5. Site inspection and subsequent field sampling program.

Summary of Site History

The search of historical information has indicated the following:

- The review of the historical aerial photographs and historical land titles records suggested that a number of former buildings appeared to have been demolished at the site, the site was used for vehicle storage, sales, and a wrecker's yard. A vehicle repair/ service station was located to the north-west of the site;
- Bankstown Council previously issued Smiths Auto Wrecker Pty Ltd with Council Orders to removal all excess fill from the Lot 1 in DP103526, No 241A Hume Highway section of the site.
- This order was issued as the use of the land as described in the Determination Notice was not in accordance with the conditions of the Development Consent contained in Determination Notice 9730 dated 31 March, 1995; and
- The results of the NSW WorkCover dangerous good search were not available at the time of the issue of the report.

Investigation Procedure

Fieldwork for the investigation was undertaken on 9 January, 2002 and included the drilling and sampling of ten boreholes at a grid spacing of approximately 27m to 40m between investigation locations. This density of sampling was approximately 50% of the NSW EPA Sampling Design Guidelines 1995.

The assessment included composite sampling techniques in order to provide economical screening for non-volatile contaminants. Soil samples were analysed for the following contaminants of Concern (COC): Heavy metals; OC pesticides; PCBs; Cyanide; PAHs; TPH; BTEX and Phenols.

Results/Conclusion

The results of the laboratory analysis on selected soil samples covered a range of contaminants commonly encountered in the Sydney region. Elevated levels of contaminants were not detected in the samples analysed. All results were less than Ecological investigation Levels and the appropriate Health Investigation Levels.

Groundwater was not encountered in the boreholes drilled for this project (to a maximum depth of 4.5m). Groundwater was not considered to be a significant resource in the area and on this basis was not considered in any further detail for this screening.

Based on the scope of work undertaken for the screening, the site was considered to be suitable for the proposed development.

EIS note that an Addendum letter to the EIS 2002 report was issued (EIS Ref: E16518Klet, dated 5 January 2015) indicating that that NSW WorkCover held no records regarding the storage of dangerous good for the site.

5.3 EIS - Stage 2 Environmental Site Assessment (2015)

The scope of work included the following:

- Review of site information including background and site history information;
- A site inspection to identify Areas of Environmental Concern (AEC);
- Preparation of a Preliminary Conceptual Site Model (PCSM);
- Design and implementation of a sampling, analysis and quality plan (SAQP);

- Interpretation of the analytical results against the adopted Site Assessment Criteria (SAC);
- Data Quality Assessment;
- Undertake a Tier 1 Risk Assessment and review of CSM; and
- Preparation of a report presenting the results of the assessment.

The north-west section of the site was formerly occupied as a service station and a number of petroleum Underground Storage Tanks (USTs) were located in this section of the site. Anecdotal evidence suggests that numerous USTs were removed from this section of the site. We understand that a Validation report was prepared. However, a copy of the validation report was not available to EIS.

Samples for the investigation were obtained from twenty nine sampling points. This density meets the minimum sampling density recommended by the EPA. Four groundwater monitoring wells were installed for groundwater sampling purposes.

Soil Results:
The following soil elevations were encountered:

- An elevated concentrations of 3.7mg/kg of benzo(a)pyrene TEQ was identified in the fill soil sample BH101 (0-0.1m) above the HIL-A criteria of 3mg/kg;
- An elevated concentrations of 400mg/kg of lead was identified in the fill soil sample BH127 (0-0.2m) above the HIL-A criteria of 300mg/kg; and
- An elevated concentrations of 1.5mg/kg of total PCBs was identified in the fill soil sample BH108 (2.0-2.2m) above the HIL-A criteria of 1mg/kg.

However, the 95% UCL results of the fill soil benzo(a)pyrene TEQ, lead and total PCBs results were below the SAC and therefore the risk to the identified human receptors is very low.

Asbestos was encountered in fill soil samples BH104 (0-0.1m) and BH128 (0-0.2m). The asbestos fibres were detected in loose fibre bundles. The asbestos detected at these sampling locations is considered friable for the purposes of this assessment.

Asbestos was also detected in the Fibre Cement Fragments (FCF) samples FC1, FC2, FC3 and FC4 which were sampled from various locations across the surface of the site as shown in Figure 3. The FCF are considered non friable (bonded) for the purpose of this assessment.

Elevated concentrations of TRH >C16 – C34 (F3) were encountered above the Management Limit (Residential, parkland and public open space) criteria in the fill soil samples BH102 (0-0.1m) and BH105 (0-0.15m).

Groundwater Results:

Elevated concentrations of heavy metals (cadmium, chromium, copper, nickel and zinc) were detected in the groundwater samples. The groundwater concentrations were considered typical of urban/regional groundwater conditions and are most likely associated leaking water infrastructure. Elevated concentrations of heavy metals are commonly encountered in shale aquifers. Furthermore, no significant point sources of chromium, copper, nickel or zinc were identified in the fill soil.

Recommendations/Conclusion:

The assessment identified a number of data gaps (see Section 10.5). However, EIS consider that the site can be made suitable for the proposed development provided that the following recommendations are implemented to address the data gaps and to minimise/ manage the risks:

1. Undertake an additional ESA to address the data gaps identified in Section 10.5. A copy of the Validation report for the removal of the USTs from the former service station section of the site should be obtained prior to undertaking the additional ESA;
2. Prepare an Asbestos Management Plan (AMP) to manage asbestos during excavation works;

3. Prepare a Remediation Action Plan (RAP) to outline remedial measures for the site;
4. Prepare a Validation Assessment (VA) report on completion of remediation; and
5. Undertake a Hazardous Materials Assessment (Hazmat) for the existing buildings prior to the commencement of demolition work.

In the event unexpected conditions are encountered during development work or between sampling locations that may pose a contamination risk, all works should stop and an environmental consultant should be engaged to inspect the site and address the issue. The conclusions and recommendations should be read in conjunction with the limitations presented in the body of the report.

5.4 EI – Tank Pit Validation (2006)

The scope of work included the following:

- Provide guidance for excavation and removal of USTs;
- Provide guidance for the excavation and removal of contaminated tank pit soils; and
- Confirm the removal of contaminated soils by carrying out validation sampling and laboratory testing.

A summary of the works is provided below:

- A total of 26 wall samples, 8 base samples and 6 samples from 3 test pits were recovered plus QA/QC samples.
- Laboratory analysis included lead, TPH & BTEX.
- The first round of validation sampling found exceedances in samples Wall-1, Wall-6, Wall-11, Wall-12 and Wall-13.

- Additional excavation occurred, apart from in the vicinity of Wall-12 due to restriction of the existing building, with the further validation samples being all below the SAC
- Following the validation sampling and off-site disposal of soil, VENM was imported to backfill the excavation area.

The report concluded that:

- The UST pits were successfully validated.
- Based on the results of the test pits towards the north eastern unexcavated portion of the site that the contamination plume did not extend to these areas of the site.
- Excavations were terminated approximately 0.8m from the existing building footprint with the final surface sampling (Wall-12 sample) showing the contamination plume may extend below the building footprint.
- It was therefore considered that the site presents a low risk to human health, the environmental or the aesthetic enjoyment of the land, and is suitable for the continued commercial or industrial use.

6 AARGUS RESPONSE TO PREVIOUS REPORTS

The EIS (2015) *Stage 2 Environmental Site Assessment* concluded that the site could be made suitable for the proposed development provided that the five recommendations, as noted in Section 5.3 above, are implemented to address the data gaps and to minimise/ manage the risks. Aargus draws attention to Point 1:

- Undertake an additional ESA to address the data gaps identified in Section 10.5. A copy of the Validation report for the removal of the USTs from the former service station section of the site should be obtained prior to undertaking the additional ESA

The data gaps listed in Section 10.5 of the EIS report were as follows:

a) Sampling was not undertaken beneath the buildings in the in the east section of the warehouse building located in the central section of the site, beneath the residential buildings or beneath the former service station shop building located in the north-west section of the site. Fill is likely to be located beneath these buildings.
b) Refusal was encountered within the fill material at borehole sampling locations BH109, BH122, BH124 and BH125. EIS note that BH122, BH124 and BH125 are located within the former service station section of the site. Anecdotal information that at least eleven USTs were removed from the service station section of the site in 2006. Although the GPR scan and the soil data obtained for the ESA did not indicate the potential for additional UST/s or indicate remnant contamination. An additional intrusive investigation is required in this section of the site to adequately assess the potential for localised soil contamination. The potential for undiscovered UST/s cannot be out ruled.
c) Access to adequate sampling locations in the vicinity of the waste oil drum adjacent to the boat service workshop and in the vicinity of the oil/water separator was not possible at the time of the investigation. An additional investigation should be undertaken to adequately assess the potential contamination from these potential sources.

d) The presence of hazardous building materials in the existing buildings has not been assessed. A Hazardous Materials Assessment (Hazmat) should be undertaken prior to the commencement of demolition work.

A response with respect to the aforementioned data gaps is provided below:

a) Sampling beneath the warehouse is currently being undertaken by Aargus as part of a *Waste Classification Assessment*. Sampling beneath the two residential dwellings and the former service station buildings will be undertaken in the future following the demolition of these features, as stated in Section 17 below.
b) An additional investigation is no longer required in the former service station area as the *Tank Pit Validation* report prepared by EI (2006) has validated the former tank farm area, as stated in Section 5.4 above. Reference should also be made to Section 14.3 for the contingency plan should any unexpected USTs be encountered.
c) Sampling of these two areas will be undertaken in the future following the demolition of these features, as stated in Section 17 below.
d) Aargus has been commissioned to undertake the Hazmat report.

Furthermore, as summarised in Section 5.4 above, one sample from the EI (2006) *Tank Pit Validation* report, that being from a surface location Wall-12, within 0.8m of the existing building, was not remediated. Aargus will consider this to be a Hotspot, with the remediation / validation discussed in Sections 7.2, 8.2 & 17 below.

7 SOIL REMEDIATION STRATEGY

7.1 Remediation Goals

The remediation goal is to render the site suitable for the proposed development upon completion of the remediation, validation and additional investigation works. This would be achieved by remediating the hydrocarbon (TRH) impacted hotspots at BH102 & BH105, the asbestos impacted hotspots at BH104 & BH128, and the TPH/BTEX impacted hotspot at Wall-12. In addition, Bonded Asbestos (non-friable) was detected in Fibre Cement Fragments (FCF) recovered from four locations across the site (FC1 to FC4).

7.2 Extent of Remediation Works

Soil remediation is currently limited to the hydrocarbon (TRH), BTEX and/or asbestos impacted hotspots at boreholes BH102, BH104, BH105, BH128 and Wall-12.

At this stage, the extent of remediation would be as follows:

- Hotspot BH102 – is located within the proposed townhouse development area and is impacted with hydrocarbons (TRH) to a depth of 0.2m BGL. The impact is directly related to surface oil staining, which occupies an approximate area of 5m x 5m. It is intended to initially excavate the Hotspot 5m long x 5m wide x 0.2m vertically deep. The fill materials in this area will be stockpiled, classified and then appropriately disposed of at EPA licenced landfill facility that can accept the waste.

- Hotspot BH104 – is located within the proposed townhouse development area and is impacted with asbestos to a depth of 0.2m BGL. It is intended to initially excavate the Hotspot 10m long x 10m wide x 0.2m vertically deep. The fill material has been classified as *Special General Solid Waste (Asbestos)* as part of the EIS Stage 2 ESA, therefore the fill materials will be disposed of at EPA licenced landfill facility that can accept asbestos waste.

- Hotspot BH105 – is located partially within the basement excavation of Building 3 and the adjacent open spaces / roadway, and is impacted with hydrocarbons (TRH). The impact is directly related to surface oil staining, which occupies an approximate area of 20m x 10m. It is intended to initially excavate the Hotspot 20m long x 10m wide x 0.2m vertically deep. The fill materials in this area will be stockpiled, classified and then appropriately disposed of at EPA licenced landfill facility that can accept the waste.

- Hotspot BH128 – is located within the proposed road area and is impacted with asbestos to a depth of 0.2m BGL. It is intended to initially excavate the Hotspot 10m long x 10m wide x 0.2m vertically deep. The fill material has been classified as *Special General Solid Waste (Asbestos)* as part of the EIS Stage 2 ESA, therefore the fill materials will be disposed of at EPA licenced landfill facility that can accept asbestos waste.

- Hotspot Wall-12 – is located approximately 0.8m from the south western corner of the former service station building, within the basement excavation of Building 1 and is impacted with hydrocarbons (TRH & BTTEX). The impact is likely related to former UST infrastructure such as a bowser / pipe. It is intended to initially excavate the Hotspot 5m long x 5m wide x 0.5m vertically deep. The fill materials in this area will be stockpiled, classified and then appropriately disposed of at EPA licenced landfill facility that can accept the waste.

- The FCF should be remediated as per the requirements of the Hazardous Materials Assessment report prepared by Aargus, that being following the completion of the demolition works, any FCF on the site surfaces are to be hand-picked by a licensed contractor and removed off-site appropriately. Following the removal works and prior to any bulk excavation works, a visual clearance certificate should be undertaken by an accredited Hygienist to ensure all FCF have been removed.

Should the additional soil investigations indicate other areas of concern and the requirement for further remediation, an addendum or revision to this RAP is required to amend the remediation strategy.

If additional contaminated material is found during the remediation works, these materials will be chased up and removed.

7.3 Soil Remediation Options Review

7.3.1 NSW EPA Preferred Hierarchy Of Options

The NSW EPA publication Guidelines for the NSW Site Auditor Scheme (2nd Edition) (NSW DEC, 2006) outlines EPA's preferred remedial strategies based on the ANZECC/ NHMRC site remediation policy in the Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC 1992 Guidelines). The preferred order of options for soil remediation and management outlined in these guidelines are:

1) On site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2) Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;
3) Removal of contaminated soil to an approved site or facility followed, where necessary, by replacement with clean fill; and
4) Consolidation and isolation of the soil on the site by containing with a properly designed barrier.

7.3.2 On-Site and Off-Site Treatment

There is a range of soil treatment technologies available depending on the type of contaminant including in-situ and ex-situ remediation methods. Most commonly, for contamination, the technologies adopted are ex-situ, requiring excavation of the contaminated

material. In-situ remediation technologies generally require a longer timeframe for completion than ex-situ technologies. Most of the treatment technologies that require excavation of the contaminated material could be undertaken on or off-site, subject to obtaining licences.

7.3.3 Excavation and Off-site disposal

This method involves the excavation of contaminated materials and disposal of the materials off-site to a landfill licensed by the NSW EPA.

Excavated soils must be classified before disposal to an appropriate landfill. Depending on the levels of contamination, soil may require pre-treatment (to reduce contaminant levels or immobilise contaminants) prior to off-site disposal to the licensed landfill.

7.3.4 Containment of Contaminated Soils

On-site capping is used to isolate areas in the subsurface from the surrounding uncontaminated environment. A physical barrier such as a layer of clean soil, synthetic material liners, asphalt and concrete layers may be installed to cap the contaminated material. A cap is typically used where it is required to remove exposure to the contaminated soils and where the contaminated soils are not mobile or there is no contact with groundwater and / or groundwater is not contaminated.

A site management plan is required with any cap and contain strategy. The site management plan identifies the party responsible for adhering to the plan, and includes commitments for ongoing monitoring and maintenance of the cap as well as control of future excavations, which must be minimised or if required, the appropriate occupational health and safety procedures are adopted and permits acquired before work is carried out.

7.4 Preferred Remedial Option

The following factors were considered in selecting the most feasible remediation method:

- **Proven technology**: the remediation method should have a proven track record of success/failure;
- **Reliability**: this is a measure of the degree of certainty that the remediation method will succeed in meeting the site remediation goals in the short and long term;
- **Regulatory approvals**: the remediation method needs to be endorsed by the relevant regulatory authorities. The difficulty in obtaining regulatory approvals will be largely dependent upon the nature of the remediation method proposed;
- **Cost**: provides an indication as to the likely costs involved in implementing each type of remediation method;
- **Implementation time:** provides an indication as to the likely time frame involved in implementing each type of remediation strategy;
- **Land use restrictions:** if contaminated material is left on-site, the regulatory authority may place restrictions on the land use and/or require notification of the contamination on the property title;
- **Ongoing liabilities (maintenance and monitoring requirements):** a remediation strategy that does not involve the complete removal of all contaminants from the site will necessitate some form of ongoing maintenance and/or monitoring to ensure the longer term integrity of the remediation strategy adopted;
- **Future liability:** any remediation strategy that does not involve the complete removal of all contaminants from the site will result in future liability for the contamination;
- **Local contractor experience:** the success and cost effectiveness of any remediation method will be at least partially dependent upon the experience local contractors have in undertaking the type of remediation works proposed;
- **On-site space requirements:** some remediation techniques (e.g. landfarming) require relatively large amounts of space to spread soil and will only be feasible if sufficient land is available;
- **Disruptions to site structures and activities:** remediation of the site is likely to create some disturbance, both to the existing site operations and structures, as well as to underground services which may pass through the remediation area (e.g. any work

involving excavation of the contaminated soil mass will involve the removal of any structures located atop the excavation zone);

- **Human health risks during remediation:** the remediation workers, site users and the general public may be exposed to hazards posed by contamination during the remediation (eg significant levels of vapours may be released when disturbing soil contaminated with volatile organic compounds); and
- **Availability of appropriate disposal sites (for remediation techniques involving excavation and off-site disposal)**: landfill disposal of contaminated soil will only be feasible if a landfill licensed to accept the contaminated soils excavated from the site is available at a reasonable distance from the site.

The table below presents an evaluation of the various options for soil remediation within the site. The table also includes a number of limitations and risks associated with each method.

Table 3: Remediation Options – Soil

Technical Characteristics	Option 1 (Treatment) Bioremediation	Option 2 (Treatment) Thermal	Option 3 Excavation and Off-Site Disposal	Option 4 Containment
Cost	Low	High	Low- Medium The costs of off-site disposal to landfill are considerably less than treatment costs.	Low
Technical feasibility	Not possible for heavy metal and asbestos contaminated material Not feasible based on the small volume of material requiring treatment Not feasible given that treatment options vary considerably for each of the contaminants identified. If treatment was feasible, it would need to be undertaken off-site at a licensed waste processing facility.	Not possible for heavy metal contaminated material Not feasible based on the small volume of material requiring treatment Not feasible given that treatment options vary considerably for each of the contaminants identified. If treatment was feasible, it would need to be undertaken off-site at a licensed waste processing facility.	Possible for a range of contaminants including those encountered at the site during the investigations The 'excavate and dispose' remediation method is a proven technology for the type of contaminants identified at the site, likely to be approved by the regulatory bodies	Possible for a wide range of contaminants including those encountered at the site
Human Health Risks	Variable – relatively low risk associated with in-situ bioremediation but greater with ex-situ, as soil needs to be excavated	Significant – excavation and handling of contaminated materials will create a volatile contaminant release hazard	Relatively low – excavation and direct off-site disposal will minimise personal contact	Relatively low – only minimal soil disturbance involved

Technical Characteristics	Option 1 (Treatment) Bioremediation	Option 2 (Treatment) Thermal	Option 3 Excavation and Off-Site Disposal	Option 4 Containment
Reliability	Variable – in-situ bioremediation presents only a low potential to adequately remediate all organic species. Ex-situ is more reliable, due to the more complete mixing of organisms, nutrients and oxygen with the contamination	Moderate – thermal processes have been successfully implemented on most organic contaminant species	Excellent – system ensures the removal of all contaminated materials	Moderate – some potential may exist for contaminant breakthrough if containment wall not properly keyed into bedrock. Care also needs to be taken to prevent preferential gas venting.
Regulatory Approval	Satisfactory – on-site treatment is generally the EPA's preferred strategy for site remediation	May be difficult. May require an EIS	Satisfactory – Compliance with Regulatory Authorities. Licensed landfills available for day cover	Generally satisfactory – whilst on-site containment is not the EPA's preferred option, it is often accepted as a feasible option
Disruption to Site Structures and Activities	Variable – disturbance relatively minor for in-situ bioremediation, but ex-situ would require existing structures to be demolished or relocated	Significant – all existing site structures need to be demolished or relocated to allow excavation of contaminated soils	Significant – all existing site structures need to be demolished or relocated to allow excavation of contaminated soils	Moderate – some disruption likely to proposed underground services
Ongoing Liabilities	Variable – need for ongoing monitoring will be largely dependent upon the success of bioremediation in destroying contaminants	Variable – need for ongoing monitoring will be largely dependent upon the success of thermal desorption in destroying contaminants	Minimal – all heavily contaminated materials removed. After completion of the remediation works by the 'excavate and dispose' remediation method, the site would continue to be suitable for the residential use with minimal access to soils, and there would be no ongoing liabilities, and very limited (if any) ongoing maintenance / monitoring required	Moderate to high – capping system need to be maintained, and ongoing monitoring necessary to ensure the integrity of the cap and cut-off wall

Technical Characteristics	Option 1 (Treatment) Bioremediation	Option 2 (Treatment) Thermal	Option 3 Excavation and Off-Site Disposal	Option 4 Containment
Contractor Experience	Very Limited – technology is still developing, and only a limited amount of trials undertaken in Australia	Very Limited – technology is still developing, and only a limited amount of trials undertaken in Australia	Good – relatively simple strategy involving only basic technologies	Moderate – contractors available with experience in the implementation of cap and contain systems
Availability of Disposal Sites	Not Applicable	Not Applicable As the majority of the site will be excavated during redevelopment, any contaminated soil treated off-site could not be returned to the site	Good – landfills available to accept solid waste	Not Applicable (assuming all materials excavated to form the cut-off wall are retained on-site)
Implementation Time Frame	Long	Short to Moderate	Short The timeframe for implementation of the 'excavate and dispose' remediation method is relatively short compared to other possible remediation methods.	Short to Moderate
PREFERENCE	**No**	**No**	**1**	**No**

7.5 Available Soil Remediation / Management Technologies

7.5.1 General

There is a range of different remediation technologies that are available for remediation of contaminated sites. Some of these technologies are proven while others have not been successfully implemented, particularly in Australia and / or there is limited local expertise for implementation.

Based on review of the possible remediation options, the preferred options were primarily ranked according to the following rationale:

1. Option 3 (Preferred) – based upon the proposed development, all contaminated material exceeding the remediation/validation criteria will be disposed off-site.
2. Option 4 – Does not fit in with the proposed development .
3. Options 1 and 2 – Not technically feasible for the contaminants to be remediated

8 REMEDIATION PROGRAMME

8.1 General

All works undertaken during the remediation program must be monitored by a suitably qualified person experienced in the assessment and remediation of contaminated sites. The RAP must be adhered to by all personnel and sub-contractors involved in the remediation program.

8.2 Soils

Assuming appropriate permits have been granted, the remediation of the site is to take place in the following stages:

- Prepare the site with fences, erosion controls, signage and environmental controls.
- Demolish site structures and concrete slabs to make way for remedial works and under slab observations.
- Undertake validation sampling beneath two the residential dwellings, former service station building, the waste oil drum area and the oil water separator area once the features have been demolished, as stated in Section 17.
- An accredited Occupational Hygienist is to prepare an Asbestos Removal Control Plan (ARCP) which will outline the requirements for the handling, monitoring and contractor disposal requirements for the Fibre Cement Fragments (FCF) noted on the sealed surfaces at FC1 to FC4 and the Special Waste soils in the vicinity of Hotspots BH102 & BH128.
- In the vicinity of BH102, where hydrocarbons (TRH) were detected, excavate a 5m x 5m hotspot area to an initial depth of 0.2m, stockpile and re-classify the soils for off-site disposal. The approximate volume to be disposed of is $5m^3$ or 9T.
- Validate the Hotspot BH102 area by recovering 1 floor and 4 wall samples.
- In the vicinity of BH104, where asbestos was detected, excavate a 10m x 10m hotspot area to an initial depth of 0.2m, and dispose of at an EPA licensed landfill that can accept *Special General Solid Waste (Asbestos)* that can accept this type of waste. The approximate volume to be disposed of is $20m^3$ or 36T.

- Validate the Hotspot BH104 area by recovering 1 floor and 4 wall samples.
- In the vicinity of BH105, where hydrocarbons (TRH) were detected, excavate a 20m x 10m hotspot area to an initial depth of 0.2m, stockpile and re-classify the soils for off-site disposal. The approximate volume to be disposed of is $40m^3$ or 72T.
- Validate the Hotspot BH105 area by recovering 3 floor and 6 wall samples.
- In the vicinity of BH128, where asbestos was detected, excavate a 10m x 10m hotspot area to an initial depth of 0.2m, and dispose of at an EPA licensed landfill that can accept *Special General Solid Waste (Asbestos)* that can accept this type of waste. The approximate volume to be disposed of is $20m^3$ or 36T.
- Validate the Hotspot BH128 area by recovering 1 floor and 4 wall samples.
- In the vicinity of Hotspot Wall-12, where hydrocarbons (TRH & BTEX) were detected, excavate a 5m x 5m hotspot area to an initial depth of 0.5m, stockpile and re-classify the soils for off-site disposal. The approximate volume to be disposed of is $12.5m^3$ or 22.5T.
- Validate the Hotspot Wall-12 area by recovering 1 floor and 4 wall samples.
- All other fill materials / bedding sands to be excavated will be temporarily stockpiled to ensure appropriate sampling of the soil requiring off-site disposal. The stockpiles will be classified according to the NSW EPA "*Waste Classification Guidelines, Part 1: Classifying Waste"* and disposed of to a licensed landfill/facility. If the material has been classified prior to excavation (in-situ), it could be immediately loaded on trucks and removed off-site to the most appropriate licensed facility.
- Samples will be recovered from 12 locations within the proposed communal open space area to determine the suitability of the soils in this area to remain onsite under the SAC. One uncontaminated deeper natural soil sample will be recovered from this area to determine the site derived EILs.
- Appropriate QA/QC samples.
- Remediation will occur by managing soil for offsite disposal to landfill for contaminated soils and for soil to an offsite soil recycling facility for reuse in the case of clean soil.

8.3 Duration of Remediation and Validation Works

Based on the proposed scope of the remediation and validation works, it is expected that the works should be completed within approximately four to eight weeks following receipt of the regulatory approvals. This timeframe does not include reporting which should be completed approximately one to two months after completion of the remediation and validation works.

9 REGULATORY COMPLIANCE

9.1 General

Regulatory requirements that must be addressed for the remedial program are described in the following sub-sections.

9.2 State Environmental Protection Policy (SEPP) 55 Regulations

The Planning Guidelines SEPP 55 – Remediation of Land defines the regulations for Category 1 and Category 2 remediation works. The remedial works to be undertaken at the site constitute Category 2 works based on Bankstown Council's requirement for a RAP to be submitted with the DA. Remedial works may only commence upon approval of the RAP by the Council.

9.3 State Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2014

UPSS Regulation requires if a storage system is decommissioned, a report for the storage system must be served on the relevant authority within 60 days of decommissioning or remediation is completed. The report must be prepared by a duly qualified person in accordance with EPA guidelines, and must describe the processes used to decommission the storage system and assess contamination at the storage site.

9.4 EPA and Waste Disposal Approvals

Approval will be sought from an EPA licensed waste facility prior to the disposal of waste soil to that facility.

9.5 Duty to Report

Under Section 60 of the Contaminated Land Management Act, there is a duty to report contamination. The notification triggers for on-site and offsite soil and groundwater contamination will be conducted in accordance with Section 2.3 of the DECC (2009) Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.

9.6 Council Regulations

Site works will occur only in designated hours in accordance with Bankstown Council policy. Wastes will be managed in accordance with this RAP to ensure compliance with Council requirements and that the environment is protected. It is possible that Council may have additional DA requirements and the RAP should be amended accordingly to ensure compliance.

9.7 WHS Regulations

9.7.1 General

Health screening for asbestos in soil, which are based on scenario-specific likely exposure levels, are adopted from the WA DoH guidelines and are referred in Table 7 in Schedule B1.
The WHS Regulations require a person conducting a business or undertaking who commissions the removal of asbestos at the workplace must also ensure asbestos removal work is carried out only by a licensed asbestos removalist who is appropriately licensed to carry out the work, unless specified in the WHS Regulations that a licence is not required.

If asbestos is non-friable, is more than 10m² and has been determined that it should be removed, it must be removed by a licensed asbestos removalist as soon as reasonably practicable. Where it is not reasonably practicable to remove it, control measures must be put in place to eliminate any exposure, so far as is reasonably practicable, or to minimise exposure so far as is reasonably practicable, but always ensuring the exposure standard is not exceeded.

Class A License can remove any amount or quantity of asbestos or ACM, including:

- any amount of friable asbestos or ACM
- any amount of ACD
- any amount of non-friable asbestos or ACM

Class B Licence can remove:

- any amount of non-friable asbestos or ACM
    - Note: A Class B licence is required for removal of more than 10 m2 of non-friable asbestos or ACM but the licence holder can also remove up to 10 m2 of non-friable asbestos or ACM)

- ACD associated with the removal of non-friable asbestos or ACM
    - Note: A Class B licence is required for removal of ACD associated with the removal of more than 10 m² of non-friable asbestos or ACM but the licence holder can also remove ACD associated with removal of up to 10m² of non-friable asbestos or ACM

9.7.2 WorkCover Notification

Notification of asbestos removal work

WorkCover must be notified five days before licensed asbestos removal work is commenced.

Asbestos removalists licensed in NSW can lodge the notification electronically using WorkCover's Asbestos and demolition online notification system or complete the notification form.

Interstate asbestos removalists who hold an asbestos removal licence issued under another Work Health and Safety Regulation must lodge the notification by completing the notification form.

Notification of respirable asbestos fibre levels at more than 0.02 fibres/ml

WorkCover must be notified within 5 days when the respirable asbestos fibre levels exceed 0.02 fibres/ml in the removal area.

NSW licensed asbestos removalists and interstate asbestos removalists who hold an asbestos removal licence issued under a work health and safety regulation must lodge the notification by completing the notification form.

Notification of the emergency demolition of a structure or plant involving asbestos

You must also notify of the demolition or refurbishment of a structure or plant:

- that was constructed or installed before 31 December 2003;
- is located in either a workplace or a residential premises where an emergency has occurred;
- the structure or plant must be demolished; and
- asbestos is fixed or installed in the structure or plant before the emergency has occurred.

Demolition or refurbishment does not include minor or routine maintenance work or other minor work.

An emergency occurs if:

- a structure or plant is structurally unsound
- collapse of the structure or plant is imminent.

The person with management or control of the workplace or, if in residential premises, the licensed asbestos removalist must notify WorkCover by completing the notification form.

Interstate asbestos removalists who hold an asbestos removal licence issued under another work health and safety regulation must also notify WorkCover if the work is located in NSW.

Completed notification forms can be lodged by:

- fax to (02) 9281 7486
- email to adu@workcover.nsw.gov.au
- delivery to, Level 10, Centennial Plaza, Building C, 300 Elizabeth Street, Sydney or any WorkCover office
- post to the Asbestos Demolition Unit, WorkCover NSW, PO Box 1476, Strawberry Hills NSW 2012.

Asbestos notifications are free.
The asbestos and demolition hotline number is (02) 8260 5885.

10 ASBESTOS CONTROL AND MANAGEMENT

The WHS Act requires all persons who conduct a business or undertaking to ensure, so far as is reasonably practicable, that workers and other persons are not put at risk from work carried out as part of the business or undertaking. The WHS Regulations include specific obligations to manage and control asbestos and ACM at the workplace. These are summarised in the table below:

Table 4: Responsibilities in Managing Asbestos

Duty Holder	Responsibilities
Person conducting a business or undertaking (PCBU)	**Control risk of exposure** • must ensure, so far as is reasonably practicable, that exposure of a person at the workplace to airborne asbestos is eliminated, except in an area that is enclosed to prevent the release of respirable asbestos fibres and negative pressure is used. If this is not reasonably practicable, the exposure must be minimised so far as is reasonably practicable • must ensure the exposure standard for asbestos is not exceeded at the workplace. **Health monitoring** • must ensure health monitoring is provided to a worker who is carrying out licensed removal work, other ongoing asbestos removal work or asbestos-related work and there is risk of exposure when carrying out that work • must ensure the health monitoring is carried out under the supervision of a registered medical practitioner and information as specified in the WHS Regulations is provided to that medical practitioner • must pay all expenses for health monitoring, obtain report and keep records of all health monitoring. **Training and use of equipment** • must ensure that information, training and instruction provided to a worker is suitable and adequate and that it is provided in a way that is readily understandable by any person to whom it is provided • must ensure that, if a worker is either carrying out asbestos-related work or may be involved in asbestos removal work, they are trained in the identification and safe handling of asbestos and ACM and the suitable control measures

	• for workers who carry out work where NOA is likely to be found, training must be provided on hazards and risks associated with NOA. **Controlling the use of equipment** • must not use, or direct or allow a worker to use, certain equipment on asbestos and ACM. **Asbestos-related work** • must, if there is uncertainty as to whether work is asbestos-related work, assume asbestos is present or arrange for an analysis of a sample to be undertaken to determine if asbestos or ACM is present • must give information as specified in regulation 480 of the WHS Regulations to a person who is likely to be engaged to carry out asbestos-related work • must ensure the asbestos-related work area is separated from other work areas at the workplace, signs are used to indicate where the asbestos-related work is being carried out and barricades are used to delineate the asbestos-related work area • must ensure a competent person carries out air monitoring of the work area if there is uncertainty as to whether the exposure standard is likely to be exceeded • must ensure that asbestos waste is contained and labelled in accordance with the GHS before it is removed, and is disposed of as soon as practicable • must ensure, where personal protective equipment (PPE) is used and contaminated with asbestos, such PPE is sealed, decontaminated, labelled and disposed of in accordance with the WHS Regulations. If this is not reasonably practicable, the PPE must be laundered in accordance with the WHS Regulations. PPE that is not clothing and cannot be disposed of must be decontaminated and kept in a sealed container until it is reused for the purposes of asbestos-related work.
PCBU with management or control of a workplace	**Identifying or assuming asbestos or ACM** • must ensure, so far as is reasonably practicable, that all asbestos or ACM at the workplace is identified by a competent person or assume its presence • may identify asbestos or ACM by arranging a sample of the material to be analysed. **Indicating presence and location** • must ensure the presence and location of asbestos or ACM identified (or assumed to be identified) at the workplace is clearly indicated (by a label if reasonably practicable). **Asbestos register** • must ensure an asbestos register is prepared, maintained, reviewed and kept at the workplace. It must be readily available to workers, their health and safety representatives and other persons

	• must ensure, when management or control of the workplace is relinquished, a copy of the asbestos register is given to the person assuming management or control. **Asbestos management plan** • must, where asbestos has been identified at the workplace, ensure an asbestos management plan is prepared, maintained and reviewed. It must be accessible to workers, their health and safety representatives and other persons. **Naturally Occurring Asbestos (NOA)** • must manage the risks associated with NOA at the workplace and, where identified at the workplace or likely to be present, ensure that a written asbestos management plan is prepared, maintained and reviewed. **Demolition and Refurbishment Work** • prior to demolition or refurbishment work starting, must review the asbestos register and ensure all asbestos that is likely to be disturbed is identified and removed so far as is reasonably practicable • must provide a copy of the asbestos register to the person carrying out the demolition or refurbishment work before the work commences • must, if an emergency occurs and a structure or plant is to be demolished, ensure that before the demolition occurs there is a procedure to reduce the risk of exposure to asbestos to below the exposure standard and notify the regulator about the emergency.
PCBU carrying out demolition or refurbishment work	**Demolition and Refurbishment Work** • must, prior to the demolition or refurbishment work being carried out: o obtain a copy of the asbestos register for the workplace from the person with management or control before the work commences o if an asbestos register is not available, ensure the structure or plant to be demolished or refurbished has been inspected by a competent person to determine if any asbestos or ACM is fixed to or installed (or assume it's presence) o where asbestos is determined to be fixed to or installed, tell the occupier, owner (if at a domestic premises) or the person with management or control in any other case o ensure asbestos at domestic premises that is likely to be disturbed by the demolition or refurbishment is identified and, if reasonably practicable, removed before the work starts o if an emergency occurs at domestic premises where asbestos is identified (or assumed) and it must be demolished, ensure there is a procedure to reduce the risk of the exposure to asbestos to below the exposure standard and notify the regulator about the emergency.

11 ENVIRONMENTAL MANAGEMENT PLAN

The remedial program will be undertaken with regard to environmental and statutory requirements. Adherence to the EMP will be monitored by an on-site Environmental Scientist who will be present during all critical remediation / validations works.

All relevant regulations are covered by the Environmental Planning and Assessment Act 1979. All due care is taken to ensure the following conditions are adhered to:

- Minimal wind borne dust leaves the confines of the site;
- Water containing any suspended matter or contaminants is managed within the confines of the site in such a manner that minimal pollution of adjacent sites, including waterways, occurs;
- Vehicles will be controlled such that minimal mud, soil or water will fall or be deposited on any public or private roadway or adjacent areas;
- Noise levels at the site boundary will comply with the required legislative requirements.
- All approvals for site works are under regulatory framework (i.e. approvals for tree removal, demolition, remedial works, etc). SEPP55 forms the basis of the remedial scope that council abides by.
- All environmental controls are adhered to as set by the Environmental Representative.

12 SITE MANAGEMENT PLAN

12.1 General

The Site Management Plan (SMP) shall be implemented by the principal remediation contractor during remediation works to ensure that statutory requirements have been met and that the following issues have been addressed (where applicable):

- Site access;
- Working hours;
- Stormwater management;
- Soil management;
- Traffic management;
- Noise, dust and odour control; and
- Work Health Safety.

The site manager/foreman of the principal remediation contractor should have a thorough understanding of the contents of the RAP, including the Site Management Plan (SMP) and should ensure that each employee or sub-contractor is familiar with the requirements of these plans.

Adherence to the SMP will be monitored by a suitably qualified and experienced Environmental Scientist/Engineer who will be present during all critical remediation / validation works.

Each of the issues to be addressed in the site management plan is briefly discussed in the following sub-sections.

12.2 Site Access

The contractor will ensure that adequate barriers have been placed around the site to prevent access of unauthorised personnel to areas where contaminated material is exposed. The contractor will also place adequate warning signs around the site.

12.3 Working Hours

The working hours for the remediation / validation works will be in accordance with Council requirements or between 7.00am to 5.00pm Mondays to Fridays and 7.00am to 1.00pm on Saturdays. No work will be carried out on Sundays and public holidays.

12.4 Stormwater Management

The contractor will put in place adequate stormwater runoff, run-on and sediment control measures for the remedial works. These requirements are outlined in Schedule B(9) of the (*site contamination*) NEPM (2013).

These include stockpiling excavated soil in a manner that will prevent contamination from being transported off-site by stormwater, and include the following measures:

- Divert stormwater runoff outside the site so that it does not flow through the site;
- Control drainage on the site by intercepting and redirecting runoff in a controlled manner;
- Stormwater collected at the site in trenches and sumps should be appropriately managed; and
- Silt stop fences should be erected at locations where stormwater may flow outside the site.

The presence of sediment in surface water or runoff must be minimised by the use of sediment controls such as diversion drains, hay bales and silt fencing.

12.5 Soil Management

Soils that require stockpiling must be managed in such a manner that these materials remain well contained and easily identifiable and that the effects of wind and rain have minimal impact on their integrity. Subsequently, if adverse weather conditions are anticipated, or if the stockpile is to remain on-site for an extended period, stockpiles must be protected and covered. Stockpile records must be maintained to track the re-use of soils at the site (if any). The following procedures will be implemented should it be necessary to stockpile soil at the site prior to off-site disposal:

- Material tracking records will be completed on a daily basis by the contractor to document the origin, quantities and fate of contaminated soil excavated, stockpiled on-site and transported off-site;
- The stockpiles of waste material to be transported off site will be labelled appropriately to enable easy assignment to landfill or re-use facility. No stockpile should be allowed to be transported until it has been appropriately classified for off-site disposal/reuse;

Any materials available to be re-used at a licensed resource recovery facility must meet the Protection of the Environment Operations (Waste) Regulation 2005 – General Exemption Under Part 6, Clause 51 and 51A.

Any plant or equipment that comes into contact with soils must be inspected prior to leaving the site, and cleaned as necessary.

12.6 Groundwater Management

Groundwater may be intercepted during the construction of the proposed development. Any groundwater encountered during excavation works should be directed to and collected in a sump. No discharge of groundwater will occur without approval of appropriate regulatory bodies. In addition, any contaminated groundwater intercepted should be collected and disposed of by an appropriately licensed contractor.

12.7 Traffic Management

Vehicular movement is to be conducted in accordance with Council requirements. The principal contractor will manage all vehicles as indicated by the principal's environmental representative to minimise tracking of any materials onto public roads. The wheels of the vehicles will be washed and brushed prior to leaving the site. If applicable, a vehicle wheel washing or shaking facility will be installed. Loads leaving the site should be maintained moist and must be covered to prevent materials from the site being spilled or left on public or private roadway or adjacent areas. Particular care should be taken if UST or any unexpected material have been encountered and are to be removed from the site.

12.8 Noise Control

The contractor should keep noise levels to a minimum and levels should not exceed limits indicated in AS 2436 1981. Noise levels must also comply with Council and NSW EPA requirements. It is expected that the equipment to be used in the remediation works will not generate noise levels above these requirements.

12.9 Dust control

Works must comply with the requirements listed in Schedule B(9) of the NEPM (2013), Council and the NSW EPA. The generation of dust should be kept to a minimum. Stockpiled contaminated material should be bunded and covered. Water sprays may be used to minimise dust. Water used for this purpose should not be allowed to flow off-site through the stormwater system, sewer, or any other way.

12.10 Odour control

The level of odours generated during remedial activities must be monitored and local Council and NSW EPA requirements must be complied with.

Should odorous compounds be encountered, the remediation contractor should take measures to mitigate them and to prevent their migration outside the site boundaries. This may involve

placing the odorous materials as soon as possible in a bunded area, covered with plastic membrane, and spraying with an odour suppressant approved by the environmental consultant.

12.11 Work Health Safety

As personnel on-site may be exposed to potentially toxic or hazardous compounds, a site-specific Work Health Safety Plan (WHSP) was prepared for implementation prior to commencement of remediation and validation work in accordance with relevant legislation. The WHSP identifies hazards, assesses the risks posed by the hazards and recommends measures to control the hazards. This includes detailed descriptions of vehicle decontamination, protective clothing, equipment and appropriate safety controls to be adopted during remediation and validation works carried out at the site.

If odours are detected at areas around the site PID measurements will be collected by the on-site Environmental Scientist. If PID readings >30 ppm are recorded breathing masks should be worn by workers in the vicinity of the odour and >300 ppm odour suppressants as well as controlled excavations should be applied.

Personnel working on the site are required to read, understand and apply the requirements of the WHSP. All staff working on the site must be inducted by an authorised induction trainer and must sign the relevant induction form. A copy of the WHSP prepared for the site is included in Appendix C.

13 OPERATIONAL CONTROLS

13.1 Fire And Explosion Hazard

Explosive atmospheres may be present where any petroleum products or other potentially flammable or explosive substance is encountered / used, including machinery. Therefore, the contractor will put into place measures to prevent fires and explosions, which include:

- preventing access to the site by unauthorised persons;
- forbidding smoking or using naked flame at the site;
- cutting of concrete to be carried out under a blanket of water in proximity to any underground storage tanks;
- approved fire extinguishers to be maintained in proximity to excavations;
- ensuring that no free product or fuel used for refuelling equipment enters a confined space or drainage/sewer system; and
- using only certified flameproof equipment in proximity to locations where free petroleum fuel is present or is expected to be present.

13.2 Public Complaints Registry

Given the nature of the remediation and validation works, it is considered that a community relations plan is not required.

13.3 Duties of the on-site Environmental Scientist

The duties of the on-site environmental scientist include:

- ensure adherence to the Remediation Action Plan, the Work Health and Safety Plan and other plans applicable to the site;
- monitor the excavation of contaminated material undertaken at the site;
- ensure environmental compliance of contractors;

- monitoring with a PID the areas adjacent to open excavated pits at least three times throughout the day, and at additional times if strong or unusual odours or if unusual substances are encountered during the excavations part of the remediation works;
- inspection of the integrity of the sediment controls placed around the site;
- inspection at approximately two hourly intervals of the roadway in the vicinity of the site used by the vehicles leaving the site to ensure that no significant amounts of materials have been tracked off-site by vehicles;
- immediately report actual or potential non-compliances to the principal's environmental representative who will report those to appropriate regulatory bodies ;
- note weather conditions, approximate temperature, direction and velocity of the wind, and rainfall at the commencement of work, at about midday and at the end of the day;
- collect samples for validation or other purposes as required by the principal's environmental representative;
- maintain a site diary which will record the following information:
  - date
  - weather conditions
  - presence of odours at the site and at the site boundaries
  - PID measurements
  - details of materials excavated during the remediation works, and details of actions taken if unexpected materials are encountered
  - details of accidents, near misses or incidents, which may have resulted in injury, and the actions taken to prevent their recurrence
  - details of environmental issues, which may result in environmental incidents and measures taken to correct them
  - details of visitors to the site or other matters relating to environmental or health issues

13.4 Unexpected Occurrences

If during remediation works, significant odours and/or evidence of gross contamination not previously detected are encountered, or any other significant unexpected occurrence, site works should cease in that area, at least temporarily, and immediate action taken to abate the odours or prevent / manage cross-contamination occurring. If required, the administering authority will be notified in writing within two working days of significant unexpected occurrence and informed of the remediation actions implemented.

13.5 Non-compliances

If the on-site environmental scientist suspects that some works carried out at the site do not comply with the requirements of the RAP, the OHSP or other plans applicable to the site, this should be reported immediately to the principal's environmental representative. If the principal's environmental representative cannot be contacted or if immediate action is required, the on-site environmental scientist has authority to stop the work or request appropriate action to be taken. This is particularly the case under the following circumstances:

- injury to person due to exposure to materials excavated from the site;
- spillage of materials at the site or on areas adjacent to the site; and
- other events that the environmental scientist believes could give rise to unacceptable risk to human health or to adverse impact to the site or to areas adjacent to the site.

14 CONTINGENCY PLANNING

14.1 Excavation Contingency Planning

The conditions that may be encountered when excavating are uncertain. As unknown and variable subsurface conditions impose a degree of uncertainty for the project a set of anticipated conditions has been assumed in developing the excavation plan. However, because field conditions vary, flexibility has been built into the excavation plan to adapt to differing conditions.

The table below summarises conditions that can be reasonably expected and the resulting problems they may cause and how these problems may be resolved within the context of the excavation program.

Table 5: Excavation Contingency Planning

Anticipated Problem	Corrective Action By Contractor
Asbestos cement sheeting, lagging, pipping etc	Stop excavations if there is the potential for people to inhale airborne asbestos fibres. Contact Aargus immediately to assess whether the material is asbestos. Cover the area with plastic and suppress dust by wetting down if needed. Place a warning sign at the entrance to the site where asbestos removal or site remediation is taking place.
Discovery of USTs	Stop excavations, contact Aargus immediately.
Chemical spill / exposure	Stop work, refer to Occupational Health, Safety and Rehabilitation Plan and immediately contact Aargus.
Excessive rain	Maintain access roads, cover high-traffic areas with gravel; or cover working areas/stockpiles with plastic during off-shifts; or shut down operations until runoff is more manageable. Inspect & maintain sediment control pond & filter fences.
Unmanageable mud in excavation zone	Improve drainage collection system; add geotextile/gravel in problem areas; or strip off mud/slurry materials; or excavate from the top of the fill.
Excessive drainage	Minimise active/contaminated work area; or improve diversion clean run-on; or maintain sufficient on-site wastewater storage capacity; or mobilise additional storage and/or treatment systems as needed.
Excessive dust	Use water sprays or biodegradable dust sprays, or cease dust-generating activity until better dust control can be achieved, or apply interim capping systems.
Sediment pond water for discharge – analytical results exceed site response levels	Perform in-situ treatment, e.g. flocculant dosing, until response levels are met. Alternatively arrange off-site disposal by a licensed Contractor.
Excessively wet materials	Stockpile and dewater on-site; or add absorbents.
Equipment failures	Maintain spare equipment or parts; or maintain alternate rental options; or shut down affected operations until repairs are made.
Release of fuel/oil from machinery	Remove source, use absorbent booms to remove oil and make any repairs as required.
Silt fence fails	Stop work and repair fence to specifications.

Excessive noise	Identify source and review noise attenuation equipment and as necessary provide silencers on noisy equipment.
Excessive odours	Monitor for volatiles using PID and upgrade PPE if necessary. Use odour and volatile suppressing agents to eliminate or reduce odours as required and/or cover odorous material if practicable.
Excavation extends below water table into natural materials which are assessed and confirmed to comprise potential acid sulfate soils (PASS).	Implement Acid Sulfate Soils management plan. This will include on-site treatment of the soils in the excavation area. Treatment would likely involve lime addition at a rate to be calculated using methods specified in the ASS Manual (1998).
Unearthing drummed material	Isolate and contact Superintendent. Arrange temporary storage in a secure part of the remediation site (to be nominated).

In addition to the above listed contingencies, the following steps may need to be undertaken should non-spadeable sludges or buried drums be discovered during the remediation works:

- upgrade of personal protective equipment (PPE), for workers within the active work zone, in accordance with the site Occupational Health, Safety and Rehabilitation Plan;
- segregation and bunding of discovered material;
- use of odour suppressants (where appropriate);
- cover the discovered material with plastic sheeting;
- appropriate sampling and analysis to assess potential contaminants; and
- appropriate off-site disposal of the materials following receipt of analytical results and any associated regulatory approvals required.

14.2 Unexpected Finds Protocol

The possibility exists for residual hazards to be present at the site. Environmental sampling is based on chemical analytes identified as a potential concern during a documented process of reviewing historical site activities. However, ground conditions between sampling points may vary, and further hazards may arise from unexpected sources and/or in unexpected locations. The nature of any residual hazards which may be present at the site are generally detectable through visual or olfactory means, for example:

- Fragments of asbestos-containing materials (visible)

- Construction / Demolition Waste (visible)
- Hydrocarbon impacted materials (visible / odourous)
- Ash and/or slag contaminated soils / fill materials (visible)

As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances be identified (or any other unexpected potentially hazardous substance), the procedure summarised in *Appendix G* is to be followed.

An enlarged version of the unexpected finds protocol, suitable for use on site, should be posted in the Site Office and referred to during the Site Specific Induction by the Principal Contractor.

The sampling strategy for each "unexpected find" shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, at concentrations which pose an unacceptable risk to human health or the environment.

The sampling frequency of the identified substance / materials shall meet the following minimum requirements:

- Insitu Sampling
  - 1 sample every 25m^3, with a minimum of three samples recovered.
  - Samples should be analysed for the chemicals of concern.

- Stockpile Sampling
  - 1 sample every 25m^3 for small volumes.
  - 1 sample every 100m^3 for large volumes.
  - Samples should be analysed for the chemicals of concern.

All additional works should be documented by the use of field notes, site photographs, site plans and reporting.

14.3 USTs

In addition to the above unexpected finds protocol, any unexpected UST's found within the site should be removed in accordance with NSW WorkCover requirements and AS4897-2008: *The design, installation and operation of underground petroleum storage systems.* In the event of conflict between the AS and NSW WorkCover requirements, the AS shall prevail. Due to the volatile nature of petroleum storage tanks, it is recommended that the USTs be excavated and disposed of by an experienced contractor and with an environmental representative present.

Following the removal of any USTs and associated visibly stained or odorous soils, in samples should be collected from the walls and floor of the tank-pits/hotspots and submitted to a NATA accredited laboratory for analysis. The targeted analytes should be, but not be limited to, heavy metals, TPH, BTEX & PAH.

The minimum sampling protocols to be used for unexpected UST areas include:

- 3 samples per backfill UST sands per UST pit
- 1 sample per tank line
- 1 sample per vent pipe area
- 1 sample per spill box (currently not present but may be found)
- 2 base samples and 8 wall (2 samples per wall face) of each tank pit

14.4 Groundwater Contingency

Should groundwater concentrations within the site be high during the remediation process, it is recommended that ongoing monitoring of the groundwater is undertaken in accordance with an EMP that may be prepared for the site.

14.5 Air Monitoring

Air monitoring requirements will vary depending on the type of asbestos being removed, the location and position of the asbestos, if an enclosure is used and whether the asbestos removal work is within a building or outside.

- ***More than 10 m² of non-friable asbestos removal***– Air monitoring is not required but may be considered to be carried out by an independent licensed asbestos assessor or competent person to ensure compliance with the duty to eliminate or minimise exposure to airborne asbestos and to ensure the exposure standard is not exceeded.
- ***Public Location***– Air monitoring should be considered where the asbestos removal work is being undertaken in or next to a public location.

Air monitoring may be required when:

- it is not clear whether new or existing control measures are effective.
- there is evidence (for example, dust deposits are outside the enclosure) the control measures have deteriorated as a result of poor maintenance.
- modifications or changes in safe work methods have occurred that may adversely affect worker exposure.
- there has been an uncontrolled disturbance of asbestos at the workplace.

As the soils in the vicinity of Hotspots BH102 & BH128 have been classified as Special Waste, an accredited Occupational Hygienist will be commissioned to prepare an *Asbestos Removal Control Plan* (ARCP) which will outline the requirements for air monitoring within the site.

15 DATA QUALITY OBJECTIVES

15.1 General

The Data Quality Objectives (DQOs) have been set to ensure that the data collected is sufficiently reliable for validation purposes. The QA/QC should be in accordance with the National Environment Protection Council (NEPC) (2013) *National Environmental Protection (Assessment of Site Contamination) Measure* and with the Australian Standard AS4482.1-1997.

15.2 Step 1 - State the Problem

The site is proposed to be developed into five medium density residential buildings with basement car parking, fourteen townhouses, roads and communal open spaces. However, previous investigations identified the following concerns:

- Hydrocarbon (TRH) impacted soils in the vicinity of boreholes BH102 & BH105 related to surface oil staining.
- Friable asbestos impacted soils in the vicinity of boreholes BH104 & BH128.
- Bonded asbestos within fibre cement fragments noted on the sealed surfaces of the site at FC1 to FC4.
- Undertake additional sampling within the former service station area, the waste oil drum area and the oil water separator area once the features have been demolished, as well as sampling within the footprint areas of the proposed Buildings 1 to 5.
- The Validation Report for the former service station was not available at the time of reporting to establish whether this area of the site was appropriately validated.

Further assessments are required to address the data gaps above and to formulate an appropriate remediation strategy as prescribed in this RAP. These works are required to confirm the suitability of the site for the proposed development.

15.3 Step 2 - Identify the Decisions of the Study

The following information is required to identify the decisions of the study:

- What is the nature and extent of Hydrocarbon (TRH) impacted soils in the vicinity of boreholes BH102 & BH105.
- What is the nature and extent of asbestos impacted soils in the vicinity of boreholes BH104 & BH128.
- Upon validation works and adopting the preferred remediation strategy, would the site be rendered suitable for the proposed development.

15.4 Step 3 - Identify Information Inputs

The following information is required for input into the decisions identified in Step 2:

- Findings from previous contaminated land reports prepared for the site.
- Selection of soil investigation and screening levels from the NEPM 2013 guidelines.
- Collection and laboratory analysis of soil samples for additional site characterisation and validation purposes.
- Headspace analysis for screening of VOCs present within soils using a PID.
- Comparison and interpretation of results again the adopted soil investigation and screening levels as prescribed in the NEPM 2013 guidelines.

15.5 Step 4 - Define the Study Boundaries

The spatial and temporal aspects of the investigation area that the data must represent to support the decisions identified in Step 2 are as follows:

- The lateral extent of the study boundary is defined by the site boundaries as shown in the Site Location Plan (refer to Figure 1).

- The vertical extent of the soil removal is at least 0.5m depth in the Hotspots up to clean underlying material.
- Additional soil sampling to target the former service station area, the waste oil drum area and the oil water separator area once the features have been demolished, as well as sampling within the footprint areas of the proposed Buildings 1 to 5.

15.6 Step 5 - Develop the Analytical Approach

The acceptable limits for laboratory QA/QC parameters are shown in the table below and are based upon the laboratory reported acceptable limits and those stated within the NEPM 2013 Guidelines.

Table 6: Acceptable Limits for QC Samples

Type of QC Sample	Control Limit
FIELD	
Rinsate Blanks	Analytes <LOR
Intra-Laboratory Duplicates	RPD's <50%
Inter-Laboratory Duplicates	RPD's <50%
Trip Blanks	Volatiles <LOR
Trip Spike Recovery	>70%
LABORATORY	
Method Blanks	< Laboratory LOR
Matrix Spike	Recovery targets: • Metals: 70% to 130% • Organics: 60% to 140%
Laboratory Duplicate	RPD's <30%
Laboratory Control Samples	Recovery targets: 60% to 140%
Surrogate Spike	Recovery targets: 60% to 140%
Asbestos	No asbestos found at the reporting limit of 0.1 g/kg

The following conditions should be adopted:

- If the control limits are exceeded, then an assessment of the significance of the results should be carried out;
- If the results of the DQI assessment indicate that the data set is reliable, then the data set will be deemed to be acceptable for the purposes of the additional investigation and validation works; and
- If the measured concentrations of soil samples analysed meet their respective validation criteria, then no additional assessment is required is required.

15.7 Step 6 - Specify Limits on Decision Errors

There are two types of decision errors:

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

These errors may lead to following (null hypothesis):

- Deciding that the site is not suitable for the proposed development when it actually is (Type I error); and
- Deciding that the site is suitable for the proposed development when it is actually not (Type II error).

A 5% significance level has been selected for Type I errors on the basis that 95% of the data set will satisfy the DQIs. Therefore, the acceptable limit of the decision errors is based on a 5% probability of the hypothesis being incorrect.

An assessment will be made as to the likelihood of a decision error being made based on:

- The acceptable limits for inter/intra laboratory duplicate sample comparisons as specified in Step 5 of the DQOs; and
- The acceptable limits for laboratory QA/QC parameters are based upon the laboratory reported acceptable limits and those stated within the NEPM Guidelines.

If the concentration of a particular contaminant of concern exceeds its assessment criteria, then a further assessment is required to address the significance of the result. Statistical analysis based on 95% UCL may be used to assess the significance of the data provided the following conditions are met:

- the arithmetic mean of the data set must be less than its respective threshold level; that is, it is acceptable for individual results to exceed its respective threshold level, but the cumulative mean of the data set of soil sample results must not exceed the threshold level;
- the standard deviation of the data set is less than 50% of the relevant threshold level; and
- no individual sample result should be greater than 250% of the relevant threshold level.

15.8 Step 7 - Optimise the Design for Obtaining Data

The optimum design for obtaining data in order to achieve the Data Quality Objectives is as follows:

- Only NATA-accredited environmental testing laboratories will be commissioned to analyse soil and groundwater samples and will implement a quality control plan conforming to the NEPM (Assessment of Site Contamination) Measure Schedule B(3) Guidelines for Analysis of Potentially Contaminated Soils.
- Review of previous contaminated land reports relevant to the Site and the surrounding area.
- An assessment of the Data Quality Indicators to determine if the field procedures and laboratory analytical results are reliable.
- The investigation will be carried out by an experienced and qualified Environmental Scientist, who is trained in sampling at contaminated sites in accordance with Aargus protocols based on best practice industry standards.
- Collection of QA/QC samples at frequencies prescribed in the NEPM 2013 Guidelines.

16 VALIDATION CRITERIA

16.1 General

The selection of appropriate human health and ecological site validation criteria were based on the "National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No.1)", NEPC (2013).

It is acknowledged that the guideline values adopted are generally intended for application as investigation and screening levels and are based on a conservative approach. However, the guidelines do not necessarily preclude their use in determining the suitability of a site for its proposed land use in the absence of remediation guideline values. Therefore, should the validation samples be at concentrations below their respective adopted criterion, they are considered to render the site suitable for the proposed use.

It should be noted that should validation samples fail their respective validation criteria, a justifiable decision should be made to determine whether a quantitative risk assessment would be warranted, based on the likelihood that it would result in a beneficial outcome in avoiding further unnecessary remediation costs.

Full details of the validation criteria for each contaminant of concern in soils are presented in below.

16.2 Soils

16.2.1 Health Investigation Levels (HILs)

The NEPM presents Tier 1 Health Investigation Levels (HILs) for a broad range of chemicals such as metals, inorganics, PAHs, phenols, pesticides and other organics. The HILs are applicable to generic land uses such as residential, commercial/industrial or public open space and all soil types, generally within the first 3 metres of soil below ground level. The HILs have been applied to assess human health risks via all relevant pathways of exposure.

Based on the proposed development, soil investigation results within the site will be assessed against the following criteria and as shown in Figure 6 in Appendix A:

Townhouse Development Area

- **HIL 'A'** - *Residential use with gardens/accessible soils, including children's day-care centres, preschools and primary schools*

Buildings 1 to 5 Development Area

- **HIL 'B' –** *Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments*

Communal Open Spaces and all other areas of the site

- **HIL 'C' –** *Public open space such as parks, playgrounds, playing fields, secondary schools and footpaths*

16.2.2 Health Screening Levels (HSLs)

The NEPM presents Tier 1 Health Screening Levels (HSLs) for the following petroleum compounds and fractions:

- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX);
- Naphthalene; and
- TPH C_6-C_{10} and TPH >C_{10}-C_{16} fractions

The HSLs are applicable to generic land uses such as residential, commercial/industrial or recreational/public open space and different soil types between the ground surface and soils >4 metres below ground level. The HILs have been applied to assess human health risks via the inhalation and direct contact pathways of exposure.

Point 1 of Table 1A (4), which indicates that HSL D can be used in lieu of HSL B for buildings that comprise car parks or commercial properties on the ground floor.

16.2.3 Interim Soil Vapour Health Investigation Levels (Interim HILs)

The NEPM presents Interim Soil Vapour Health Investigation Levels (Interim HILs) for selected Volatile Organic Chlorinated Compounds (VOCCs).

The Interim Soil Vapour HILs are applicable to generic land uses such as residential, commercial/industrial or recreational/public open space and all soil types within the first metre depth from the ground surface or the first metre depth beneath a sub-slab. The Interim Soil Vapour HILs have been applied to assess human health risks via the inhalation pathways of exposure.

16.2.4 Ecological Investigation Levels (EILs)

The NEPM presents Ecological Investigation Levels (Interim EILs) for As, Cu, CrIII, Ni, Pb, Zn, DDT and naphthalene.

The EILs are applicable to generic land uses such as areas of ecological significance, urban residential areas and public open space, and commercial/industrial land uses. The EILs have been applied to assess risks to terrestrial ecosystems, generally, within the top 2 metres of soil at the final surface/ground level.

Site specific EILs for Copper, Zinc, Nickel and Chromium III can be derived by adding the Ambient Background Concentration (ABC) to the Added Contaminant Limits (ACL), as per the following formula:

$$EIL = ABC + ACL$$

The ABC of a contaminant is the soil concentration in a specified locality that is the sum of the naturally occurring background level and the contaminant levels that have been introduced from diffuse or non-point sources by generating anthropogenic activity not attributed to industrial, commercial, or agricultural activities.

The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required. ACLs are based on the soil characteristics of pH, CEC and clay content. Different soils types / profiles will have different contaminant EILs rather than a single generic EIL for each contaminant. ACLs apply chromium III (CrIII), copper (Cu), nickel (Ni) and zinc (Zn) for site-specific EIL determination. The soil properties to be measured for site-specific derivation of ACLs for CrIII, Cu, Ni and Zn are summarised below:

- pH - Cu
- CEC - Cu, Ni, Zn
- % clay - CrIII

Note – the lowest concentration of copper that is derived from the pH or the CEC calculation is to be used for the ACL.

Insufficient data was available to derive ACLs for As, Pb, DDT and naphthalene. As a result, the derived EILs are generic to all soils and are presented as total soil contaminant concentrations in Tables 1(B)4 and 1(B)5.

16.2.5 Ecological Screening Levels (ESLs)

Table 1B (6) of the NEPM presents Ecological Screening Levels (ESLs) for TPH C_6-C_{40} fractions, BTEX and benzo(a)pyrene.

The ESLs are applicable to generic land uses such as areas of ecological significance, urban residential areas and public open space, and commercial/industrial land uses. The ESLs have been applied to assess risks to terrestrial ecosystems, generally, within the top 2 metres of coarse or fine soil at the final surface/ground level.

16.2.6 Petroleum Hydrocarbon Management Limits

Table 1B (7) of the NEPM presents petroleum hydrocarbon management limits for application to TPH fractions C_6-C_{10}, >C_{10}-C_{16}, >C_{16}-C_{34} and >C_{34}-C_{40}. The management limits are applicable for coarse or fine soils in residential, parkland, public open space or commercial/industrial land uses following consideration of relevant ESLs and HSLs.

16.3 Asbestos in Soils

16.3.1 General

Health screening for asbestos in soil, which are based on scenario-specific likely exposure levels, are adopted from the WA DoH guidelines and are referred in Table 7 in Schedule B1.

16.3.2 Air Quality Monitoring

Asbestos and dust monitoring may be necessary during DSI, remediation and site development, and should meet the Guidelines (0.01fibre/mL) and NEPM ambient air criteria (PM10 of 50 mg/m3 over 24 hours), respectively.

Any admissible exposure to airborne asbestos should be kept as low as achievable and in any case below the specified exposure standards. These standards are determined by the *National Commission for Occupational Exposures*. Below is a summary of the threshold limits for airborne concentrations measured as a time-weighted average (TWA) fibre concentration.

Table 7: Exposure Standards – TWA Fibre Concentration Limits

Asbestos Species	Concentration (fibres/mL)
Chrysotile	0.1
Crocidolite	0.1
Amosite	0.1
Other forms	0.1
Other mixtures of species	0.1

Air monitoring must be conducted by an Occupational Hygienist or WorkCover Approved Asbestos Assessor, in accordance with the following guidelines: *Guidance Note on Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC: 3003(2005)]*.

Note: Air sampling results should not be used to conclude that there has been no asbestos fibre release from soils or materials, or to justify use of less stringent site management measures, because the sampling methodology is not sufficiently accurate or representative for these purposes.

16.4 Export of Waste

To assess the waste classification of materials to be disposed of off-site, the NSW EPA refers to the NSW EPA (2014) "*Waste Classification Guidelines, Part 1: Classifying Waste"*.

17 VALIDATION SAMPLING AND ANALYSIS QUALITY PLAN

17.1 Objectives

The objective of the Validation Sampling and Analysis Quality Plan (VSAQP) is to ensure that at completion of the remediation works, the site is suitable for its proposed redevelopment. The validation programme for each area to be remediated is detailed in the following sub-sections and the summary table of validation sampling is shown in the table below.

Table 8: Validation Programme

Area of Concern	Minimum Number of samples	Analytes to be tested
Validation Sampling beneath two residential dwellings and former service station building	2 surface samples beneath each building once demolished from a total of 6 locations, that being 2 locations per building	Heavy Metals, TRH, BTEX, OC, PAHs & Asbestos %w/w plus TCLP metals & PAH (if required).
QA/QC	1 inter-laboratory duplicate 1 intra-laboratory duplicate 1 rinsate Trip Spike / Trip Blank	Heavy Metals, TRH, BTEX, OC & PAHs BTEX & TRH (C_6-C_{10})
Validation Sampling – Waste Oil Drum & Oil/Water Separator	1 surface sample at each feature once removed	Heavy Metals, TRH, PAHs, Phenols & VOC, and TCLP metals & PAH (if required).
QA/QC	1 inter-laboratory duplicate 1 intra-laboratory duplicate 1 rinsate Trip Spike / Trip Blank	Heavy Metals, TRH, BTEX & PAHs BTEX & TRH (C_6-C_{10})
Stockpile of BH102 excavation	Allow 1 sample	Metals, TPH, BTEX, PAH & Asbestos, and TCLP metals & PAH (if required).
Validation Hotspot BH102	1 floor sample, 4 wall samples	Metals, TPH, BTEX and PAH
QA/QC	1 inter-laboratory duplicate 1 intra-laboratory duplicate 1 rinsate	Metals, TRH, BTEX & PAH

	Trip Spike / Trip Blank	BTEX & TRH (C6-C10)
Validation Hotspot BH104 QA/QC	1 floor sample, 4 wall samples 1 inter-laboratory duplicate 1 intra-laboratory duplicate	%w/w asbestos %w/w asbestos
Stockpile of BH105 excavation	Allow 2 samples	Metals, TPH, BTEX, PAH & Asbestos, and TCLP metals & PAH (if required).
Validation Hotspot BH105 QA/QC	3 floor samples, 6 wall samples 1 inter-laboratory duplicate 1 intra-laboratory duplicate 1 rinsate Trip Spike / Trip Blank	Metals, TPH, BTEX and PAH Metals, TRH, BTEX & PAH BTEX & TRH (C6-C10)
Validation Hotspot BH128 QA/QC	1 floor sample, 4 wall samples 1 inter-laboratory duplicate 1 intra-laboratory duplicate	%w/w asbestos %w/w asbestos
Stockpile of Wall-12 excavation	Allow 1 sample	Metals, TPH, BTEX, PAH & Asbestos, and TCLP metals & PAH (if required).
Validation Hotspot Wall-12 QA/QC	1 floor sample, 4 wall samples 1 inter-laboratory duplicate 1 intra-laboratory duplicate 1 rinsate Trip Spike / Trip Blank	Metals, TPH, BTEX and PAH Metals, TRH, BTEX & PAH BTEX & TRH (C6-C10)
Sampling in Communal Open Space Area QA/QC	Allow for 12 fill samples from 12 locations, and 1 natural for EIL derivation 1 inter-laboratory duplicate 2 intra-laboratory duplicate 1 rinsate Trip Spike / Trip Blank	Heavy Metals, CrIII, TPH, BTEX, PAHs and %w/w asbestos plus Heavy Metals, CrIII, CEC, pH and %clay for the natural sample only Metals, TRH, BTEX & PAH BTEX & TRH (C6-C10)

Backfill Material (if required)	Certified VENM or 1 sample per 250m^3, with a minimum of 5 samples	HM, TPH, BTEX, PAH, OCP, PCB, Phenol, Cyanide & Asbestos. Additional contaminants of potential concern may need to be included in the testing suite depending on the source site.
Unexpected Finds In-situ Sampling	1 sample every 25m^3, with a minimum of 3 samples	HM, TPH, BTEX, PAH, OCP, PCB, Phenol, Cyanide & Asbestos.
Unexpected Finds Stockpile Sampling	Small Volumes - 1 sample every 25m^3 Large Volumes - 1 sample every 100m^3	HM, TPH, BTEX, PAH, OCP, PCB, Phenol, Cyanide & Asbestos.

17.2 Additional soil sampling

The EIS Stage 2 ESA 2015 report identified a number of data gaps and to address these gaps, the following is proposed:

- Validation sampling beneath the two residential dwellings, the former service station building, the waste oil drum area and the oil/water separator area once the features have been demolished.
- The number of locations and samples to be recovered from each area are as summarised below:
    - 2 boreholes and 2 surface samples for each of the two residential dwellings and the former service station building, being a total of 6 boreholes and 6 samples plus QA/QC samples. Laboratory analysis will include the Heavy Metals, TRH, BTEX, OC, PAHs & Asbestos %w/w.
    - 1 borehole and 1 surface sample for each of the waste oil drum and the oil/water separator areas, being a total of 2 boreholes and 2 samples plus QA/QC samples. Laboratory analysis will include the Heavy Metals, TRH, PAHs, Phenols & VOC.

17.3 Waste classification of Hotspots BH104 & BH128

The excavated contaminated soil from Hotspots BH104 & BH128 has been classified as *Special General Solid Waste (Asbestos)*. The contaminated soils from Hotspots BH104 & BH128 should be disposed of an EPA licensed facility that can accept asbestos waste.

The volume of soil from Hotspots BH104 & BH128 that requires to be disposed of off-site as *Special General Solid Waste (Asbestos)* is approximately is $40m^3$ or 72T.

17.4 Validation of Hotspots BH104 & BH128

Following removal of soils from Hotspots BH104 & BH128, photographic records of the floor and wall of the excavation will be taken for reference in the Validation Report.

The minimum sampling protocols to be used per Hotspot include 1 floor sample and 4 wall samples. Soil validation samples will be collected and analysed for %w/w asbestos.

Where contaminant concentrations in validation samples exceed the site remediation criteria, further excavation must be carried out, until new validation samples return concentrations below the site validation criteria.

17.5 Waste classification of Hotspot BH102

In the vicinity of BH102, where hydrocarbons (TRH) were detected, excavate a 5m x 5m hotspot area to an initial depth of 0.2m and then stockpile. One soil sample will be recovered from the stockpiled soils and analysed for heavy metals, TPH, BTEX, PAH & asbestos, with TCLP for metals & PAH if required.

The stockpile will then be classified wrt the NSW EPA (2014) Waste Classification Guidelines and disposed of to an appropriately licensed facility. The approximate volume to be disposed of is $5m^3$ or 9T.

17.6 Validation of Hotspot BH102

Following removal of soils from Hotspot BH102, photographic records of the floor and wall of the excavation will be taken for reference in the Validation Report.

The minimum sampling protocols to be used include 1 floor sample and 4 wall samples. Soil validation samples will be collected and analysed for Metals, TPH, BTEX and PAH.

Where contaminant concentrations in validation samples exceed the site remediation criteria, further excavation must be carried out, until new validation samples return concentrations below the site validation criteria.

17.7 Waste classification of Hotspot BH105

In the vicinity of BH105, where hydrocarbons (TRH) were detected, excavate a 20m x 10m hotspot area to an initial depth of 0.2m and then stockpile. Two soil samples will be recovered from the stockpiled soils and analysed for heavy metals, TPH, BTEX, PAH & asbestos, with TCLP for metals & PAH if required.

The stockpile will then be classified wrt the NSW EPA (2014) Waste Classification Guidelines and disposed of to an appropriately licensed facility. The approximate volume to be disposed of is $40m^3$ or 72T.

17.8 Validation of Hotspot BH105

Following removal of soils from Hotspot BH105, photographic records of the floor and wall of the excavation will be taken for reference in the Validation Report.

The minimum sampling protocols to be used include 3 floor samples and 6 wall samples. Soil validation samples will be collected and analysed for Metals, TPH, BTEX and PAH.

Where contaminant concentrations in validation samples exceed the site remediation criteria, further excavation must be carried out, until new validation samples return concentrations below the site validation criteria.

17.9 Waste classification of Hotspot Wall-12

In the vicinity of Wall-12, where hydrocarbons (TRH & BTEX) were detected, excavate a 5m x 5m hotspot area to an initial depth of 0.5m and then stockpile. One soil sample will be recovered from the stockpiled soils and analysed for heavy metals, TPH, BTEX, PAH & asbestos, with TCLP for metals & PAH if required.

The stockpile will then be classified wrt the NSW EPA (2014) Waste Classification Guidelines and disposed of to an appropriately licensed facility. The approximate volume to be disposed of is 12.5m^3 or 22.5T.

17.10 Validation of Hotspot Wall-12

Following removal of soils from Hotspot Wall-12, photographic records of the floor and wall of the excavation will be taken for reference in the Validation Report.

The minimum sampling protocols to be used include 1 floor sample and 4 wall samples. Soil validation samples will be collected and analysed for Metals, TPH, BTEX and PAH.

Where contaminant concentrations in validation samples exceed the site remediation criteria, further excavation must be carried out, until new validation samples return concentrations below the site validation criteria.

17.11 Additional soil sampling – Communal Open Space Area

Additional soil sampling is to be undertaken within the proposed communal open soil area to determine the suitability of the fill materials to be retained in this area.

We therefore recommend that further soil sampling be undertaken once the building and associated concrete slabs have been removed. The further soil investigation in this area should identify the depth of fill and the concentrations of contaminants in fill soils.

In total, 12 soils samples will be recovered from 12 locations and analysed for Heavy Metals, CrIII, TPH, BTEX, PAHs and %w/w asbestos.

One uncontaminated natural soil sample will be recovered and analysed for Heavy Metals, CrIII, CEC, pH and %clay in order to determine the site derived EILs.

17.12 Waste classification of the Remaining Fill Materials

The fill layer has already been sampled as part of the previous works, therefore this data will be used in conjunction with any further waste classification assessments undertaken across the site.

The fill materials may be classified insitu or excavated and temporarily stockpiled on a heavy duty plastic sheet or a sealed surface such as concrete, and covered with an impermeable plastic sheet to prevent rain infiltration.

The fill materials will be classified according to the NSW EPA Waste Classifying Guidelines and disposed of to a licensed facility. For all fill materials to be removed off site w.r.t. the basement excavation works, these soils will be managed by segregating material able to meet reuse criteria and taken to an appropriate reuse facility as general solid waste with the remaining materials taken off site for appropriate landfill disposal (if above re-use criteria). If areas of fill are considered potentially able to meet ENM criteria, then appropriate testing will occur w.r.t. ENM exemption criteria for batches.

17.13 Disposal of Excavated Material

Soils excavated from the site will be disposed of at an appropriately licensed landfill facility. If disposal of contaminated liquids is required, this will be undertaken by a licensed contractor. The weighbridge and truck dockets must be retained by the contractor and made available to the Client's environmental representative. Waste disposal documentation should be included in the Validation Report as a means to verify that soils from site have been disposed of appropriately.

17.14 Validation Of Areas Where Fill Has Been Temporarily Stockpiled

The excavated contaminated fill will be temporarily stockpiled on a plastic sheet and covered with an impermeable plastic sheet to prevent rain infiltration. However, if this is not carried out, soil samples must be collected beneath stockpiles following off-site disposal to confirm that cross-contamination of the soil underneath has not occurred during stockpiling.

17.15 Validation Of Imported Fill

If required, the imported fill must be certified VENM material OR other material that is certified and suitable to be used on the site and be tested in accordance with the requirements of the NSW EPA waste classification guidelines (including testing for asbestos) at a rate of 1 sample per 250 m^3. It will also be visually assessed for fibro sheeting and samples analysed for asbestos if detected. A minimum of 5 samples for imported fill will be conducted.

17.16 Field Measurements

A sub-sample should be taken from each soil sampling location and placed in zip-lock bags for headspace analysis using a calibrated PID meter.

17.17 Field QA/QC

17.17.1 Sample Collection Methodology

All samples must be collected by a suitably qualified person, collected in the appropriate containers and labelled to identify their origins.

Primary and QA/QC samples should be placed in clean laboratory-supplied containers appropriate for each suite of analysis required, leaving no headspace, and closed using Teflon-coated lids.

Soil sampling for asbestos will be carried out in general accordance with the following protocols as outlined in the NEPM 2013 guidelines:

- A minimum 10L sample from each sample location will be recovered;
- Each sample (minimum of 10 L) will be screened through a 7mm sieve and the material retained on the sieve examined for any bonded ACM and / or suspect material and forwarded to the laboratory for analysis if any suspected ACM is encountered;
- If visible FA material is present or suspected, the soil should be wetted to minimise the release of fibres;
- Identified bonded ACM and FA should be weighed for each sample;
- One wetted 500ml sample from each sampling location will be submitted for laboratory analysis for AF;
- %w/w will be quantified in the laboratory results and reported in the subsequent validation report.

17.17.2 Sample Preservation

Samples should be stored in an ice brick-cooled esky or similar and transported to the laboratory. The samples should be sent to the laboratory for analysis within 24 hours of collection. Chain of Custody documentation and handling protocols must be in accordance with the guidelines particularly the Australian Standard AS4482.1 (2005) and the NEPM (2013).

17.17.3 Decontamination Procedures

As a minimum standard, decontamination of non-dedicated sampling equipment should be achieved by washing the equipment with phosphate-free detergent and tap water, followed by a final rinse with distilled water. Decontamination should be conducted after the collection of samples at each sample location.

17.17.4 QA/QC Samples

The minimum target frequency for each type of QA/QC sample should be carried out in accordance with the following tables:

Table 9: QA/QC Requirements

Field QA/QC Sample	Frequency (Soil)
Intra-Laboratory Duplicate	1 in 10 samples
Inter-Laboratory Duplicate	1 in 20 samples
Field Blanks	1 per day (rinsate)
Trip Blank	1 per sample batch
Trip Spike	1 per sample batch

18 CONCLUSIONS

It is considered that the site will be suitable for the redevelopment into five medium density residential buildings with basement car parking, fourteen townhouses, roads and communal open spaces subject to the implementation of remediation and validation works in accordance with this RAP.

We would be pleased to provide further information on any aspects of this report.

For and on behalf of

Aargus Pty Ltd

Mark Kelly
Environmental Manager

Reviewed by

Nick Kariotoglou
Senior Principal

19 LIMITATIONS

The Aargus assessment is based on the result of limited site investigations and sample testing. Neither Aargus, nor any other reputable consultant, can provide unqualified warranties nor does Aargus assume any liability for site conditions not observed or accessible during the time of the investigations.

Despite all reasonable care and diligence, the materials encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. In addition, site characteristics may change at any time in response to variations in natural conditions, chemical reactions and other events, e.g. groundwater movement and or spillages of contaminating substances. These changes may occur subsequent to Aargus investigations and assessment.

This report and associated documentation and the information herein have been prepared solely for the use of the client and interested parties at the time and is valid (for the purposes of transport of material) for a period of one month only from the date of issue. Any other reliance assumed by third parties on this report shall be at such parties' own risk. Any ensuing liability resulting from use of the report by third parties cannot be transferred to Aargus.

Please note that Part 5.6, Section 143 of the Protection of the Environment Operations (POEO) Act 1997 states that is an offence for waste to be transported to a place that cannot lawfully be used as a facility to accept that waste. It is the duty of the owner and transporter of the waste to ensure that the waste is disposed of appropriately. Aargus accepts no liability for the unlawful disposal of waste materials from any site. Aargus does not accept any responsibility for the material tracking, loading, management, transport or disposal of waste from the site. Before disposal of the material to a licensed landfill is undertaken, the waste producer will need to obtain prior consent from the landfill. The receiving site should check to ensure that the material received matches the description provided in the report.

Opinions are judgements, which are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions.

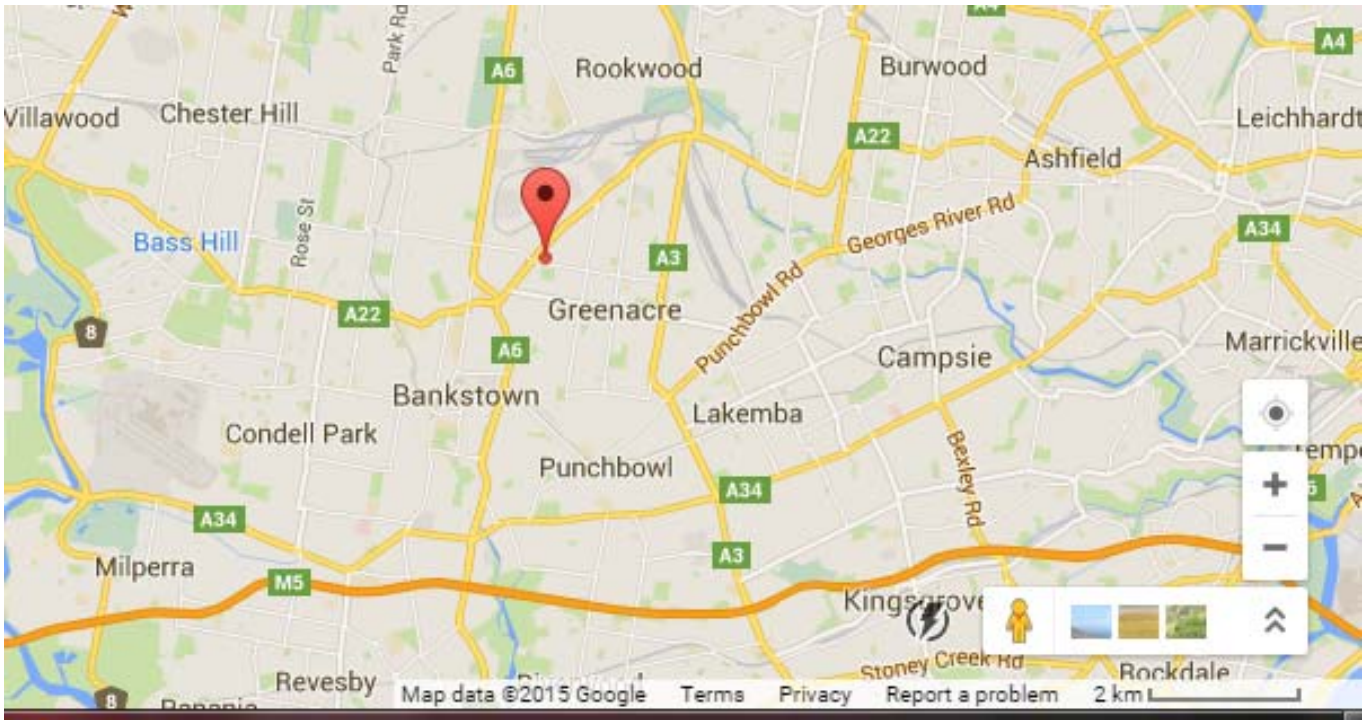
REFERENCES

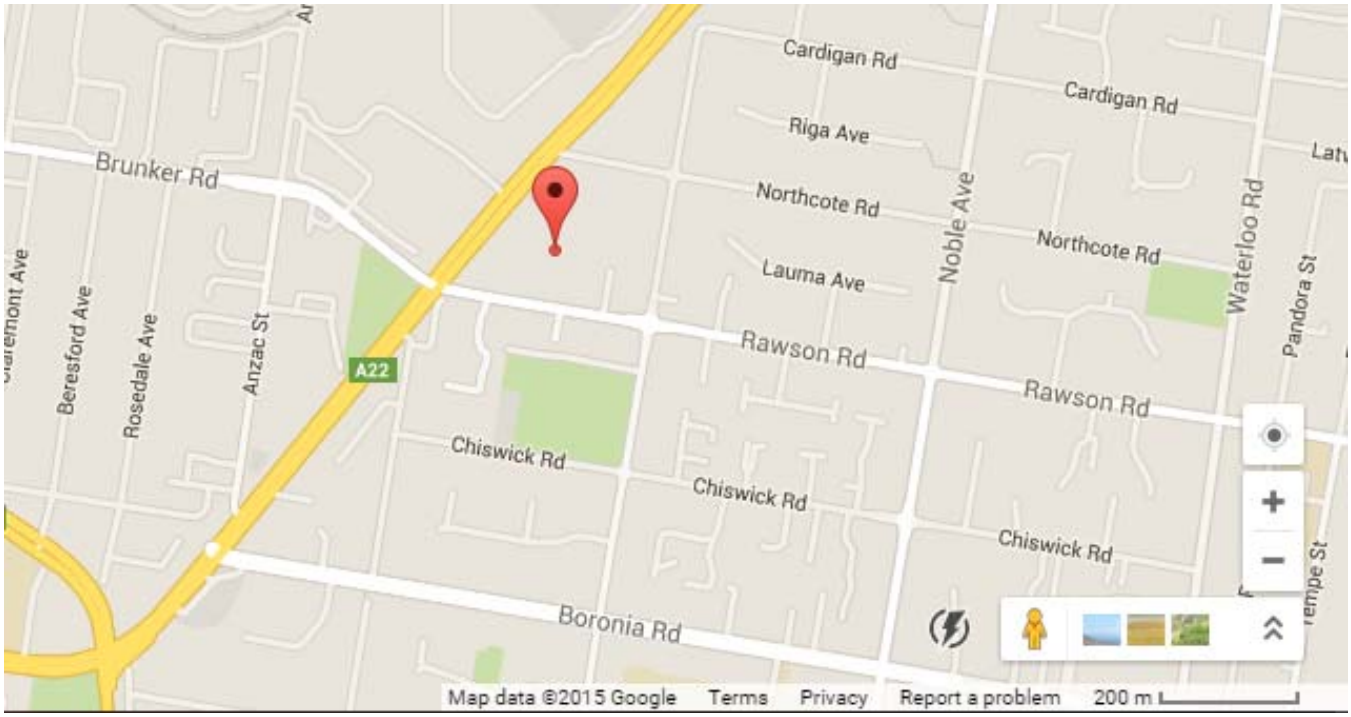
- Department of Urban Affairs and Planning – EPA (1998) "*Managing Land Contamination – Planning Guidelines – SEPP 55 – Remediation of Land*"
- National Environmental Protection Council (NEPC) (2013) National Environmental Protection (Assessment of Site Contamination) Measure.
- NSW EPA (1994) "*Guidelines for Assessing Service Station Sites*".
- NSW EPA (1995) "*Sampling Design Guidelines*".
- NSW EPA (2011) "*Guidelines for Consultants Reporting on Contaminated Sites*".
- NSW EPA (2006, 2nd Edition) "*Guidelines for the NSW Site Auditor Scheme*".
- NSW EPA (2009) "*Guidelines on Significant Risk of Harm from contaminated land and the duty to report*".
- NSW EPA *"Waste Classification Guidelines, Part 1: Classifying Waste"* (2014).
- Environmental Investigation Services (2002) - "Environmental Site Screening, 213-241A Hume Highway, Greenacre NSW" (Report Ref: E16518FRPTK, dated 22 January 2002).
- Environmental Investigation Services (2015) - "Stage 2 Environmental Site Assessment, 225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW" (Report no: E28203Krpt, dated 25th April 2015).
- Environmental Investigations (2006) - "*Site Contamination Assessment and Tank Pit Validation, at 225 Hume Highway, Greenacre*" (Report no: E561.1 AAKrpt, dated 3 May 2006).

APPENDIX A

SITE PLANS

SITE LOCALITY MAP





Source: Google Maps 2015

PROJECT DETAILS			DRAWING DETAILS			
Project Title	Remediation Action Plan		**Figure No.**	1	**Rev No.**	0
Project No.	ES6324		**Scale**	As above	**Size**	A4
Client	Medica Properties Pty Ltd		**Drawn by**	MK	**Date**	22.07.15
Site Address	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW		**Approved by**	MK	**Date**	23.07.15

Aargus

LOT & DP LAYOUT

Source: Platinum Design Architects

ABN 75 050 212 710 Aargus Pty Limited Environment – Remediation – Geotechnical Engineering

PROJECT DETAILS		DRAWING DETAILS			
Project Title	Remediation Action Plan	Figure No.	2	Rev No.	0
Project No.	ES6324	Scale	NTS	Size	A3
Client	Medica Properties Pty Ltd	Drawn by	MK	Date	22.07.2015
Site Address	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW	Approved by	MK	Date	23.07.2015

Aargus

LOT & DP LAYOUT – AERIAL VIEW

Source: Six Maps 2015

PROJECT DETAILS		DRAWING DETAILS			
Project Title	Remediation Action Plan	**Figure No.**	3	**Rev No.**	0
Project No.	ES6324	**Scale**	1:2,257	**Size**	A4
Client	Medica Properties Pty Ltd	**Drawn by**	MK	**Date**	22.07.15
Site Address	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW	**Approved by**	MK	**Date**	23.07.15

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SAMPLING LOCATIONS

Source: Environmental Investigation Services Report Ref: E28203K, dated 25th April 2015

ABN 75 050 212 710 Aargus Pty Limited Environment – Remediation – Geotechnical Engineering

PROJECT DETAILS	
Project Title	Remediation Action Plan
Project No.	ES6324
Client	Medica Properties Pty Ltd
Site Address	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW

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DRAWING DETAILS			
Figure No.	4	Rev No.	0
Scale	1:850	Size	A3
Drawn by	MK	Date	22.07.2015
Approved by	MK	Date	23.07.2015

EXCEEDANCE PLAN

Source: Environmental Investigation Services Report Ref: E28203K, dated 25th April 2015

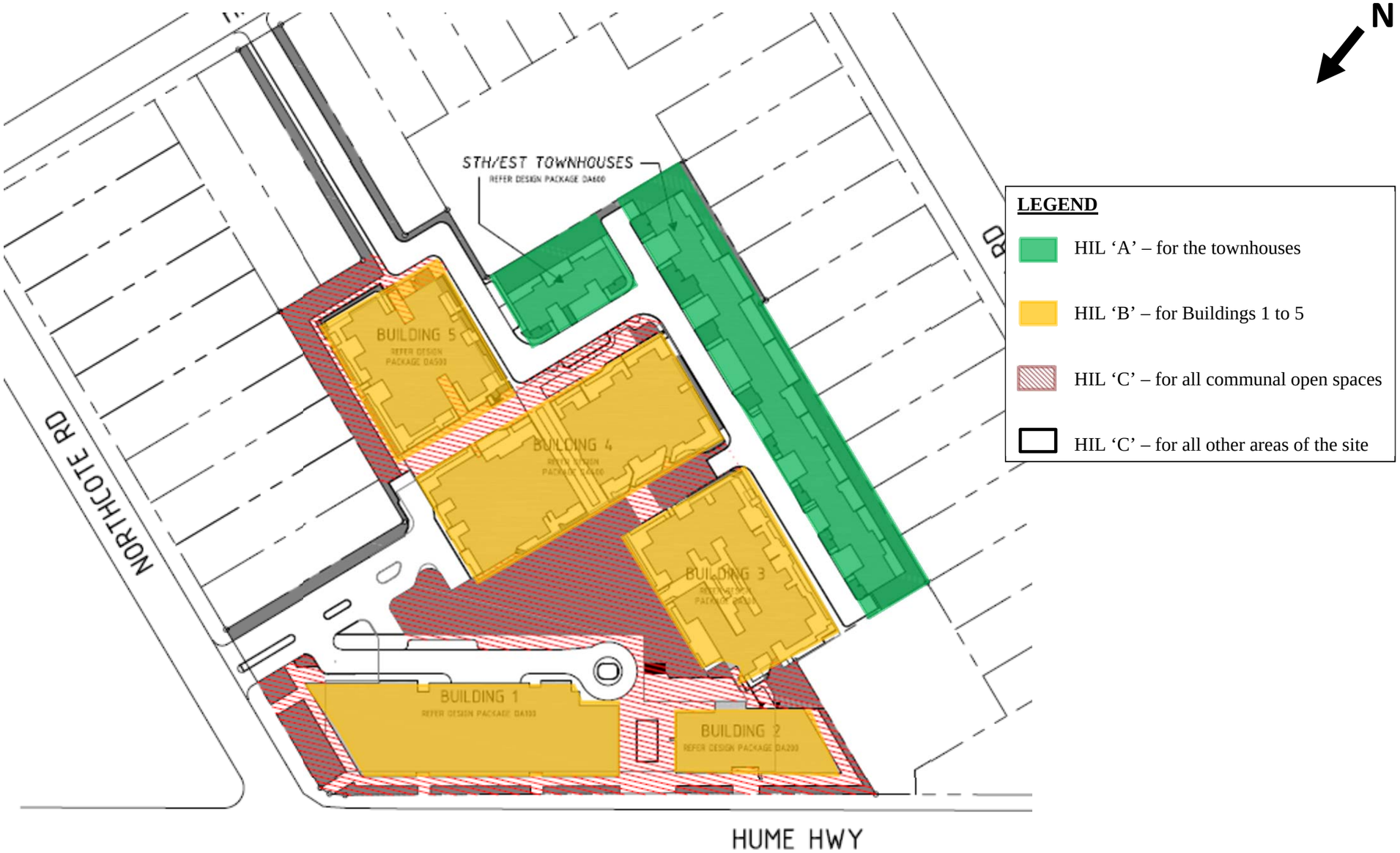
ABN 75 050 212 710 Aargus Pty Limited Environment – Remediation – Geotechnical Engineering

PROJECT DETAILS	
Project Title	Remediation Action Plan
Project No.	ES6324
Client	Medica Properties Pty Ltd
Site Address	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW

Aargus

DRAWING DETAILS			
Figure No.	5	Rev No.	0
Scale	1:850	Size	A3
Drawn by	MK	Date	22.07.2015
Approved by	MK	Date	23.07.2015

ADOPTED CRITERIA

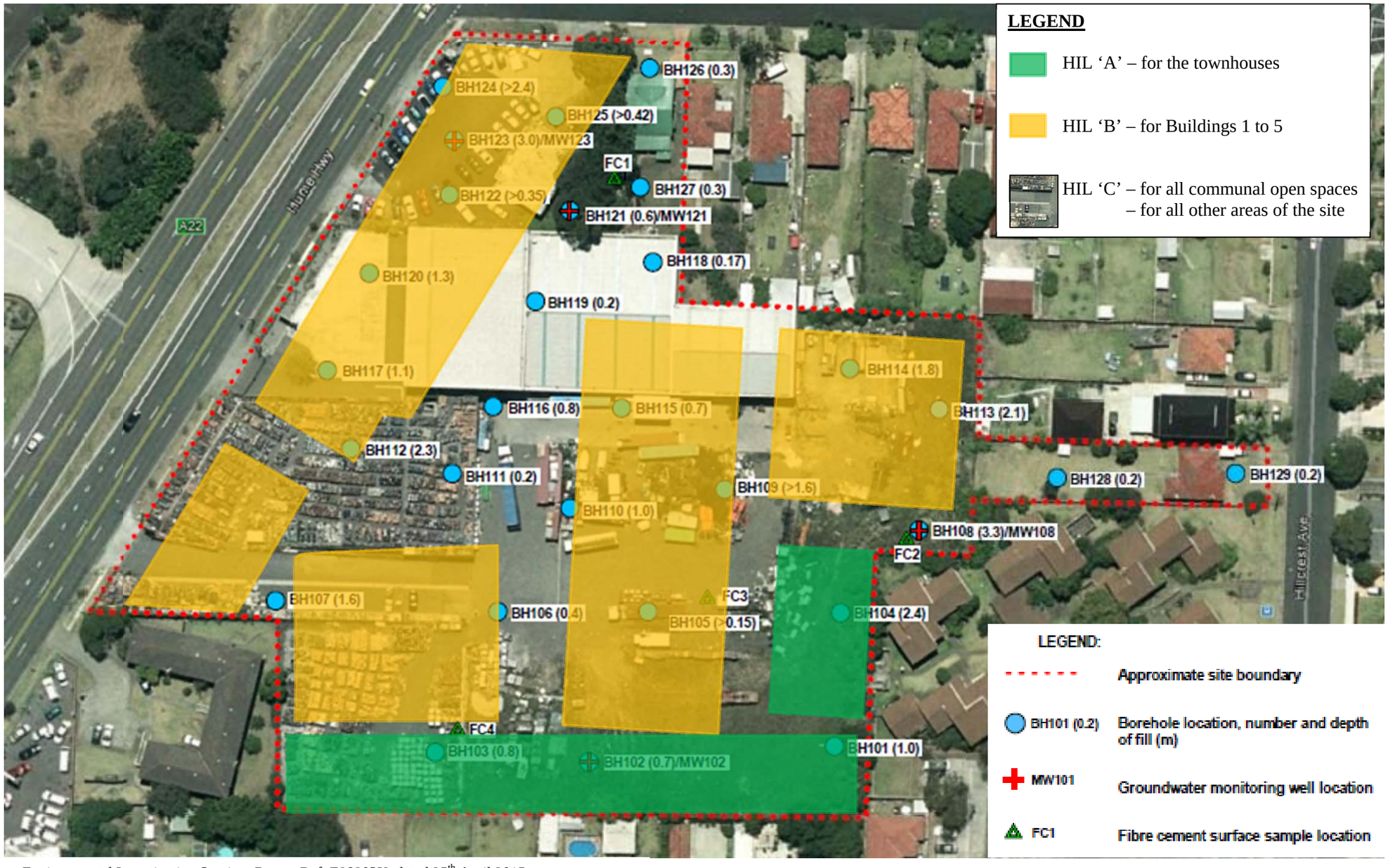


Source: Platinum Design Architects

PROJECT DETAILS		DRAWING DETAILS			
Project Title	Remediation Action Plan	Figure No.	6	Rev No.	0
Project No.	ES6324	Scale	NTS	Size	A3
Client	Medica Properties Pty Ltd	Drawn by	MK	Date	22.07.2015
Site Address	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW	Approved by	MK	Date	23.07.2015

Aargus

BOREHOLES ON DEVELOPMENT LAYOUT



Source: Environmental Investigation Services Report Ref: E28203K, dated 25th April 2015

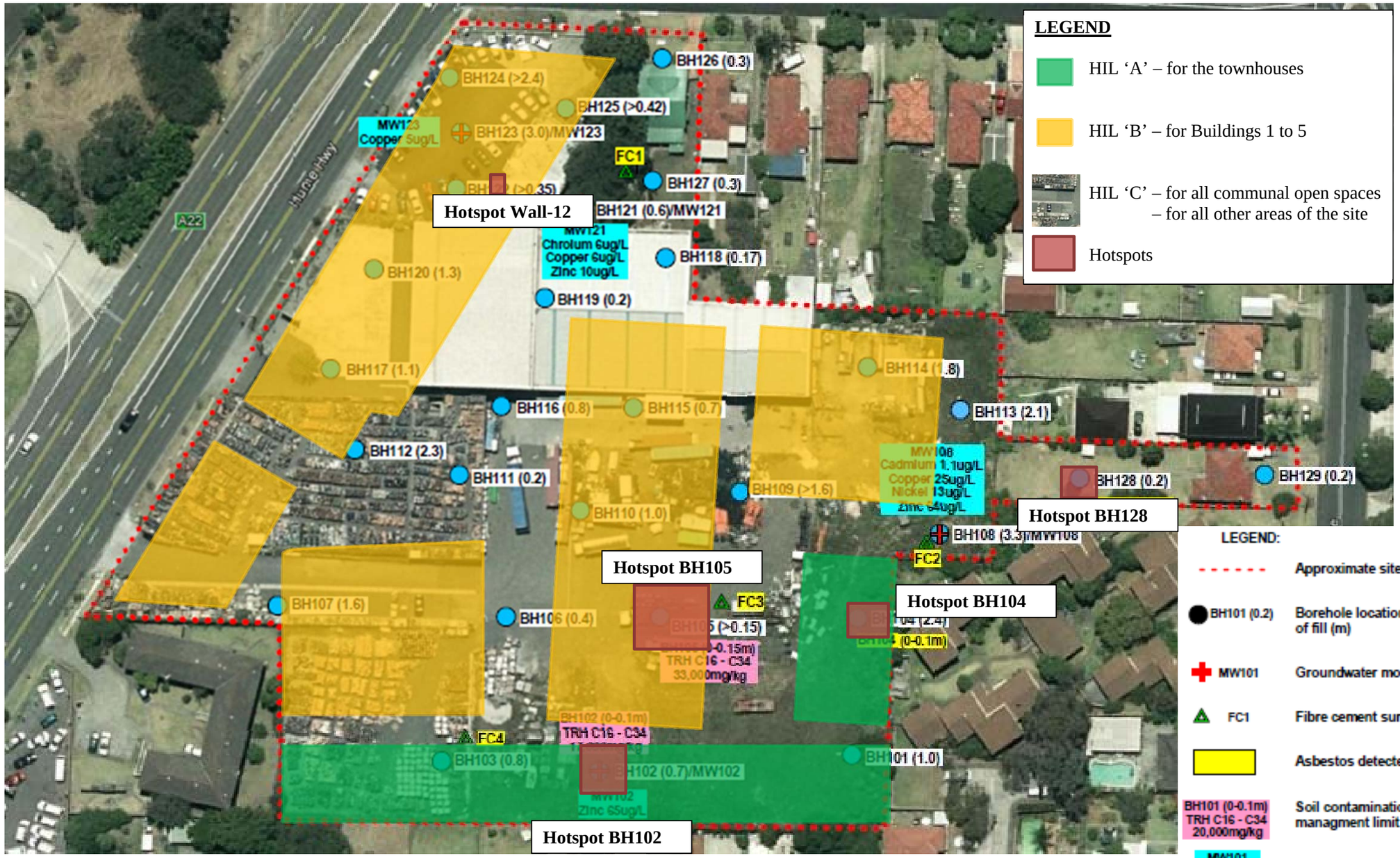
ABN 75 050 212 710 Aargus Pty Limited Environment – Remediation – Geotechnical Engineering

PROJECT DETAILS	
Project Title	Remediation Action Plan
Project No.	ES6324
Client	Medica Properties Pty Ltd
Site Address	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW

Aargus

DRAWING DETAILS			
Figure No.	7	Rev No.	0
Scale	1:850	Size	A3
Drawn by	MK	Date	22.07.2015
Approved by	MK	Date	23.07.2015

HOTSPOTS ON DEVELOPMENT LAYOUT



Source: Environmental Investigation Services Report Ref: E28203K, dated 25th April 2015

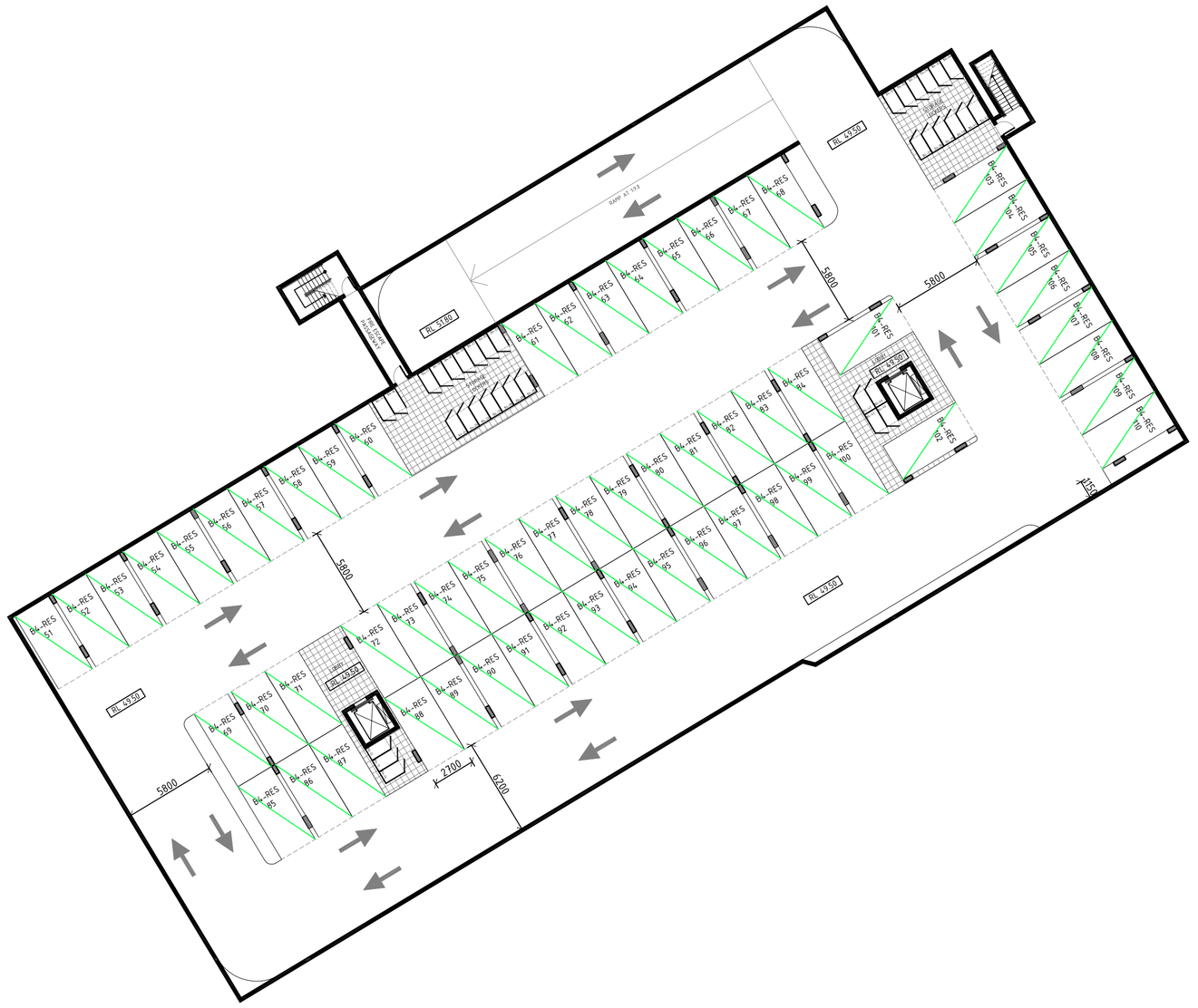
PROJECT DETAILS	
Project Title	Remediation Action Plan
Project No.	ES6324
Client	Medica Properties Pty Ltd
Site Address	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW

Aargus

DRAWING DETAILS			
Figure No.	8	Rev No.	0
Scale	1:850	Size	A3
Drawn by	MK	Date	22.07.2015
Approved by	MK	Date	23.07.2015

APPENDIX B

PROPOSED DEVELOPMENT PLANS



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1:250 @ A1

NORTH

PLATINUM DESIGN ARCHITECTS

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DEVELOPMENT APPLICATION

PROJECT
HUME HWY
REDEVELOPMENT

LOCATION
225–241A HUME HWY/112 NORTHCOTE/24 HILLCREST AVE, GREENACRE

AMENDMENTS

ISSUE	AMENDMENT	DATE
P1	PRELIMARY ISSUE	08.12.2014
P2	INFORMATION RESPONSE	29.05.2015
P3	COUNCIL RESPONSE	18.08.2015

CLIENT
MEDICA PROPERTY HOLDINGS PTY LTD

TITLE
BASEMENT LVL02 SITE PLAN

SCALE	DATE	DRAWN
1: 250@A1 1: 500@A3	18.08.2015	NF
JOB NUMBER	SHEET No	ISSUE
565	DA010	P3

PLATINUM DESIGN ARCHITECTS	TELEPHONE 07 3189 1036 MOBILE 040 212 9944 EMAIL dino@platinumdesignarchitects.com	DEVELOPMENT APPLICATION PROJECT: HUME HWY REDEVELOPMENT LOCATION: 225-241A HUME HWY/112 NORTHCOTE/24 HILLCREST AVE, GREENACRE	CLIENT: MEDICA PROPERTY HOLDINGS PTY LTD TITLE: BASEMENT LVL01 SITE PLAN

AMENDMENTS

ISSUE	AMENDMENT	DATE
P1	PRELIMARY ISSUE	04.11.2014
P2	BUILDING 1 BASEMENT LEVEL REVISED	08.12.2014
P3	STAGING LINES ADDED	04.02.2015
P4	INFORMATION RESPONSE	29.05.2015
P5	PRELIMINARY COUNCIL RESPONSE	18.08.2015

SCALE	DATE	DRAWN
1:250@A1 1:500@A3	18.08.2015	NF
JOB NUMBER	SHEET No	ISSUE
565	DA011	P5

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	EMAIL dino@platinumdesignarchitects.com	LOCATION: 225–241A HUME HWY/112 NORTHCOTE/24 HILLCREST AVE, GREENACRE

AMENDMENTS

ISSUE	AMENDMENT	DATE
P1	PRELIMARY ISSUE	04.11.2014
P2	BUILDING 1 BASEMENT LEVEL REVISED	08.12.2014
P3	STAGING LINES ADDED	04.02.2015
P4	INFORMATION RESPONSE	29.05.2015
P5	COUNCIL RESPONSE	18.08.2015

CLIENT: MEDICA PROPERTY HOLDINGS PTY LTD

TITLE: GROUND FLOOR SITE PLAN – SHEET 1

SCALE	DATE	DRAWN
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JOB NUMBER	SHEET No	ISSUE
565	DA012	P5

JOINS DA012

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1:250 @ A1

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DEVELOPMENT APPLICATION

PROJECT
HUME HWY
REDEVELOPMENT

LOCATION
225–241A HUME HWY/112
NORTHCOTE/24 HILLCREST
AVE, GREENACRE

AMENDMENTS

ISSUE	AMENDMENT	DATE
P1	PRELIMARY ISSUE	08.12.2014
P2	STAGING LINES ADDED	04.02.2015
P3	INFORMATION RESPONSE	29.05.2015
P4	COUNCIL RESPONSE	14.08.2015

CLIENT
MEDICA PROPERTY
HOLDINGS PTY LTD

TITLE
GROUND FLOOR SITE
PLAN – SHEET 2

SCALE	DATE	DRAWN
1:250@A1 1:500@A3	14.08.2015	NF
JOB NUMBER	SHEET No	ISSUE
565	DA013	P4

APPENDIX C

WORK HEALTH SAFETY PLAN

Aargus

Aargus
AUSTRALIA

Environmental - Remediation - Engineering - Laboratories - Drilling

WORK HEALTH AND SAFETY PLAN

for

225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre NSW

Prepared for

Medica Properties Pty Ltd

23rd July 2015

HEAD OFFICE: PO Box 398 Drummoyne NSW 1470
Telephone: 1300 137 038 Facsimile: 1300 136 038 Email: admin@aargus.net Website: www.aargus.net
Aargus Pty Ltd ACN 063 579 313 Aargus Engineering Pty Ltd ACN 050 212 710 Aargus Laboratories Pty Ltd ACN 086 993 937

TABLE OF CONTENTS

APPENDICES

Aargus

1.0 INTRODUCTION

Aargus Pty Ltd has been engaged to undertake a remediation and validation program on behalf of our client. Project specific details are provided in Appendix 1.

Personnel engaged on the project will be provided with a copy of this plan. When you have read the Work Health and Safety Plan you are asked to sign a Statement of Compliance and Confidentiality. You will also be asked to complete and sign a Safe Work Method Statement (provided in Appendix 2) prior to works commencing.

2.0 OBJECTIVES

The objective of the plan is to protect the health and safety of workers on the project. This document will also serve to familiarise workers with good work practices, which should be followed during on- site activities. It also identifies those people who should follow the guidelines set out in the plan.

3.0 KEY PEOPLE AND THEIR RESPONSIBILITIES

The Project Manager has overall responsibility for Work Health and Safety on the Project. The responsibilities of the Project Manager include:

- Developing and reviewing health and safety site specific requirements;
- Identifying, assessing and controlling hazards;
- Ensuring the Site Coordinator is fully conversant with their responsibilities;
- Inspecting the site on a random basis, to ensure health and safety requirements are followed; and

- Reviewing all accident and non-conformance forms forwarded by the Site Coordinator.

The Site Coordinator is responsible for Work Health and Safety on the site itself. Personnel, visitors and sub-contractors must follow his/her directions and adhere to the requirements of the Work Health and Safety Plan. Specific responsibilities include:

- Advising personnel of the health and safety requirements and procedures;
- Implementing health and safety requirements and procedures;
- Maintaining health and safety and first aid equipment;
- Providing First Aid assistance whenever necessary;
- Inspecting the site to ensure all equipment is in order and that work procedures are followed;
- Completing all accident and non-conformance forms when required, forwarding such forms to the Project Manager;
- Informing the client of any hazardous and emergency conditions; and
- In the event of an emergency, informing other Authorities as required.

4.0 SITE DESCRIPTION

The address of the site and a site plan are provided in Appendix 1.

5.0 PROPOSED SITE ACTIVITIES

This health and safety plan describes precautionary measures to be carried out in relation to site work to be conducted by and on behalf of Aargus Pty Ltd. It also presents procedures for responding to emergencies and other incidents.

Site work may comprise of any of the following:

- Use of a drill rig, concrete coring, excavators, backhoes, cranes, trucks, vehicles, hand augers, geoprobes and electronic equipment;
- Collection of soil samples for analysis;
- Removal of concrete slabs;
- Excavation of contaminated soil;
- Treatment of contaminated soil;
- Storage and disposal of treated soil;
- Collection of contaminated water;
- Backfilling of excavations with approved material;
- Paving or reinstatement of surfaces; and
- Erection of fences, site accommodation facilities and facilities for collecting or treating environmental contaminants (including plumbing or electrical connections thereto).

The specific site activities to be undertaken for this project are listed in Appendix 1 and can be referred to within the contractors Construction Management Program.

6.0 PROJECT HAZARDS

A number of hazards are likely to be present on this project. Some of these are common to many types of industrial work, some are specific to this project. Please observe the following safety guidelines.

6.1 Potential Hazards

The most common physical hazards are described in the table below. Personnel must be aware of hazards and exercise care in minimising the risks associated with these hazards.

POTENTIAL HAZARD & PRECAUTIONS

Pit Excavations

- **Barricade** excavations and open boreholes
- Works in excavations need to be performed in compliance with the WHSA *Code of Practice for Safety Precautions in Trenching Operations*. In particular, **do not enter** an unshored or unbattered trench which is greater than 1.5 m in depth.
- Excavated areas can be soft or slippery, especially the sloped ramps or batters of pits and trenches. **Test for surface stability and traction** before entering pits or trenches.
- **Use the length of the ramp** to enter pits or trenches. Do not step down into an excavation from the side of the pit or trench.
- **Chemical vapours** given off by contaminated soil or water can be flammable, intoxicating or suffocating. Heavier-than-air vapours can accumulate in depressions. Use respiratory equipment as necessary.
- Be mindful of the possibilities of **falling objects**.

Confined spaces (i.e. in basements of buildings, storage rooms, below platforms etc.)

- No confined space work is permitted on the site

Hot work

- **"Hot work"** is any work which can produce a source of ignition eg. sparks, hot surfaces or flames. Examples are cutting or grinding, welding or brazing, cutting with a flame (oxy torch), some electrical equipment, hammering, chiselling, chipping and use of internal combustion engines.
- The Site Co-ordinator will check whether the area is free of potentially harmful vapours and a **Hot Work Permit** must be issued by the Site Co-ordinator.

Trafficked Areas

- Place **warning signs** in visible locations where they provide sufficient notice to traffic of works ahead.
- Wear **safety vests** and other personal protective equipment.
- **Barricade** the workplace.

Mobile equipment

- Operators must use **care** when moving equipment especially when reversing and other people on-site should be aware of traffic.
- An assistant must **guide** a heavy vehicle when it is reversing unless it has a reversing buzzer and adequate clearance behind it.
- Flashing warning light should be used on the roof in areas where heavy vehicles frequent.

Underground services

- The Site Coordinator will be responsible for ensuring **sample locations are cleared with site employees** so as not to interfere with underground piping or services.
- A **search for underground services** may also be performed, by engaging a specialist contractor.
- Personnel should be aware of **bunting and markers** which may indicate services (such as electrical cables or sewers) buried in the ground.

Electricity

- **Check for overhead electricity wires** before raising any extended equipment (eg. drill rigs, augers). A minimum distance of 3 metres must be kept from overhead power lines of less than 330 kV, unless it is otherwise shown to be safe. A minimum of 8 metres clearance must be kept from overhead power lines of more than 330 kV.
- **Check for underground services** prior to drilling or excavating. Ensure mains electrical connections and switches are **kept dry**, and do not operate with wet hands.

Gas

- Gas lines should **not be disturbed**. Alert the Site Co-ordinator.

Compressed Air

- Ensure that the air supply valve is closed and the pressure is released before any air hose is disconnected. Never direct a stream of compressed air at yourself or another person.

Explosive Hazards

- The use of naked flames will only be allowed if a **Hot Work Permit** has been obtained. Smoking will not be allowed in the work area.

Manual Handling

- Do not attempt to lift **large or bulky items** without assistance. **Lifting assistance** may be in the form of a lifting or carrying device (eg. trolley) or with the aid of one or more co-workers.

Trips and Falls

- Ensure footwear is **appropriate** for the surface.
- **Do not run** on-site, and exercise caution when near trip hazards.
- Keep the workplace **tidy**, do not leave tools, equipment or materials where they could be a hazard.
- Use **handrails** on stairways.

Sunlight

- Wear shade hats, sunscreen and sunglasses as necessary.

Noise

- Works causing elevated noise will not occur outside of 7 am to 6 pm
- Monday to Friday, and 8 am to 4 pm on Saturday. **Use earplugs or earmuffs** as necessary, and when in designated hearing protection areas.

Heat Stress

- Each worker should **monitor colleagues** for signs of heat stress (loss of concentration, profuse sweating, dizziness, lethargy etc).
- **Consume sufficient fluids** to remain adequately hydrated and implement **rest** regimes.

Dust Generation

- Light watering of exposed soil in excavation areas and stockpiles wll be undertaken as needed to suppress the generation of dust.
- Each worker should be supplied with and wear an appropriate particulates rated respirator where necessary.

Odour Control

- To suppress any offensive odours encountered during the excavation and stockpiling of hydrocarbon impacted soil, a liquid odour suppressant (such as Biosolve) should be used as required.

Air

- Ambient air monitoring will be undertaken once a day during the remediation works using a photoionisation detector (PID) in three locations. One reading should be taken in the active work zone surrounding the excavation, one to the south of the excavation in the vicinity of the railway station building and one to the

north of the excavation, towards the site boundary with neighbouring residential properties

- If the PID measures volatile vapours within ambient air concentrations exceeding 50 ppm, excavation works should cease and the source of the vapours should be investigated.
- Each worker should be supplied with and wear an appropriate combined particulates, organic vapours and acid gases rated respirator where necessary.

6.2 Site Specific Chemical Hazards

Chemical contaminants may be present on a site in:

- Soil;
- Groundwater;
- Waste;
- Dust;
- Surface water; and
- Air.

Specific **Work Health and Safety information** on the hazardous chemicals listed above is presented in Appendix 1 and in the **chemical data sheets** (Appendix 3). Where possible, the chemical data sheets provided are Material Safety Data Sheets (MSDSs) prepared by a manufacturer. However, this is not always possible, as chemical contaminants are rarely pure, manufactured products. As chemical contaminants are usually present in a mixture with soil, water or waste, they are likely to be present at lower concentrations than is assumed in the chemical data sheets or MSDSs. Compliance with the health and safety requirements of the chemical data sheets or MSDSs should therefore be a conservative approach.

Relevant **airborne concentrations** of the contaminants at which no adverse health effects occur or undue discomfort is caused (exposure standards) are listed in Appendix

1. These exposure standards have been prepared by the National Occupational Health and Safety Commission, Australia.

Relevant airborne concentrations of the contaminants at which no adverse health effects occur or undue discomfort is caused (exposure standards) are listed in Appendix 1. These exposure standards have been prepared by the National Occupational Health and Safety Commission, Australia.

Personnel should be aware of these potential risks to health and safety. Safety precautions are detailed in Section 7 and 8 of this Health and Safety Plan and contained in each of the chemical data sheets and MSDSs in Appendix 3.

7.0 HEALTH AND SAFETY EQUIPMENT

The health and safety equipment on-site consists of the following:

- Personal protective equipment;
- First aid equipment; and
- Fire extinguishers suitable for ordinary combustibles, flammable liquids and electrical fires.

The Site Co-ordinator will be responsible for instruction of personnel in the use and maintenance of health and safety equipment.

7.1 Personal Protection

The personal protection regimes which apply on work sites follow the modified OSHA/NIOSH (USA) classifications, namely:

Level A Full chemical suit with self-contained breathing apparatus (SCBA) using tanks or airline.

Level B Use of SCBA with lesser protective suits.

Level C2 Use of full-face cartridge respirators.

Level C1 Use of half-face respirators.

Level D Use of minimal level of protection. This includes:

- Long sleeved shirt and trousers;
- Gloves (for protection against dermal (skin) contact);
- Eye protection;
- Safety boots; and
- Hard hats.

The general store of specific personal safety equipment will comprise:

- Disposable plastic gloves suitable for general use and nitrite gloves suitable for media with high concentrations of hydrocarbon;
- Steel cap boots (waterproof and chemically resistant);
- Tyvek or similar disposable overalls;
- Safety glasses and dust proof goggles;
- Hard hats / head gear;
- Ear plugs or ear muffs;
- Half-face piece respirators which combined particulate and chemical fitter cartridges suitable for organic vapours, pesticides, herbicides etc (Class AUSP1, (AS1716));
- Full face respirator with combined particulate and organic vapour filter cartridge (Class A2 P2);
- Supply of clean water and towels;
- Mobile telephone; and
- First aid kit

7.2 First Aid Equipment

The First Aid equipment available on-site will include:

- A fully supplied first aid kit;
- Eye washing equipment;
- Facilities for washing skin exposed to contaminants; and
- Emergency shower.

If a medical emergency occurs the Site Co-ordinator will administer first aid. The Site Coordinator will be responsible for organising conveyance of an injured person in order to seek medical assistance. Emergency contact numbers specific to the project are included in Appendix 3. General first aid procedures are presented on the following table

General Emergency First Aid Procedures

UNCONSCIOUS:
• Turn onto side and clear airway.
• Check for breathing (look, listen and feel).
• If breathing, leave on side and observe continuously.
• If not breathing:
  • roll onto back;
  • support jaw by lifting it up and forward;
  • give five breaths;
  • feel for pulse. If pulse present continue expired air resuscitation at the rate of 15 breaths per minute; and
  • If no pulse, perform cardio-pulmonary resuscitation if trained.
• Send for help.
• Control serious bleeding as soon as possible.

INGESTION: • Do not induce vomiting. • Wash with water or wipe away if substance is corrosive. • Give nothing by mouth. • Seek medical attention.
INHALATION: • If necessary, move casualty to fresh air, taking care not to become the next casualty. • Loosen clothing. • If casualty has difficulty breathing or shows signs of intoxication,
EYE CONTAMINATION: • Immediately rinse the eyes with the saline eyewash in the first aid kit. • Rinse for 15 minutes. • Be sure to lift the eyelids during rinsing. • Inform the Site Co-ordinator, and obtain assistance in seeking medical
SKIN CONTAMINATION: • Immediately wash the affected area with water and detergent, rinse thoroughly and remove contaminated clothing. • If any symptoms or signs of poisoning are observed, seek medical attention.

BURNS: • Remove casualty from danger. • Hold burnt area under cold, gently running water for up to 10 minutes. • Remove jewellery and clothing, but leave any that is stuck. • Cover burn with a sterile, non stick dressing. • Seek medical attention. • Do not apply lotions, ointments, prick/ break blisters or give alcohol to drink.
BLEEDING: • Apply direct pressure to the wound. Use gloves if available. • As soon as possible, place a clean dressing over the wound and firmly bandage. • Loosen tight clothing and give nothing by mouth. • Seek medical attention if bleeding is severe or persistent.

7.3 Fire Extinguishers

Appropriate fire extinguishers for the expected fire hazards will be available on-site and kept in serviceable condition. A Class BE extinguisher, suitable for fire involving flammable liquids and electrical equipment is provided in serviceable condition.

7.4 Health and Safety Requirements

During the site work, site personnel are to comply with following requirements. This will ensure that exposure to the contaminants is minimised and the safety at the site is guaranteed.

- Eating or drinking is not permitted during excavating, drilling or sampling. Site personnel need to decontaminate before eating or drinking;
- Consumption of alcohol or non-prescribed drugs or any illegal substance is prohibited on-site;

- Smoking is not permitted;
- Avoid agitation or splashing of contaminated soil and water;
- Contact with potentially contaminated substances is to be avoided;
- No one may enter a tank or vessel unless specific prearranged precautions have been taken and approved by the Site Co-ordinator;
- No naked flames or heat sources that emit sparks are permitted;
- Areas are to be kept tidy and "good housekeeping" policies maintained;
- Equipment and materials are to be maintained in good and safe condition, and the work area is to be cleaned up upon completion of the program;
- Personnel collecting or handling environmental samples must wear protective overalls/ long trousers, safety boots and gloves;
- All site personnel must be equipped with and fit-tested for appropriate respirators, if required. Appropriate respiratory protection will be determined by air monitoring;
- Personnel should use their senses to alert them to potentially dangerous situations (eg. odours, noise, vibration); and
- Each employee has to work with at least one other member of the team.

All gloves and overalls used are to be consistent with the requirements listed in the chemical data sheets/MSDSs. Any additional, project specific health and safety instructions and equipment requirements for site workers are provided in Appendix 5.

7.5 Vehicles On-Site

The following requirements are to be followed for vehicles in use on the site:

- Vehicles are to be driven with extreme care and at a speed not greater than 5 km/h;
- Personnel driving vehicles must possess a current driving licence;
- Vehicles should be parked in positions that will not obstruct site work activities. Keys should be left in the ignition where appropriate; and

- A decontamination station will be installed at the property for the purpose of removing contaminated soil from vehicles leaving the site. Waste wash water will be temporarily stored on-site and periodically disposed of off-site by a liquid waste contractor, or by addition to soil to assist the treatment process.

7.6 Air Monitoring

If site conditions are not expected to present elevated levels of airborne contaminants once asbestos types of materials are removed, there will not be a monitoring program for air quality. However, the need for air monitoring will be reviewed throughout the duration of the project by the Site Co-ordinator and is proposed for the duration of the asbestos removal process. Appendix 1 shows if air monitoring is included in the health and safety program for this project.

If necessary, airborne concentrations will be monitored during site work activities and compared to national workplace exposure limits. Details of exposure limits are contained in Appendix 1.
Where hydrocarbon type contaminants may be encountered, air quality will be monitored by use of a PID. Appendix 1 indicates if a PID will be used for the project. In such cases, the health and safety precautions to be taken will depend on the readings obtained by the PID:

PID Reading	**Personal Protective Equipment to be Used**
PID readings less than the EXCEEDANCE VALUE listed in Appendix 1.	**Level D**
PID readings in excess of the EXCEEDANCE VALUE but below the UPPER LIMIT VALUE listed in Appendix 1.	**Level C1**
PID readings in excess of the UPPER LIMIT VALUE but below the MAXIMUM PERMITTED VALUE listed in Appendix 1.	**Level C2**
PID readings above the MAXIMUM PERMITTED VALUE listed in Appendix 1	**Work must cease or Independent Respiratory Device must be used**

7.7 Respirators

Note that the half face respirators are fitted with Class AUS P2 filters and the full-face respirator is fitted with Class 2 P2 filters. These are combined chemical and particulate filters suitable for **organic vapours** (to a maximum of 1 000 ppm) and **particulates** (including dust, mist and fumes). These are the common types of chemical hazards at contaminated sites. However, they are **not suitable** for many inorganic gases and vapours including:

- Halogens;
- Hydrogen sulphide;
- Carbon monoxide and dioxide;
- Sulphur dioxide;
- Hydrogen cyanide/hydrocyanic acids;
- Acid mists and vapours;
- Ammonia; and
- Mercury gases, vapours and particulates.

Also, independent respiratory devices (SCBA) must be used in the following situations:

- Toxic inorganic gases (eg. H2S, SO2, CO etc) are present at concentrations above their respective exposure standards; and
- Oxygen levels are less than 17% vol%.

7.7 Decontamination

The Site Co-ordinator will instruct personnel in the appropriate procedures for decontaminating personal protective equipment and work equipment. The decontamination procedures are to be followed prior to leaving the site or when entering the lunch room at the site. Personal decontamination procedures include:

- Washing all dirt off work boots;
- Removing contaminated clothing and disposing of it in bins provided;
- Washing of hands and other parts of the body having had contact with the contamination; and
- Personal protective equipment should either be cleaned or disposed of.

Disposable protective equipment must not be removed from the site. Personal protective wear must be cleaned or disposed of appropriately before completion of work. In addition equipment used on-site that may be potentially contaminated will not leave the site unless it has been thoroughly cleaned and inspected by the Site Co-ordinator prior to leaving the site.

8.0 ENVIRONMENTAL RISKS

Assessment or remediation of site contamination presents risks to the environment as well as to site personnel. The most common environmental risks are described in the table below. Personnel must be aware of these risks and exercise care in minimising their potential.

Environmental Risk	Precautions

Migration of Contamination and/or Contamination of Groundwater Resources	• Care should be taken to avoid drilling or excavating through a contaminated aquifer into an uncontaminated underlying aquifer therefore creating a conduit through which contamination may migrate. • During backfilling, test pit soil should be returned to the test pit at roughly the same depth from which it was excavated to avoid introducing contamination to an otherwise clean soil stratum. • Barriers on diversion channels maybe required to prevent contaminated surface run off from impacting on adjacent sites, water courses or stormwater drainage systems. • Sampling should never take place during periods of heavy rain. • Contaminated drill cuttings and flush water from borehole purging should be collected in lined drums or tanks for appropriate treatment or disposal. • Dust suppression measures should be taken to prevent windblown contamination from being spread to other parts of the site or to adjacent sites. • Decontamination of vehicles, clothing or plant and equipment should be carried our before leaving the site as per Section 7.7.
Degradation of Heritage Sites	• Care should be taken to ensure that work on the site will not have an adverse impact on any sites of cultural of natural heritage significance. Heritage places may include buildings, structures, archaeological remains or landscaped or natural areas of aesthetic, historic, scientific or social value.
Degradation of Natural Habitats	• Care should be taken to ensure that any remediation works activities will have limited impact to the surrounding flora and fauna. Special care should be taken where rare natural habitats or any endangered species may be at risk.

9.0 UNEXPECTED SITE CONDITIONS

If during the course of subsurface investigations, unexpected or perceived hazardous conditions are encountered:

- All works will be stopped;
- The Site Co-ordinator should be informed immediately;
- If it is considered necessary, backfilling of test holes/ pits/ excavated areas will occur;
- The Site Co-ordinator will undertake appropriate measures to determine how best to characterise the unexpected conditions and how to proceed with the project. If necessary a new or revised work procedure will be prepared; and
- All personnel will be notified of the changed procedures by the Site Co-ordinator, and the client will also be advised of the changes.

10.0 INCIDENT REPORTING AND EMERGENCY PROCEDURES

In the event of an incident or emergency, the following procedures should be followed:

10.1 Reporting of Incidents and Record Keeping

- An incident is any event in which people or the environment are injured or damaged, or a near- miss event where these could have occurred but did not.
- Any accident, injury, or near-miss events experienced by personnel whilst on the site are to be reported to the Site Co-ordinator immediately;
- In the case of an accident, the Site Co-ordinator will take appropriate first aid measures or will direct a responsible person to take such measures on his behalf;
- The Site Co-ordinator will be responsible for organising conveyance of an injured person to medical aid where necessary. A list of emergency contact telephone numbers is attached in Appendix 4;
- The Site Co-ordinator will record details of the incident on the form provided in Appendix 6 (PR321);
- All hazardous conditions and emergencies will be reported to the client by the Site Co-ordinator;
- The Site Co-ordinator will initiate an investigation into the cause of the incident. Adequate corrective action will be taken;
- The Site Co-ordinator will maintain records of daily activities and also keep records of any incidents on-site (Appendix 6); and
- If the incident is a Notifiable Incident, WorkCover is to be notified immediately, and provided with follow-up. Notifiable Incidents are listed below.

Types of Incidents to be Notified

Notification is required where an incident at a workplace or equipment site results in death or specified serious injury. That is, if an injured person requires:

- Medical treatment within 48 hours of being exposed to a substance;
- Immediate hospital treatment as an in-patient and/or
- Immediate medical treatment for:
  - Amputation;
  - Serious head injury;
  - Serious eye injury;
  - Separation of skin from underlying tissue (for example de-gloving or scalping);
  - Electric shock;
  - Spinal injury;
  - Loss of bodily function; and
  - Serious laceration.

Notification is also required of dangerous occurrences which seriously endanger the lives or the health and safety of people in the immediate vicinity. Such dangerous occurrences include:

- Collapse, overturning, failure or malfunction of, or damage to, certain items of major plant;
- Collapse or failure of an excavation or the shoring support of an excavation;
- Collapse or part of a building or structure;
- Implosion, explosion or fire;
- Escape, spillage or leakage of substances;
- The fall from a height of dangerous or heavy object(s).

Source: Work Health and Safety (Incident Notification) Regulations 2011. Work Health and Safety Act 2011.

At the conclusion of the project, the Project Manager will complete the Project Review Report (PR322), a copy of which is provided in **Appendix 6**. The completed form is to be filed in the job file held by Aargus Pty Ltd.

10.2 Emergency Contact

The Site Co-ordinator should immediately be informed of any incidents and emergencies which may arise during site work. He/she will then initiate any emergency procedures. Should contacting the Site Co-ordinator be impossible or impractical, appropriate external assistance in management of the emergency should be sought (eg. call 000).

Contact telephone numbers and locations for emergency and medical services are given in the list of emergency contact numbers in Appendix 4. The site Coordinator will hold a copy of these details at the site.

10.3 Emergency Procedures

Fire:

- Personnel who have been instructed on extinguishing fires may attempt to put out a fire if it is small and you are not at risk. Otherwise, inform the Site Co-ordinator of the fire or other relevant personnel; and
- If the fire cannot be easily extinguished and/or the premises are unattended, use the 000 emergency procedures to call the fire brigade.

Note that only personnel trained in extinguishing fires are advised to do so.

Injuries:

- Provide first aid, if possible;
- Inform the Site Co-ordinator; and
- Use the **000 emergency procedure** if injuries are severe; otherwise evacuate the casualty to hospital. A listing of the nearest hospital and emergency co-ordinators is given in **Appendix 4**.

Evacuation:

If a major emergency occurs such as a fire, explosion, or toxic vapour release:

- Sound the vehicle horn to gain attention of on-site personnel requiring evacuation;
- Call the Site Co-ordinator;
- Evacuate the work area to a designated area, in an upwind location;
- Evaluate potential dangers to persons in a down wind direction. All personnel should evacuate to an upwind location;
- Shut off or remove any inflammable materials from danger (if it is safe to do so);
- Notify Emergency Services, phone 000;
- A head count will be performed by the site co-ordinator to make sure that everybody is accounted for. Search for any unaccounted persons; and
- Wait for the all clear from the Site Co-ordinator before returning to the work area.

11.0 STATEMENT OF COMPLIANCE AND CONFIDENTIALITY

When you have read and understood this document, please sign the *Statement of Compliance and Confidentiality* provided in Appendix 7. Please seek clarification on any matter you are unclear of from the Site Co-ordinator, before signing the form. If, during the period you are working on the site you require assistance or further information, please speak to the Site Co-ordinator.

APPENDIX 1

Aargus

Appendix 1

Project Details

Client:	Medica Properties Pty Ltd
Purpose:	Remediation and Validation Program
Site Address:	225-241a Hume Highway, 112 Northcote Road & 24 Hillcrest Avenue, Greenacre New South Wales.
Project Manager:	TBC
Contractor Representative:	TBC

Site work specific to small jobs can include:

- Sampling and analysis of the soil for classification for off-site disposal;
- Coordination of excavation of asbestos and hydrocarbon impacted soil;
- Collection of validation samples from the walls and base of the excavated area; and
- Monitoring of asbestos dust.

Chemical hazards specific to this site are expected to exist in the form of contamination of:

- Soil;
- Dust;
- Groundwater; and
- Air.

Chemical species likely to be present include:

- Asbestos
- Metals
- Hydrocarbons

Chemicals toxic to humans and which are likely to be present include:

- Asbestos
- Metals
- Hydrocarbons

AIR MONITORING

Exposure standards for Petrol (TWA) is 193 (based upon an average molecular weight of petrol of 114. For this reason, Aargus takes the most significant carcinogen in fuel being benzene that has a TWA of 5ppm (1.6mg/m^3) and uses this for its PID monitoring screening level.

PID exceedance value is 9.2 (say 10ppm) based on the TWA for benzene and a conversion factor of 0.54 for a minirae 2000PID.

PID upper limit value of 100ppm (lesser of 1000ppm and 10 times the exceedence value)

PID maximum permitable value is 500ppm (lesser of 1000ppm and 50 times the exceedence value with a class AUS or class 1 filter cartridge)

PID maximum permitable value is 1000ppm (lesser of 5000ppm and 100 times the exceedence value with a class 2 filter cartridge)

PID maximum permitable value is 1000ppm (lesser of 10000ppm and 100 times the exceedence value with a class 3 filter cartridge)

Prior to use the PID is calibrated to read 102ppm laboratory grade isobutylene (refer to AS/NZS 1715:1994 for further guidance).

HEALTH ASPECTS AND EXPOSURE STANDARDS OF ASBESTOS

Inhalation of high concentrations of asbestos may result in asbestosis, a progressive scarring of lung tissue and lung cancer, or mesothelioma, a form of lung cancer. The destructive nature on lung tissues of asbestos fibres below 3 microns (3□m) in diameter has been well documented, especially that of blue and brown forms of asbestos. Common latency periods for associated diseases to develop are within 10 to 50 years, which emphasizes the need to minimize potential exposure pathways and maximizing control measures and monitoring procedures.

Any admissible exposure to airborne asbestos should be kept as low as achievable and in any case below the specified exposure standards. These standards are determined by the *National Commission for Occupational Exposures*. Below is a summary of the threshold limits for airborne concentrations measured as a time-weighted average (TWA) fibre concentration.

Exposure Standards – TWA Fibre Concentration Limits

Asbestos Species	Concentration (fibres/mL)
Chrysotile	0.1
Crocidolite	0.1
Amosite	0.1
Other forms	0.1
Other mixtures of species	0.1

APPENDIX 2

Aargus

SAFE WORK METHOD STATEMENT OF ENVIRONMENTALSITE INVESTIGATION

ORGANISATION NAME: Aargus Pty Ltd	**PHONE/FAX: 1300 137 038**
BUSINESS ADDRESS: 446 Parramatta Rd, Petersham NSW 2039	**PROJECT NAME: 225-241a Hume Hwy, Greenacre NSW**
ABN NUMBER: 75 050 212 710	**REVISION # & DATE: Rev 0, 23rd July 2015**

This SWMS was prepared by: (inert name, signature, position and date below)

NAME	POSITION	SIGNATURE	DATE
Con Kariotoglou	Project Manager and WHS Consultant		23.07.2015

This SWMS was approved by: (inert name, signature, position and date of **senior management representative** of the organization below)

NAME	POSITION	SIGNATURE	DATE
Mark Kelly	National Environmental Manager		23.07.2015

The names and positions of personnel assigned the responsibility for supervising this work and their qualifications are as follows:

NAME	POSITION	QUALIFICATIONS	DATE
Con Kariotoglou	Project Manager and WHS Consultant	BSc, Dip OH&S	23.07.2015
Joseph McDermott	Environmental Scientist	BSc	23.07.2015

The names of workers or their nominated safety representatives who were consulted and involved in the development of this SWMS are as follows:	
Con Kariotoglou	
Mark Kelly	

SAFE WORK METHOD STATEMENT OF ENVIRONMENTALSITE INVESTIGATION

NSW and National Occupational Health & Safety Commission – Hierarchy of Control Definitions
Controlling the health and safety risks in a workplace is necessary to prevent injury and illness. First, identify and assess the risks, then decide on the best way to control them by applying the Hierarchy of Controls as follows: 1. **Elimination** - controlling the hazard at source 2. **Substitution** - replacing one substance or activity with a less hazardous one 3. **Isolation** – separating the hazard from the person 4. **Engineering** - installing guards on machinery 5. **Administration** - implementing policies and procedures for safe work practices 6. **Personal Protective Equipment** - use of goggles, respirators, and ear plugs etc. When deciding on the best way to control a risk, start at the top of the hierarchy of controls, i.e. investigate if the risk can be eliminated first, for example by changing the way the work is done, or by using safer substances or equipment. This is the most effective way to control a hazard. If these methods are not possible, use engineering, isolation or administrative controls to reduce or minimise the risk.

Risk Assessment Matrix

		Likelihood				
		Almost certain	Likely	Possible	Unlikely	Rare
Consequence	Extraordinary	1	2	4	7	11
	Major	3	5	8	12	16
	Moderate	6	9	13	17	20
	Minor	10	14	18	21	23
	Insignificant	15	19	22	24	25

Risk Class

High / 1-6	Those risks with a relatively high likelihood and large impact
Medium / 7-15	Risks with a medium likelihood or impact.
Low / 16-25	Those risks with a relatively low likelihood and impact.

Consequence	Description	Likelihood	Description
Extraordinary	Catastrophic impact on project. Major incident involving fatalities or permanent disability.	Almost Certain	The event/impact is common and expected to occur in most circumstances *(will occur regularly / 10 times for year)*
Major	Major negative impact on project. Serious injury or disease to staff or subcontractors or the general public.	Likely	The event/impact has happened before and will probably occur again *(will occur often / 5-10 times per year)*
Moderate	Significant negative impact on project. Medical treatment required loss of production capability.	Possible	This event/impact could occur at some time *(is likely to occur few / 2-3 times per year)*
Minor	Minor negative impact on project. First aid treatment required.	Unlikely	This event/impact is not likely to occur *(is unlikely to occur more than once per year)*
Insignificant	Insignificant negative impact on project. No injuries.	Rare	This event/impact may occur in exceptional circumstances only *(is unlikely to occur during a year)*

SAFE WORK METHOD STATEMENT OF ENVIRONMENTALSITE INVESTIGATION

ACTIVITY	POSSIBLE HAZARDS	RISK RATING	POSSIBLE CAUSES	POSSIBLE RISKS	POTENTIAL OUTCOMES	CONTROL MEASURES	CHECKED BY
Establishment Disestablishment Moving About Site	On-Site traffic accidents On-Site accidents Impact by site machinery Noise	2-4 2-4 2-4 2-4	Lack of concentration Lack of communication Lack of traffic control measures	Injury to person(s) Damage to machinery Damage to utilities	Death/serious/minor injury Costly repairs/delays	Coordinating activities with drillers, spotter and other personnel on site Clear direction to personnel of site duties All drilling staff complete necessary site inductions PPE Erect Signage and Barricades around work area	Drillers Spotter Contractor Inductor
Drilling activities	Services contact Being struck by tools, equipment, objects Being caught in core drill Slipping on wet ground Mishandling equipment, tools Exposure to contaminated materials	2-4 2-4 4-7 4-7 4-7 4-7	Lack of concentration Lack of observation Lack of communication Poorly coordinated works Insufficient information provided on services drawings Set up too close to services Being too close to works Unclean work area Incorrect use of tools Lack of traffic control measures	Injury to person(s) Damage to machinery Damage to utilities	Death/serious/minor injury Costly repairs/delays	Service location/identification prior to Excavation by 'Dial Before You Dig' services and by services search sub-contractor. Coordinating activities with drillers, spotter and other personnel on site Maintaining equipment; checking for potential damage to equipment Correct use of tools and equipment Maintain safe distance from machinery and vehicular pathways Maintain safe distance (3metres) for overhead electrical wiring Wearing appropriate safety gear	Drillers Spotter Engineer Services search Sub-contractors. Client Representative
Logging of Drilling activities	Being struck by tools, equipment, objects Being caught in drill rods Slipping on wet ground Being struck by objects	4-7 4-7 4-7 4-7	Lack of concentration Lack of observation Lack of communication Poorly coordinated works Being too close to works Unclean work area Incorrect use of tools	Injury to person(s)	Death/serious/minor injury	Coordinating site activities Maintain safe distance from machinery and vehicular pathways Wearing appropriate safety gear	Engineer
DCP Equipment	Contact with underground services Equipment breakdown Equipment malfunction Improper use of equipment	9-13 9-13 9-13 9-13	Lack of concentration Lack of observation Lack of communication Poor training with equipment Poorly coordinated works Insufficient information Insufficient use of PPE Unserviced & old equipment	Injury to person(s) Damage to machinery Damage to utilities	Time delays to project Minor Injury , First Aid needed	Regular servicing of the equipment Update materials/equipment when required Correct procedures must be followed as per the Aargus Fieldwork Protocols. Services Search DBYD Pot Holing	Geotechnician Engineer

Aargus

SAFE WORK METHOD STATEMENT OF ENVIRONMENTALSITE INVESTIGATION

ACTIVITY	POSSIBLE HAZARDS	RISK RATING	POSSIBLE CAUSES	POSSIBLE RISKS	POTENTIAL OUTCOMES	CONTROL MEASURES	CHECKED BY
Hand drilled boreholes Hand Auger	Contact with underground services UV Exposure/dehydration Equipment breakdown Equipment malfunction Improper use of equipment	14-18 14-18 14-18 14-18 14-18	Lack of concentration Lack of observation Lack of communication Poor training with equipment Poorly coordinated works Insufficient information Insufficient use of PPE Unserviced & old equipment	Injury to person(s) Damage to machinery Damage to utilities	Minor injury, Costly repairs, delays	Dial before you dig plans & service locator Correct use of tools and equipment Wearing appropriate PPE (gloves, hard hat, long sleeves, safety boots, high-visible vest). Regular servicing of the equipment Correct procedures must be followed	Supervisor Contractor Drillers Sub-contractors
Sample Collection	Lifting injuries Contaminated materials Being struck by tools, equipment, objects Slipping on wet ground Being struck by objects Odours and damage to olfactory system Exposure to contaminated materials	14-18 14-18 9-13 4-7 4-7 14-18 14-18	Manual handling Contact with contaminated soils Lack of concentration Lack of observation Lack of communication Lack of correct PPE Poorly coordinated works Being too close to works Unclean work area Incorrect use of tools	Injury to person(s) Disease	Serious/minor injury Time loss due to sick leave	Restricting lifting loads Maintain safe distance from machinery and vehicular pathways Wearing appropriate safety gear (gloves, hard hat, long sleeves, safety boots, hi-visible vest). Applying appropriate odour spraying methodology for the entire length of works Placing contaminated material on a plastic membrane in a designated area	Engineer Scientist
Asbestos impacted materials and soils	Uncontrolled release of Asbestos fibres	3-8	Lack of concentration Lack of observation Lack of correct PPE Lack of dampening control measures Manual handling Contact with contaminated soils	Injury to person(s) Disease	Serious/minor injury Time loss due to sick leave	Restricting lifting loads Maintain safe distance from machinery and vehicular pathways Wearing appropriate safety gear Applying appropriate water spraying methodology for the entire length of works Placing contaminated material on a plastic membrane or bags in a designated area Maintain safe distance from drilling equipment	Supervisor Scientist Client Representative
Site Clean Up	Lifting injuries Being struck by tools, equipment, objects Services contact Slipping on wet ground Odours and damage to olfactory system Exposure to contaminated materials	4-7 4-7 2-4 4-7 14-18 14-18	Manual handling Poorly stored equipment Lack of observation Poorly coordinated works Set up too close to services	Injury to person(s) Damage to utilities	Death/serious/minor injury Costly repairs/delays	Coordinating site activities Restricting lifting loads Materials to be correctly stored/used Maintain safe distance from machinery and vehicular pathways Applying appropriate odour spraying methodology for the entire length of works Placing contaminated material on a plastic membrane in a designated area	Engineer Drillers Spotter

General	Tripping Dust/flying objects Noise	4-7 4-7 2-4	Lines, hoses and tools on ground Drilling activities Machinery motors	Smaller injuries/discomfort Partial/complete blindness Eye irritations Ear irritation/damage	Serious/minor injury Time loss due to sick leave	Wearing appropriate safety gear, including boots, hard hats, eye protection, ear plugs etc Training of site personnel Completion of Workcover induction course	Engineer Drillers Spotter
Equipment	Equipment breakdown Equipment malfunction Explosions	8-18 14-18 4-7	Unserviced, old equipment Ignition of Fuel	Small injuries/ discomfort Burns	Serious to minor injury Time loss due to sick leave Time delays to project	Regular servicing of the equipment Update materials/equipment when required No smoking on site	Fleet Manager Engineer Drillers Spotter
Transport of Materials	Impact with truck Odours and damage to olfactory system Exposure to contaminated materials	2-4 14-18 14-18	Lack of traffic control measures Contact with contaminated soils Lack of concentration Lack of observation Lack of communication Lack of correct PPE	Injury to person(s) Disease	Serious/minor injury Time loss due to sick leave	Coordinating site activities Maintain safe distance from machinery and vehicular pathways Wearing appropriate safety gear Clear direction to personnel of site duties All drilling staff complete necessary site inductions Applying appropriate odour spraying methodology for the entire length of works	

PERSONNEL COMPETENCY AND TRAINING:	
Con Kariotoglou	OH&S training, WorkCover Asbestos Approved Assessor
	General Induction (White Card) Training, Worker on Foot Training
	Railway Safety Worker Card

LIST OF PPE:	
Hard hat (dated) with slots for ear muffs & face shield	Required
Lace up steel capped ankle fit safety boots	Required
Long trousers - company issue	Required
High visibility Orange, long sleeved shirt or vest closed at front	Required
AS1270 Hearing Protection	Required
AS1337 Safety Glasses	Required
AS4150 Gloves - rated 3 minimum for cut resistance	Required
Rubber or PVC gloves	Not Required
Dust Masks	Required
Face shield for Hard Hat	Not Required
AS1891.1 Safety Harness	Not Required
Disposable Coveralls	Required
Night Reflective Coveralls	Not Required
Type B First Aid Kit	Required
AS1841 Type A Dry Powder Fire Extinguisher : 6 month tagged	Not Required

PLANT AND EQUIPMENT:	
GENERIC – Sampling Containers, Esky, Ice Bricks, Trowel	

HAZARDOUS SUBSTANCES AND DANGEROUS GOODS USED:	
N/A	

EMERGENCY PROCEDURES OR RESCUE PLANS RELEVANT TO THE ACTIVITY:
Emergency Department - Tel: 000, Mobile 121
Nearest Hospital: Bankstown-Lidcombe Hospital- 68 Eldridge Road, Bankstown Tel: 02 9722 8000
Nearest Medical Centre: Workcare Medical- 4 Brunker Road, Chullora Tel: 02 9707 7800
Poisons Information Centre (National) - Tel: 02 9998 0333
Evacuation Area: 225-241a Hume Hwy, Greenacre
WHS Consultant - Con Kariotoglou – Tel: 1300 137 038, Mobile 0425 230 906

HEALTH AND SAFETY LEGISLATION:
Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011
APPLICABLE AUSTRALIAN STANDARDS:
AS2210 Safety Boots
AS1801 Hard Hat
AS2162 Gloves
AS1270 Hearing Protection
AS4150 Safety Glasses
AS/NZS 1715:1994 Respiratory Protection
prEN ISO13982-1 Disposable Tyvec Suits rated Type 5
APPLICABLE INDUSTRY CODES OF PRACTICE:
NSW WorkCover Codes of Practice: How to Manage Work Health and Safety Risks, Construction Works, Hazardous Materials Tasks,
Managing Noise and Preventing Hearing Loss at Work
MANUFACTURERS / SUPPLIERS SPECIFICATIONS:
N/A

SAFE WORK METHOD STATEMENT OF ENVIRONMENTALSITE INVESTIGATION

NAME AND SIGNATURE OF PERSON(S) CARRYING OUT THE TRAINING:	
NAME	**SIGNATURE**
Mark Kelly	

SWMS INDUCTION STATEMENT - The following persons have been inducted into the work activities described in this SWMS.		
• I have read and understood the content of this SWMS.		
• I will work in accordance with this SWMS.		
• If deemed necessary to amend this SWMS I will consult with my immediate supervisor and assist where required in reviewing this SWMS.		
PRINT NAME	**SIGNATURE**	**DATE**
Con Kariotoglou		23.07.2015
Mark Kelly		23.07.2015

APPENDIX 3

CALTEX -- LEADED PETROL

MATERIAL SAFETY DATA SHEET
NSN: 913000N030685
Manufacturer's CAGE: 0BET2
Part No. Indicator: A
Part Number/Trade Name: LEADED PETROL

General Information

Company's Name: CALTEX INC
Company's Street: 540 PADRE FAURA ST
Company's City: ERMITA, MANILA, PHILIPPINES
Company's Emerg Ph #: 5231-35-01
Company's Info Ph #: 5231-35-01
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 19JUN90
Safety Data Review Date: 10JUL95
MSDS Serial Number: BPGRW
Hazard Characteristic Code: F2

Ingredients/Identity Information

Proprietary: NO
Ingredient: GASOLINE (CONSISTS OF MAINLY STRAIGHT CHAIN AND BRANCHED PARAFFINIC HYDROCARBONS, OLEFINS, CYCLOPARAFFINS & AROMATICS)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: LX3300000
CAS Number: 8006-61-9
OSHA PEL: 300 PPM;500 PPM STEL
ACGIH TLV: 300 PPM;500 PPM STEL

Proprietary: NO
Ingredient: BENZENE
Ingredient Sequence Number: 02
Percent: 0.5-4.0
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2
OSHA PEL: NOT APPLICABLE
ACGIH TLV: 0.1 PPM
Other Recommended Limit: 1 PPM; 5 STEL (MFR)

Proprietary: NO
Ingredient: SUPP DATA: CERTAIN EPIDEMIOLOGY STUDIES HAVE INDICATED THAT EXCESS BENZENE EXPOS MAY CAUSE CANCER OF BLOOD- (ING 4)
Ingredient Sequence Number: 03
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 3:FORMING ORGANS INCL LEUKEMIA. WHILE BENZENE CONTENT OF PETROL IS RELATIVELY LOW, IT IS IMPORTANT TO (ING 5)
Ingredient Sequence Number: 04
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 4: EXPOS TO SKIN & RESP SYS TO WELL W/IN CURRENT EXPOS STD.
Ingredient Sequence Number: 05
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: OTHER PREC: TO REMOVE. EMPTY DRUMS SHOULD BE COMPLETELY DRAINED, PROPERLY BUNGED & PROMPTLY RETURNED TO A DRUM (ING 7)
Ingredient Sequence Number: 06
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 6:RECONDITIONER. ALL OTHER CONTR SHOULD BE DISPOSED OF IN AN ENVIRONMENTALLY SAFE MANNER & I/A/W GOVERNMENT REGS.
Ingredient Sequence Number: 07
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: RESP PROT:PREFILTER. IN ABSENCE OF LOC APPRVD AUTH, FOLLOW U. S. NIOSH/MSHA OR U.K. BSI APPROVAL STD. USE (ING 9)
Ingredient Sequence Number: 08
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 8:NIOSH/MSHA APPRVD SUPPLIED AIR RESP PROT FOR CLEANING LG SPILLS/UPON ENTRY INTO TANKS, VESSELS, OR (ING 10)
Ingredient Sequence Number: 09
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 10:OTHER CONFINED SPACES. IN ABSENCE OF LOCAL APPROVAL AUTH, FOLLOW U.S. NIOSH/MSHA OR U.K. APPROVAL STANDARDS.
Ingredient Sequence Number: 10
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: VENT: CONTROLS MAY BE NEEDED. LOCAL EXHAUST VENT &/OR ENCLOSURE OF PROCESS IS PREFERRED IN THESE CASES.
Ingredient Sequence Number: 11
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Physical/Chemical Characteristics

Appearance And Odor: LIGHT STRAW COLOR.
Boiling Point: >32F,>0C
Vapor Pressure (MM Hg/70 F): N/A

Vapor Density (Air=1): 3-4
Specific Gravity: 0.7-.77
Solubility In Water: SLIGHT
Percent Volatiles By Volume: 100
pH: N/A

Fire and Explosion Hazard Data

Flash Point: -40F,-40C
Lower Explosive Limit: 1.4%
Upper Explosive Limit: 7.6%
Extinguishing Media: ACCD TO U.S. NFPA GUIDE, USE DRY CHEM, FOAM/CO2.
Special Fire Fighting Proc: NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP(FP N). H2O MAY BE INEFTIVE ON FLAMES, BUT H2O MAY BE USED TO KEEP FIRE-EXPOS CONTR COOL. IF LEAK/SPILL (SUPP DATA)
Unusual Fire And Expl Hazrds: FLOWING PETROL CAN BE IGNITED BY SELF-GENERATING STATIC ELEC; USE ADEQ GROUND.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HEAT.
Materials To Avoid: STRONG OXIDIZERS.
Hazardous Decomp Products: CO AND CO2 MAY BE FORMED ON BURNING IN LIMITED AIR SUPPLY.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: EYES:MAY CAUSE MOD IRRIT. INGEST: EXPECTED TO HAVE MOD ACUTE TOX BY INGEST. INHAL: MAY CAUSE DIZZ, IRRIT OF EYES, NOSE & THROAT, VOMIT, & CNS EFTS UPON INHAL. CONVULS, SEIZURES & SUDDEN LOSS OF CONSCIOUSNESS, COMA & DEATH ARE POSS FROM EXTREME EXPOS. SKIN:MOD IRRITATING TO SKIN & MAY CAUSE RED, EDEMA, (EFTS OF OVEREXP)
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: YES
Explanation Carcinogenicity: BENZENE: OSHA REGULATED, GROUP 1(IARC);KNOWN CARCINOGEN (NTP):GASOLINE GROUP 2B (IARC).
Signs/Symptoms Of Overexp: HLTH HAZ:/DRYING. MAY PRDCE SYSTEMIC TOX BY SKIN ABSORP. LIM CHRONIC INHAL TOX STUDIES SHOWED KIDNEY DISEASE & KIDNEY CANCER WHERE ANIMALS WERE EXPOS TO WHOLLY VAPORIZED PETROL. ADDNL STUDIES WHICH EVALUATED EXPOS LIM TO VOLAT FRACTION OF PETROL DID NOT PRDCE KIDNEY DAM/KIDNEY CANCER. EPIDEMIOLOGY STUDIES (SUPP DATA)
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES: FLUSH IMMED WITH FRESH WATER FOR AT LEAST 15 MIN WHILE HOLDING LIDS OPEN. SKIN: WASH THOROUGHLY WITH SOAP AND WATER. INGEST: DO NOT INDUCE VOMIT. ASPIR OF FLUID CAN CAUSE SERIOUS LUNG INJURY SUCH AS CHEMICAL PNEUMONITIS. CALL MD IMMED. INHAL: MOVE TO FRESH AIR. IF BREATHING HAS STOPPED, APPLY ARTF RESP. CALL MD.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: ELIMINATE ALL IGNITION SOURCES INCL INTERNAL COMBUSTION ENGINES, DE-ENERGIZE ELEC EQUIP & SYS. VENT AREA. AVOID BRTHG VAP. CNTN SPILL IF POSS. REMOVE W/INERT ABSORB. USE NIOSH/MSHA APPROVED

RESP & PROT CLTHG AS DISCUSSED IN THIS MSDS.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: IT IS RESPONSIBILITY OF USER OF PROD TO DETERM, @ TIME OF DISP, WHETHER PROD MEETS CRITERIA FOR HAZ WASTE. PROD USES, TRANSFORMATIONS, MIX & PROCESSES, MAY RENDER RESULTING MATERIAL HAZARDOUS. DISPOSE I/A/W FED, ST & LOC REGS (FP N).
Precautions-Handling/Storing: KEEP AWAY FROM HEAT/SPARKS/FLAME. TRANSPORT, HNDLE & STORE I/A/W LOC REGS REGARDING FLAMM LIQ. EMPTY CONTR RETAIN RESIDUE(LIQ/VAP) & CAN BE DANGEROUS.
Other Precautions: DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTR TO HEAT, FLAME, SPARKS, STATIC ELEC, OR OTHER SOURCES OF IGNIT: THEY MAY EXPLODE & CAUSE INJURY/DEATH. DO NOT ATTEMPT TO CLEAN SINCE RESIDUE IS DFCLT (ING 6)

Control Measures

Respiratory Protection: RESP PROT IS NOT NORMALLY REQD. HOWEVER, IF OPERATING CNDTNS CREATE AIRBORNE CONC WHICH EXCEED RECOM EXPOS STD, USE OF AN NIOSH/MSHA APPRVD RESP IS RECOM. WEAR NIOSH/MSHA APPRVD PROT SUCH AS AN ORG VAP CARTRIDGE RESP W/PARTICULATE (ING 8)
Ventilation: NO SPECIAL VENT IS USUALLY NEC. HOWEVER, IF OPERATING CNDTNS CREATE HIGH AIRBORNE CONC OF MATL, ENGINEERING (ING 11)
Protective Gloves: NEOPRENE OR NITRILE GLOVES.
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: IMPERVIOUS PROT CLTHG. PROT CLTHG MADE FROM NEOPRENE, NITRILE, OR N-BUTYL RUBBER IS SUITABLE IN THESE APPLICATIONS.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: FIRE FIGHT PROC: HAS NOT IGNITED, USE H2O TO DISPERSE VAPOR & TO PROVIDE PROT FOR PERSONS ATTEMPTING TO STOP LEAK. EFTS OF OVEREXP: IN HUMANS EXPOS TO HYDROCARBONS HAVE NOT INDICATED EXCESS RISK OF KIDNEY CANCER. PETROL CNTNS BENZENE IN CONC FROM ABOUT 0.5-4.0%. CHRONIC TOX STUDIES IN LAB ANIMALS & CERTAIN & (ING 3)

Transportation Data

Trans Data Review Date: 92328
DOT PSN Code: GTN
DOT Proper Shipping Name: GASOLINE
DOT Class: 3
DOT ID Number: UN1203
DOT Pack Group: II
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: HRV
IMO Proper Shipping Name: GASOLINE
IMO Regulations Page Number: 3141
IMO UN Number: 1203
IMO UN Class: 3.1
IMO Subsidiary Risk Label: -
IATA PSN Code: RMF
IATA UN ID Number: 1203
IATA Proper Shipping Name: MOTOR SPIRIT
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: MUC
AFI Prop. Shipping Name: GASOLINE
AFI Class: 3
AFI ID Number: UN1203
AFI Pack Group: II
AFI Label: FLAMMABLE LIQUID
AFI Basic Pac Ref: 7-7

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 18MAY92
Label Date: 06MAY92
Label Status: G
Common Name: LEADED PETROL
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: FLAMMABLE. KEEP AWAY FROM HEAT, SPARKS, OPEN FLAME, AND STRONG OXIDIZERS. ACUTE: MAY CAUSE MODERATE EYE IRRITATION. MODERATELY IRRITATING TO SKIN. MAY PRODUCE SYSTEMIC TOXICITY BY SKIN ABSORPTION. EXPECTED TO HAVE MODERATE ACUTE TOXICITY BY INGESTION. INHALATION MAY CAUSE DIZZINESS, IRRITATION OF EYES, NOSE, AND THROAT, VOMITING, CNS EFFECTS, CONVULSIONS, SEIZURES, LOSS OF CONSCIOUSNESS, COMA, AND DEATH. CHRONIC:CANCER HAZARD. CONTAINS BENZENE WHICH HAS BEEN SHOWN TO CAUSE CANCER OF THE BLOOD-FORMING ORGANS INCLUDING LEUKEMIA. GASOLINE IS LISTED AS A CARCINOGEN.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: CALTEX INC
Label Street: 540 PADRE FAURA ST
Label City: ERMITA, MANILA, PHILIPPINES
Label Emergency Number: 5231-35-01

ExxonMobil

123455-22 DIESEL #2, ON-ROAD (LOW SULFUR)
MATERIAL SAFETY DATA BULLETIN

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1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: DIESEL #2, ON-ROAD (LOW SULFUR)
SUPPLIER: EXXONMOBIL OIL CORPORATION
3225 GALLOWS RD.
FAIRFAX, VA 22037

24 - Hour Health and Safety Emergency (call collect): 609-737-4411

24 - Hour Transportation Emergency:
CHEMTREC: 800-424-9300 202-483-7616
LUBES AND FUELS: 281-834-3296

Product and Technical Information:
Lubricants and Specialties: 800-662-4525 800-443-9966
Fuels Products: 800-947-9147
MSDS Fax on Demand: 713-613-3661
MSDS Internet Website: http://www.exxon.com, http://www.mobil.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAMES AND SYNONYMS: HYDROCARBONS AND ADDITIVES

GLOBALLY REPORTABLE MSDS INGREDIENTS:

Substance Name	Approx. Wt%
DIESEL FUEL (68334-30-5)	100

COMPONENT(S) OF PRODUCT INGREDIENTS INCLUDE:

NAPHTHALENE (91-20-3)	0.5
ETHYL BENZENE (100-41-4)	0.5

NOTE: Composition may contain up to 0.5% performance additive.

See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

This product is considered hazardous according to regulatory guidelines (See Section 15).

EMERGENCY OVERVIEW: Clear (May Be Dyed) Liquid. Material is combustible. Liquid can release vapors that readily form flammable mixtures at or above the flash point. Product can accumulate a static charge which may cause a fire or explosion. DOT ERG No. : 128

POTENTIAL HEALTH EFFECTS: Respiratory irritation, headache, dizziness, nausea, loss of consciousness, and in cases of extreme exposure, possibly death. Diesel exhaust may cause lung cancer. Prolonged, repeated skin contact may result in skin irritation or more serious skin disorders. Low viscosity material-if swallowed may enter the lungs and cause lung damage. Note: This product contains polycyclic aromatic hydrocarbons, some of which have been reported to cause skin cancer in test animals and in humans under conditions of poor personal hygiene and prolonged repeated contact.

POTENTIAL ENVIRONMENTAL EFFECTS: Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment.

For further health effects/toxicological data, see Section 11.

4. FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.

SKIN CONTACT: Remove contaminated clothing. Dry wipe exposed skin and cleanse yourself with waterless hand cleaner and follow by washing thoroughly with soap and water. For those providing assistance, avoid further contact to yourself or others. Wear impervious gloves. Launder contaminated clothing separately before reuse. Discard contaminated articles that cannot be laundered. (See Section 16 - Injection Injury)

INHALATION: Remove from further exposure. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with mechanical device or use mouth-to-mouth resuscitation.

INGESTION: Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIANS: Material if aspirated into the lungs may cause chemical pneumonitis. PRE-EXISTING MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY EXPOSURE: Hydrocarbon Solvents/Petroleum Hydrocarbons- Skin contact may aggravate an existing dermatitis.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.

SPECIAL FIRE FIGHTING PROCEDURES: Water may be ineffective, but water should be used to keep fire-exposed containers cool. Prevent runoff from fire control or dilution from entering streams,

sewers, or drinking water supply.
SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Material is combustible. Liquid can release vapors that readily form flammable mixtures at or above the flash point. Product can accumulate a static charge which may cause a fire or explosion.
COMBUSTION PRODUCTS: Fumes, smoke, carbon monoxide, sulfur oxides, aldehydes and other decomposition products, in the case of incomplete combustion.
Flash Point C(F): > 55(131) (ASTM D-93).
Flammable Limits (approx.% vol.in air) - LEL: 0.6%, UEL: 7.0%
NFPA HAZARD ID: Health: 1, Flammability: 2, Reactivity: 0

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6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills/releases as required to appropriate authorities. U.S. Coast Guard and EPA regulations require immediate reporting of spills/releases that could reach any waterway including intermittent dry creeks. Report spill/release to Coast Guard National Response Center toll free number (800)424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.
PROCEDURES IF MATERIAL IS RELEASED OR SPILLED:
LAND SPILL: Eliminate sources of ignition. Shut off source taking normal safety precautions. Take measures to minimize the effects on ground water. Recover by pumping using explosion-proof equipment or contain spilled liquid with sand or other suitable absorbent and remove mechanically into containers. If necessary, dispose of adsorbed residues as directed in Section 13.
WATER SPILL: Eliminate sources of ignition and warn other ships in the vicinity to stay clear. Notify port and other relevant authorities. Confine with booms if skimming equipment is avaliable to recover the spill. Otherwise disperse in unconfined waters, if permitted by local authorities and environmental agencies. If permitted by regulatory authorities the use of suitable dispersants should be considered where recommended in local oil spill procedures.
ENVIRONMENTAL PRECAUTIONS: Prevent material from entering sewers, water sources or low lying areas; advise the relevant authorities if it has, or if it contaminates soil/vegetation.
PERSONAL PRECAUTIONS: See Section 8

---

7. HANDLING AND STORAGE

HANDLING: Keep product away from high energy ignition sources, heat, sparks, pilot lights, static electricity, and open flame. Harmful in contact with or if absorbed through the skin. Avoid inhalation of vapors or mists. Use in well ventilated area away from all ignition sources. See Section 8 for additional personal protection advice when handling this product.
STORAGE: Store in a cool area. Avoid sparking conditions. Ground and bond all transfer equipment.
SPECIAL PRECAUTIONS: To prevent and minimize fire or explosion risk from static accumulation and discharge, effectively bond and/or

ground product transfer system. Do not use electronic devices (including but not limited to cellular phones, computers, calculators, pagers, etc.) in or around any fueling operation or storage area unless the devices are certified intrinsically safe by an approved national testing agency and to the safety standards required by national and/or local laws and regulations. Electrical equipment and fittings must comply with local fire prevention regulations for this class of product. Use the correct grounding procedures. Refer to national or local regulations covering safety at petroleum handling and storage areas for this product.

EMPTY CONTAINER WARNING: Empty containers retain residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to refill or clean container since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS:

ExxonMobil recommends an 8-hour time-weighted average (TWA) exposure of 500 mg/m3 total vapor (approx. 100 ppm) or 5 mg/m3 stable aerosols.

		---TWA---		----STEL---		NOTE
Substance Name (CAS-No.)	Source	ppm	mg/m3	ppm	mg/m3	
NAPHTHALENE (91-20-3)						
	OSHA	10	50	15	75	
	ACGIH	10	52	15	79	
ETHYL BENZENE (100-41-4)						
	OSHA	100	435	125	545	
	ACGIH	100	434	125	543	

NOTE: Limits shown for guidance only. Follow applicable regulations.

VENTILATION: Use in well ventilated area with local exhaust ventilation. Ventilation equipment must be explosion proof. Use away from all ignition sources.

RESPIRATORY PROTECTION: Approved respiratory equipment must be used when airborne concentrations are unknown or exceed the recommended exposure limit. Self-contained breathing apparatus may be required for use in confined or enclosed spaces.

EYE PROTECTION: If splash with liquid is possible, chemical type goggles should be worn.

SKIN PROTECTION: Impervious gloves must be worn. If contact is likely

oil impervious clothing must be worn. Good personal hygiene practices should always be followed.

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9. PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.

APPEARANCE: Liquid
COLOR: Clear (May Be Dyed)
ODOR: Hydrocarbon
ODOR THRESHOLD-ppm: NE
pH: NA
BOILING POINT C(F): > 149(300)
MELTING POINT C(F): NA
FLASH POINT C(F): > 55(131) (ASTM D-93)
FLAMMABILITY (solids): NE
AUTO FLAMMABILITY C(F): NE
EXPLOSIVE PROPERTIES: NA
OXIDIZING PROPERTIES: NA
VAPOR PRESSURE-mmHg 20 C: 0.5
VAPOR DENSITY: > 2.0
EVAPORATION RATE: NE
RELATIVE DENSITY, 15/4 C: 0.82-0.87
SOLUBILITY IN WATER: Negligible
PARTITION COEFFICIENT: > 3.5
VISCOSITY AT 40 C, cSt: > 1.0
VISCOSITY AT 100 C, cSt: NE
POUR POINT C(F): < -7(20)
FREEZING POINT C(F): NE
VOLATILE ORGANIC COMPOUND: NE
DMSO EXTRACT, IP-346 (WT.%): NA
NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

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10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable.
CONDITIONS TO AVOID: Extreme heat and high energy sources of ignition.
INCOMPATIBILITY (MATERIALS TO AVOID): Halogens, strong acids, alkalies, and oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: Product does not decompose at ambient temperatures.
HAZARDOUS POLYMERIZATION: Will not occur.

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11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.
DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the

components.
INHALATION TOXICITY (RATS): Practically non-toxic (LC50: greater than 5 mg/l). ---Based on testing of similar products and/or the components.
EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.
SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

Repeated dermal application of middle distillates, heating oils and diesel oils to rabbits for 2-4 weeks at up to 1 gm/kg resulted in strong to severe skin irritation with some weight loss at the higher dose. Toxic effects ranging from weight loss to mortality was observed in rabbits treated repeatedly with very high doses (6 gm/kg) of these oils. Repeated inhalation exposure of middle distillate and diesel vapor and aerosol to rats for 2-4 weeks at up to 6 mg/l resulted in respiratory tract irritation, lung changes/infiltration/accumulation, and some reduction in lung function.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---

Diesel fuel vapors were tested in an inhalation teratology (developmental toxicity) study in rats and when only minimal maternal toxicity was observed, no fetotoxic or developmental effects were observed. A developmental toxicity study of dermally applied middle distillates did indicate fetotoxicity (reduced litter size, litter weight, increased resorptions) at doses that also caused significant maternal toxicity.

---CHRONIC TOXICOLOGY (SUMMARY)---

Diesel fuel, heating oil and middle distillates have been shown to be carcinogenic in lifetime mouse skin painting bioassays. While in some cases, the tumor incidence is low in the test populations and possibly associated with skin irritation, concurrent evidence from short-term predicative tests (Modified Ames) does indicate some level of mutagenic activity associated with levels of polycylic aromatic compounds in certain test samples.

---SENSITIZATION (SUMMARY)---

Middle distillate oils were not skin sensitizers when tested in a Modified Buehler Guinea Pig Sensitization Assay.

---OTHER TOXICOLOGY DATA---

Overexposure to diesel exhaust fumes may result in eye irritation, headaches, nausea, and respiratory irritation. Animal studies involving lifetime exposure to high levels of diesel exhaust have produced variable results, with some studies indicating a potential for lung cancer. Limited evidence from epidemiological studies suggest an association between long-term occupational exposure to diesel engine emissions and lung cancer. Diesel engine exhaust typically consists of gases and particulates, including carbon dioxide, carbon monoxide, nitrogen compounds, oxides of sulfur, and hydrocarbons. Diesel exhaust composition will vary with fuel, engine type, load cycle, engine maintenance,

tuning and exhaust gas treatment. Use of adequate ventilation and/or respiratory protection in the presence of diesel exhaust is recommended to minimize exposures. This product contains ethylbenzene. The International Agency for Research on Cancer (IARC) has evaluated ethylbenzene and classified it as possibly carcinogenic to humans (Group 2B) based on sufficient evidence for carcinogenicity in experimental animals, but inadequate evidence for cancer in exposed humans.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS:

In the absence of specific environmental data for this product, this assessment is based on information for representative substances.

ECOTOXICITY: Based on test results for similar products, this substance may be toxic to aquatic organisms such as algae and daphnia (EL50/ IrL50 =1-10 mg/L). This substance has also been shown to be toxic to specific fish species (LL50 = 1-10 mg/L for rainbow trout, Atlantic silverside).

MOBILITY: Dissolution of the higher molecular weight hydrocarbon components in water will be limited, but losses through sediment adsorption may be significant.

PERSISTENCE AND DEGRADABILITY: The majority of the components in this product are expected to be inherently biodegradable. The consitituents of diesel fuels/heating oil which are volatilized will photodegrade in the atmosphere. The less volatile, more water-soluble components which are aromatic hydrocarbons will also undergo aqueous photodegradation.

BIOACCUMULATIVE POTENTIAL: Not established.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning for fuel value in compliance with applicable laws and regulations.

RCRA INFORMATION: Disposal of unused product may be subject to RCRA regulations (40 CFR 261). Disposal of the used product may also be regulated due to ignitability, corrosivity, reactivity, or toxicity as determined by the Toxicity Characteristic Leaching Procedure (TCLP).

FLASH: > 55(131) C(F)

14. TRANSPORT INFORMATION

NOTE:The flash point of this material is > 131F. Regulatory classifications vary as follows:

DOT: Flammable Liquid OR Combustible Liquid - (49CFR 173.120(b)(2))
OSHA: Combustible Liquid
IATA/IMO: Flammable Liquid

USA DOT:

SHIPPING NAME:	Diesel Fuel
HAZARD CLASS & DIV:	COMBUSTIBLE LIQUID
ID NUMBER:	NA1993
ERG NUMBER:	128
PACKING GROUP:	PG III
STCC:	NE
DANGEROUS WHEN WET:	No
POISON:	No
LABEL(s):	NA
PLACARD(s):	Combustible
PRODUCT RQ:	NA
MARPOL III STATUS:	NA

RID/ADR:

HAZARD CLASS:	3
PACKING GROUP:	III
LABEL:	3
DANGER NUMBER:	30
UN NUMBER:	1202
SHIPPING NAME:	Gas Oil
REMARKS:	NA

IMO:

HAZARD CLASS & DIV:	3
UN NUMBER:	1202
PACKING GROUP:	PG III
SHIPPING NAME:	Gas Oil
LABEL(s):	Flammable Liquid
MARPOL III STATUS:	NA

ICAO/IATA:

HAZARD CLASS & DIV:	3
ID/UN Number:	1202
PACKING GROUP:	PG III
SHIPPING NAME:	Gas Oil
SUBSIDIARY RISK:	NA
LABEL(s):	Flammable Liquid

STATIC ACCUMULATOR (50 picosiemens or less): YES

---

15. REGULATORY INFORMATION

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined to be hazardous.

EU Labeling: Product is dangerous as defined by the European Union Dangerous Substances/Preparations Directives.

Symbol: Xn N Harmful, Dangerous for the environment.

Risk Phrase(s): R40-65-66-51/53.
Limited evidence of a carcinogenic effect. Harmful: may cause lung damage if swallowed. Repeated exposure may cause skin dryness or cracking. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrase(s): S24-2-36/37-62.
Avoid contact with skin. Keep out of the reach of children. Wear suitable protective clothing and gloves. If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Contains: Gas oil - unspecified.

Governmental Inventory Status: All components comply with TSCA, EINECS/ELINCS, AICS, METI, DSL, KOREA, and PHILIPPINES.

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:
This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (311/312) REPORTABLE HAZARD CATEGORIES:
FIRE CHRONIC ACUTE

This product contains the following SARA (313) Toxic Release Chemicals:

CHEMICAL NAME	CAS NUMBER	CONC.
ETHYL BENZENE(COMPONENT ANALYSIS)	100-41-4	0.5%

The following product ingredients are cited on the lists below:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS *
NAPHTHALENE (COMPONENT ANALYSIS) (0.50%)	91-20-3	16, 22
ETHYL BENZENE (COMPONENT ANALYSIS)	100-41-4	1, 8, 24
DIESEL OIL..C9-20	68334-30-5	21, 26

--- REGULATORY LISTS SEARCHED ---

1=ACGIH ALL	6=IARC 1	11=TSCA 4	16=CA P65 CARC	21=LA RTK
2=ACGIH A1	7=IARC 2A	12=TSCA 5a2	17=CA P65 REPRO	22=MI 293
3=ACGIH A2	8=IARC 2B	13=TSCA 5e	18=CA RTK	23=MN RTK
4=NTP CARC	9=OSHA CARC	14=TSCA 6	19=FL RTK	24=NJ RTK
5=NTP SUS	10=OSHA Z	15=TSCA 12b	20=IL RTK	25=PA RTK
				26=RI RTK

* EPA recently added new chemical substances to its TSCA Section 4 test rules. Please contact the supplier to confirm whether the ingredients in this product currently appear on a TSCA 4 or TSCA 12b list.

Code key:CARC=Carcinogen; SUS=Suspected Carcinogen; REPRO=Reproductive

16. OTHER INFORMATION

USE: DIESEL FUEL

NOTE: PRODUCTS OF EXXON MOBIL CORPORATION AND ITS AFFILIATED COMPANIES ARE NOT FORMULATED TO CONTAIN PCBS.

Health studies have shown that many hydrocarbons pose potential human health risks which may vary from person to person. Information provided on this MSDS reflects intended use. This product should not be used for other applications. In any case, the following advice should be considered:

INJECTION INJURY WARNING: If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

Precautionary Label Text:

CONTAINS DIESEL OIL.. C9-20

WARNING!

COMBUSTIBLE LIQUID AND VAPOR. RESPIRATORY IRRITATION, HEADACHE, DIZZINESS, NAUSEA, LOSS OF CONSCIOUSNESS, AND IN CASES OF EXTREME EXPOSURE, POSSIBLY DEATH. LOW VISCOSITY MATERIAL-IF SWALLOWED, MAY BE ASPIRATED AND CAN CAUSE SERIOUS OR FATAL LUNG DAMAGE.

MAY CAUSE SKIN CANCER ON PROLONGED, REPEATED SKIN CONTACT. ANIMAL SKIN ABSORPTION STUDIES RESULTED IN INCREASED MORTALITY, EFFECTS ON BODY WEIGHT, THE IMMUNE SYSTEM AND THE UNBORN CHILD. PROLONGED, REPEATED SKIN CONTACT MAY CAUSE IRRITATION. DIESEL EXHAUST MAY CAUSE LUNG CANCER.

Keep away from heat and flame. Avoid prolonged or repeated overexposure by skin contact or inhalation. Use with adequate ventilation. Keep container closed. Keep out of reach of children.

FIRST AID: If inhaled, remove from further exposure. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation. In case of contact, remove contaminated clothing. Dry wipe the exposed skin and cleanse with waterless hand cleaner and follow by washing thoroughly with soap and water. For those providing assistance, avoid further skin contact to yourself and others. Wear impervious gloves. If swallowed, seek immediate medical attention. Do not induce vomiting. Only induce vomiting at the instruction of a physician.

This warning is given to comply with California Health and Safety Code 25249.6 and does not constitute an admission or a waiver of rights. This product contains a chemical known to the State of California to cause cancer, birth defects, or other reproductive harm. Chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm are created by the combustion of this product. Refer to product Material Safety Data Sheet for further safety and health information.

****

For Internal Use Only: MHC: 1* 1* 1* 1* 1*, MPPEC: C, TRN: 123455-22, CMCS97: EMGF22, REQ: PS+C, SAFE USE: C

EHS Approval Date: 03APR2003

****

Prepared by: ExxonMobil Oil Corporation
Environmental Health and Safety Department, Clinton, USA

APPENDIX 4

Appendix 4

EMERGENCY CONTACT NUMBERS

Ambulance Fire Brigade	000
Police	000
Poisons Information Centre	13 11 26
Bankstown-Lidcombe Hospital	(02) 9722 8000
Sydney Water Corporation (repairs)	13 20 90

Aargus Pty Ltd

Project Director	Mark Kelly 0425 344 389
Project Manager	TBC
Field Environmental Scientist	TBC
Environmental Representative Head Office	1300 137 038

Contractor	TBC
Project Manager	TBC
Foreman	TBC

APPENDIX 5

Appendix 5

PROJECT SPECIFIC HEALTH AND SAFETY INSTRUCTIONS

Project Health & Safety Instructions are:

1. A Health and Safety induction must be attended prior to commencing work on the site.
2. Follow the work instructions exactly as specified in the Work Health and Safety Plan.
3. An Asbestos Removal Control Plan must be prepared to excavate, transport and dispose of the underlying asbestos impacted soils.
4. Do not start work until the site coordinator has stated that all the necessary work permits have been obtained.
5. Appropriate Personal Protective Equipment must be worn whenever physically handling asbestos containing materials and asbestos impacted soils.
6. Control Asbestos Air Monitoring maybe recommended around site boundaries during excavation of asbestos impacted soils.
7. A particulates and organic vapours rated respirator must be worn at all times whilst working in the vicinity of odorous hydrocarbon impacts soil or in areas where dust is generated.
8. Only intrinsically safe electrical equipment approved by the site manager can be used on site.

APPENDIX 6

Environment Health and Safety Incident Report

(To be completed by Project Manager)

Job No. .....
Project: .....
Client: .....
Site Address: .....
.....
Project Manager: .....
Site Co-ordinator: .....

Date of Incident: .....
Time of Incident: .....
Type of Incident or Near Incident .....

Description of Incident:.....
.....
.....
Persons Involved:.....
.....
Type of Involvement:.....
.....
Witnesses (not involved in incident):.....
.....
Immediate Actions Taken: .....
.....
.....
Cause of Incident: .....
.....
If near-miss, what might have happened: .....
.....
.....
Corrective Action Implemented/Proposed: .....
.....
.....

Is this a notifiable incident (see List of Notifiable Incidents in Section 9.1 of the Health and Safety Plan)

If Yes: Call WorkCover immediately on 132 360 Date: .....
Send written notification within 48 hours Date: .....
Signature: ....
Aargus Pty Ltd Project Manager

Filing Instructions

1. Original in Job File.
2. Copy to Techfile 7.3.2.1 Health and Safety Incidents

EHS Project Review Report

(To be completed by Project Manager)

Job No. .....

Project: .....

Client: .....

Site Address: .....

.....

Project Manager: .....

Site Co-ordinator: .....

Date(s) of Site Work: .....

Did any Notifiable Incidents occur during site work:

☐ Yes See Incident Report No. .....

☐ No

Signature: ....

Aargus Pty Ltd Project Manager

Filing Instructions

1. Original in Job File.
2. Copy to Techfile 7.3.2.1 Health and Safety Incidents

APPENDIX 7

Appendix 7

STATEMENT OF COMPLIANCE AND CONFIDENTIALITY

AARGUS PTY LTD - HEALTH AND SAFETY PLAN

- I have read and understood the attached Work Health and Safety Plan;
- I have been informed of the potential hazards associated with work on the site;
- I have been instructed in the use of all safety equipment on the site:
- I agree to comply with the safety procedures detailed in the attached Health and Safety Plan;
- I agree to keep confidential all information supplied to me or information of which I become aware of in the course of carrying out any work on the site.

Name:_____ Name:_____

Company:_____ Company:_____

Signature:_____ Signature:_____

Date:_____ Date:_____

Name:_____ Name:_____

Company:_____ Company:_____

Signature:_____ Signature:_____

Date:_____ Date:_____

Aargus

APPENDIX D

ENVIRONMENTAL WORK SHEETS

Aargus

Aargus Pty Ltd

Daily Worksheet

Sampling & Monitoring Details for Individual Determinants

Location/Address:_____
Name of Officer Responsible:_____
Title of Officer Responsible:_____
Phone:_____Fax:_____
Mobile:_____Other:_____

Other persons involved in inspection & monitoring (including laboratories, passed on information, electronic readings, etc)_____
_____
_____
_____

Date of Inspection: / / Time of Start:_____Finish:_____
Description of Weather:_____Wind Direction:_____
Wind Speed:_____Rainfall(mm):_____Humidity:_____

Odours present Y/N____Location:_____Time:_____
Odours spraying Y/N_____Location:_____Time:_____
Environmental &/or other accidents/concerns:(details)_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____Actions:_____
_____
_____
_____
_____
_____

Stormwater controls Y/N____Location(s):_____Time:_____
Dust suppression Y/N_____Location(s):_____Time:_____
Traffic control Y/N_____Location(s):_____Time:_____
Equipment on site:_____

_____

_____

_____

_____

_____

_____

Truck movement tally:_____

_____

_____

Field Measurements

Location	PID level	Location	PID level	Location	PID level	Location	PID level
Location	PID level	Location	PID level	Location	PID level	Location	PID level
Location	PID level	Location	PID level	Location	PID level	Location	PID level
Location	PID level	Location	PID level	Location	PID level	Location	PID level
Location	PID level	Location	PID level	Location	PID level	Location	PID level
Location	Other	Location	Other	Location	Other	Location	Other
Location	Other	Location	Other	Location	Other	Location	Other
Location	Other	Location	Other	Location	Other	Location	Other
Location	Other	Location	Other	Location	Other	Location	Other

A a r g u s P t y L t d

Daily Monitoring Parameters - Date:_____

SUBJECT	TIME	VISUAL INSPECTION	LOCATION	□	x	ACTION
SOIL						
Soil in Trench						
Soil Stockpiled						
Transport of Soil						
Soil PID						
Soil Reinstatement						
Reinstatement Method						
Species Planted						
Soil Erosion Measures						
Soil on Roads						
Soil wetting						
Covers for Trucks						
Fill Condition						
Wheel Wash/Shakers						
Utilities Encountered						
WATER						
Trench Water Inspection						
Estimated Volume						
Flocculant Used						
Surface Water Retention						
Sediment Controls						
Silt Screens & Fences						
Fence Inspection						
Water Colour						
AIR						
Odours Encountered						
Mufflers on Equipment						
Visible Dust						
OTHER						
Refuse						
Chemicals Used						
Bunding of Chemicals						
Decontamination						

Total Non-conformances_____

E1430/2 - Macquarie Park

A a r g u s P t y L t d

Weekly Monitoring Summary - Week Ending_____

SUBJECT	CRITERIA	# check	#☐	#X	REASON FOR NON-CONFORMANCE	NCR#	ACTIONS	BY WHO	DUE DATE
Soil Chemical Analysis									
Soil in Trench									
Soil Stockpiled									
Transport of Soil									
Soil PID									
Soil Reinstatement									
Reinstatement Method									
Species Planted									
Soil Erosion Measures									
Soil on Roads									
Soil wetting									
Covers for Trucks									
Fill Condition									
Wheel Wash/Shakers									
Utilities Encountered									
Water Chemical Analysis									
Trench Water Inspection									
Estimated Volume									
Flocculant Used									
Surface Water Retention									
Sediment Controls									
Silt Screens & Fences									
Fence Inspection									
Water Colour									
Air/Noise Analysis									
Odours Encountered									
Mufflers on Equipment									
Visible Dust									
EMP Induction/Awarenes									
Refuse									
Chemicals Used									
Bunding of Chemicals									
Decontamination									

Total Non-conformances_____

A a r g u s P t y L t d

Measurement and Analysis

SUBJECT	DATE	TIME	SAMPLE LOCATION	INSTRUMENT TECHNIQUE	CALIBRATION	RESULT	√	x	ACTION
SOIL									
PID									
Other Substances									
1									
2									
3									
4									
5									
6									
WATER									
Non Filterable Residue									
pH									
Oil and Grease									
Other Substances									
1									
2									
3									
4									
5									
6									
AIR/NOISE									
Airborne Particles									
Peak Station									
Local Station									
Noise Measurements									
OTHER									
EMP/OH&S Induction									
EMP/OH&S Awareness									

Total Non-conformances_____

DAILY MOVEMENT SUMMARY

Job Name:

Date:____/____/____

#	Rego	Name	Time In	Time Out	Origin	Destination	Load Class	Weigh Docket #	Weight tonnes

Environmental Consultant Name_____

Signature_____

Receipients Name_____

Signature:_____

Non-Conformance Report - Corrective Action Request

NCR/CAR Number:_____

(This section is to be filled out by the person discovering the nonconformance/requesting corrective action. Or, if this is a complaint, the person in contact with the person complaining).

Name:_____Company:_____Date:_____Contact Details:_____

Complaint (if applicable)

Name:_____Location:_____

Company (if applicable):_____Phone:_____

Complaint:_____

_____

_____

_____

_____

Nonconformance/Problem Description

Details/Explanation:_____

_____

_____

_____

_____

_____

Problem Resolution (attach appropriate supporting documents)

"Root Cause" Investigation and Impact Analysis:_____

_____

_____

_____

_____

Action(s) taken to resolve and prevent recurrence:_____

_____

_____

_____

Nonconformance/Complaint Closed (to be completed by authorised officer)

Was follow-up performed: Yes____Date:___/___/___None Needed____

Closed by:_____Date:___/___/____

Aargus Pty Ltd
Waste Tracking Form

Aargus
AUSTRALIA

WASTE GENERATOR

Name:_____

Site Address:_____

Suburb:_____

Waste Type:_____ Truck Rego:_____

Load Number:_____ Estimated Weight:_____

Contact Name:_____ Phone Number:_____

Site Contact:_____ Mobile:_____

Signature:_____ Date:_____

RECEIVAL FACILITY

Landfill:_____

Landfill Address:_____

Phone Number:_____

Fax Number:_____

Weight Received:_____

Weighbridge Docket Number:_____

Signature:_____ Date:_____

APPENDIX E

SAMPLING QUALITY AND FIELDWORK ASSURANCE PLAN

Aargus

Environmental - Remediation - Engineering - Laboratories - Drilling

Sampling Quality & Fieldwork Assurance Protocols

NOTE:
Whilst these protocols are based upon standard industry best practice, since preparing this document, the new recently released NEPM 2013 Guidelines may provide more updated methodologies used in sampling, quality and fieldwork procedures. This document therefore is in the process of being updated.

January 201O

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1 OBJECTIVE AND SCOPE

The objective of Aargus Pty Ltd (Aargus) Protocols is to ensure that the methodology followed during fieldworks is adequate to provide data which is usable and representative of the conditions actually encountered at the site.

The scope of these protocols is to:

- Outline the methods and procedures for the field investigations during an engineering, laboratory or environmental assessment or remediation and validation program; and
- Specify methods and procedures which ensure that soil and groundwater samples recovered are representative of the actual subsurface or surface conditions at the site, as well as ensuring that the risk of introducing external contamination to samples and to the environment is minimised.

These protocols must be adhered to by Aargus personnel and by sub-contractors involved in field investigations under Aargus Management. Any deviations from these protocols should be explained within the Aargus Report to which they are attached.

2 SOIL SAMPLING

2.1 Collection methods

Possible collection methods

Soil samples are generally collected by drilling or excavating the subsurface, using one of the following drilling / excavating technique:

- Rotary air hammer
- Hand auger, trowel or manual handling (shovel)
- Solid or hollow auger
- Backhoe or Excavator

Rotary Air Hammer

The air hammer technique requires the use of synthetic blend lubricants to prevent potential contamination of the borehole if a leak were to occur. In addition, micro-filters are installed into the drilling airline to avoid contamination by hydrocarbons present in the compressed air.

Samples of rock are generally not collected. Where rock samples are needed, specialised techniques are used.

Hand auger, trowel or manual

A hand auger or trowel is generally used to investigate subsurface conditions of unconsolidated materials at shallow depths or in areas difficult to access with other equipment. Samples are recovered from the hand auger, taking care to avoid cross contamination, especially between samples from the same hole but at different depths. Sampling equipment is to be thoroughly cleaned between sampling events, in accordance with the procedures outlined in Section 2.5 Equipment decontamination. In the case of laboratory sampling, a pick and shovel can be used to gather adequate sample size as cross contamination is not considered an issue.

Solid or Hollow auger

Solid and hollow auger drilling techniques are well suited to unconsolidated materials. The main advantage of the hollow auger technique is that the drill rods allow access of sampling equipment at specified depths within the annulus of the drill rods.

Samples of soil are recovered using a split spoon sampler at specific depth intervals. The split spoon sampler is driven into the soil by the drill rig whilst attached to the end of the drill rods. The retrieved sample is then split lengthways into two halves when duplicate samples are required. A few centimetres of soil from the top of the split spoon sampler is discarded. Samples for volatile analysis are collected first, without mixing.

Test pits and trenches excavated with a backhoe or an excavator

Test Pit and Trenches excavated with a backhoe/excavator are used to collect relatively shallow (i.e. less than 3.5m depth) soil samples on occasions where:

- Access multiple sample locations at a site are needed;
- A description of the subsurface soil profile to approximately 3.5 m depth is required (generally in unsaturated conditions);
- The investigated site is free from known underground services and access problems;
- The investigated site is free from impenetrable surface or near surface layers including concrete and asphalt pavements; and
- Undisturbed soil samples are required, usually at multiple depths.

Backfilling

On completion of drilling / test pitting, the investigated locations are backfilled with cuttings and compacted. Excess drill cuttings are disposed of appropriately. If the sampling location is located in an area used for the circulation of people or vehicles, the top of the sampling location should be sealed with mortar.

2.2 Soil logging

The lithological logging of soil samples and subsurface conditions is undertaken by Aargus personnel. The soil characteristics are logged in accordance with the Australian Standard *AS1726-1993 Geotechnical Site Investigations.* This includes description of grain size, visible staining, odour and colour, and of the clues which may suggest that the soil may be contaminated. Descriptions of soils are made using the Northcote method.

2.3 Collecting soil samples

The soil sample is collected using a stainless steel trowel, split tube sampler, or directly with the hand if the sampler wears disposable gloves. Soils are quickly transferred into 250g clean amber glass jars, which have been acid washed and solvent rinsed. The jars are sealed with a screw-on teflon lined plastic lid, labelled, and placed for storage in an ice filled chest. Alternatively for engineering and laboratory sampling, 20kg plastic bulk bags are used and appropriately labelled.

2.4 Labelling of soil samples

Samples are labelled with the following information:

- Job number;
- Date of sample collection;
- Name of the Aargus professional who collected the sample; and
- Sample number: the letters used to label the samples are BH, C, SS, SP, TP and V which refer respectively to borehole samples, composite samples, surface samples, stockpile samples, test pit samples and validation samples. For borehole samples, BH3.1.0 is the sample taken from borehole 3 at 1.0m below ground level. For stockpile samples, SP1/1 is the first sample from stockpile 1. TP1.2.5 is the sample taken from testpit 1 at a depth of 2.5 metres below ground level. V3/F is the validation sample taken from location V3, the letters F N, S, E and W refer to the floor, north, south, east and west walls of an excavation; if some contamination is found in the validation sample, then chasing out of the contamination is required and in this case, the label of the sample is changed by adding /1 or /2 according to the number of times the contamination has been chased out. B stands for blind and could be B1, B2 etc. dependant on how many blind samples were taken.

2.5 Equipment decontamination

The drilling and sampling equipment are cleaned using an appropriate surfactant (e.g. phosphate-free detergent or Decon 90), then rinsed with tap water prior to final rinsing with distilled water.

The following procedures shall be followed for decontamination of drilling and sampling equipment where required:

- buckets or tubs used for decontamination shall be cleaned with tap water and detergent and rinsed with tap water before sampling commences;
- fill first bucket or tub with tap water, and phosphate free detergent;
- fill second bucket or tub with tap water;
- clean equipment thoroughly in detergent water, using a stiff brush; rinse equipment in tap water;
- dry equipment with disposable towels;

- rinse equipment by thoroughly spraying with tap water, then final rinse with distilled water;
- allow equipment to dry; and
- change water and detergent solution between sampling event where required or when water is dirty.

Sampling decontaminated equipment should be kept in a clean area to prevent cross-contamination. Equipment that cannot be thoroughly decontaminated using the detergent wash and water rinse should be cleaned with steam or high pressure water or if a cleaner is not available, not used for further sampling (and labelled clearly "not decontaminated") or discarded. Equipment decontaminated using the high pressure steam cleaner will be treated as described above. Any equipment that cannot be thoroughly decontaminated shall be discarded and replaced.

A new pair of latex gloves is used to handle each sample. Contaminated materials such as disposable clothing should be disposed of in accordance with environmental best practice.

2.6 Surveying of sampling locations

Sampling locations are generally located by measured reference to existing ground and site features, e.g. fences, buildings.

If the survey for location and elevation is required, it should be done by a licensed surveyor, or alternatively by an Aargus environmental engineer / scientist using proprietary laser dumpies and theodolites required can be obtained by the use of Aargus field equipment. Aargus also has GPS equipment and level meters.

If the location is given by a licensed surveyor, it is generally given to the nearest 0.1m and referenced to the Australian Map Grid (AMG) coordinates.

3 GROUNDWATER SAMPLING

3.1 Groundwater Sampling Objectives

The primary objective of any groundwater (quality) sampling is to produce groundwater samples that are representative of groundwater in the aquifer and will remain representative until analytical determination or measurements are made.

3.2 Groundwater well construction

Typically wells are installed to gain access to the groundwater to be sampled. Well construction details will depend on hydrogeological setting of the site, for example the depth to groundwater strata present. Relevant information regarding the hydrogeological setting will have been obtained prior the development of any groundwater sampling program.

The preferred drilling methods will depend on the hydrogeological setting of the site and the objectives of the groundwater sampling program. For example, shallow wells in unconsolidated materials, such as sand, may be drilled using a hand auger. Drill rigs using solid of hollow flight augers may be used to drill deeper wells or through semi consolidated materials, such as stiff clay. Rotary air hammer drilling may be used were well is to be drilled through consolidated materials, such as rock. Soil samples may also be collected during drilling (see Section 2 SOIL SAMPLING).

Drilling methods and materials must not have an unacceptable impact on the groundwater to be sampled. For example, if groundwater from the wells is to be tested for organic analytes, petroleum based lubricants are not to be used and oil traps must be installed on compressed air lines. Drilling techniques should also minimise compaction or smearing of the boreholes wells and transport of material into different zones, in particular, when drilling through potentially contaminated material to access groundwater.

Drill cuttings accumulated over a hole are to be removed as drilling progresses so as to prevent fallback of cuttings into the hole. Samples may be collected at a range of depths in the borehole profile during drilling.

The depth of groundwater well depends of the purpose of the investigation on the soil profile and the regional geology of the area. If the borehole location is covered by concrete, coring of the superficial hard layer is undertaken first.

Petroleum based lubricants are not used on drilling and sampling equipment, instead, Teflon based greases are used where appropriate. An Aargus professional monitors and records drilling activities, procedures adopted, materials used, progress of the stages of well construction, screen location, standpipe lens, placement, of sand filters and well seals, and general completion details, as well as the lithology of the subsurface, visible staining, unusual odours and colours (if any).

The use of a rotary air hammer rig has many advantages for consolidated material (e.g. rock), including:

- Large diameter to allow precise placement of groundwater monitoring equipment;
- No injection of drilling fluids into the formation with resulting benefits in ensuring integrity of recovered samples, and therefore no need to dispose off-site drilling fluids;
- Rapid penetration in consolidated material; and
- Provision of reliable indications of saturated conditions whilst drilling.

Drill cuttings accumulated over a hole are removed as drilling progresses so as to prevent fallback of cuttings into the hole. Samples are taken at a range of depths in the borehole profile.

Construction of the monitoring well may be carried out by the Aargus professional or the drilling contractor under the direct supervision of the Aargus environmental scientist/engineer. Typically on completion of drilling, slotted heavy duty PVC pipe (generally 50mm in diameter for the installation of monitoring well) is inserted into the drilled hole. The base of the pipe is capped prior to insertion in order to prevent natural soils entering the well from below. The drilled area surrounding the pipe screen is filled with coarse-grained sand. Bentonite or cement grout seal plugs may be placed above the screen depending on the hydrogeological setting of the site and sand cement mix. Excess drill cuttings are disposed of in accordance with environmental best practice.

The Aargus professional will monitor and record drilling activities, and materials encountered during drilling (including visible staining, unusual odours and colours (if any)). They will log the procedures adopted, materials used, and well construction (i.e. location of the screen, placement of sand packs and well seals and general completion details).

3.3 Development of monitoring wells

Development is the process of removing fine sand silt and clay from the aquifer around the well screen in order to maximise the hydraulic connection between the bore and the formation.

Development involves removal of fluids that may have been introduced during drilling operations as well as fines from the sand filter and screens. Well development generally involves actively agitating the water column in the well then pumping water out until, ideally, water pumped comes out visibly clean and of

constant quality. Development can be undertaken immediately after installation of the groundwater well or after sufficient time has been allowed for bentonite / grout seals to consolidate.

Bores used for groundwater quality monitoring should be developed after drilling, then left for a period until bore chemistry can be demonstrated to have stabilised, anywhere between 24 hours and 7 days.

3.4 Purging of monitoring well

In most groundwater monitoring wells, there is a column of stagnant water above the screen that remains standing in the bore between sampling rounds. Stagnant water is generally not representative of formation water because it is in contact with bore construction materials for extended periods, is in direct contact with the atmosphere and is subject to different chemical equilibrium.

Purging is the process of removing this water from the well prior to sampling. In newly installed wells, the disturbance cause by drilling may also affect water present in the well, and purging may be carried out concurrently with well development. Ideally wells should be purged at the lowest rate practicable until stable water chemistry is achieved.

Purging is to be performed less than 24 hours before sample collection, but usually it is performed just before sampling. The default procedure for purging a groundwater monitoring well is as follows:

- If required, measure the concentration of volatile organic vapours in the well standpipe headspace.
- Measure the depth to the standing water level in the well standpipe and the total depth of the well relative to a reference mark (generally the top of the groundwater pipe). The depth of any light non-aqueous phase liquids (LNAPL) floating on the standing water should be recorded if present using an interface probe or other suitable device.
- Calculate the volume of the groundwater in the well standpipe. The internal diameter of the well casing and the diameter of the drill hole are used to calculate the volume of water to be removed during development (nominally a minimum of three well volumes, including water present in the sand pack, should be abstracted during purging).

- Samples of water are collected generally following development/purging of each well volume. The samples are measured immediately in the field for water quality parameters, pH, electrical conductivity, redox potential and temperature. Water quality measurement probes are to be calibrated against stock standards on regular basis and decontaminated between wells.

- Pump/bail groundwater from the well until the water quality parameters have stabilised (i.e. within 10% of the previous reading) or the well is pumped/bailed dry. Collect all purged water into an appropriate volume measurement vessel. Purged water is disposed of appropriately.

- Record all appropriate development details on the well development and sampling sheet.

- Decontaminate all equipment used in the purging procedure.

3.5 Groundwater sampling

For each sampling event, starting water levels, purging times and volumes, water quality parameters and sample details are recorded on well development and sampling sheets.

At each groundwater monitoring well, a polyethylene sheet or Eski lid is placed beside the well head and firmly fixed into position. Sampling equipment is placed onto the sheet to avoid cross contamination between the ground surface and the groundwater in the well.

Groundwater samples are collected in a bailer (Stainless Steel or disposable polymer) fitted with an emptying device. The bailer is decontaminated prior to use. All groundwater samples are retrieved at an appropriate rate in order for turbulence (which leads to cloudy samples) to be minimised.

When collecting a water sample the bailer is lowered gently into the well, until it is within the screened interval. The bailer is then steadily withdrawn, to minimise agitation of water in the well and disturbance of the surrounding sand filter material.

The procedure for using the bailer is:

- Slowly lower the bailer into the water and allow it to sink and fill with a minimum of disturbance;

- Empty the first bailer sample into a container in order to measure the volume of bailed water and to rinse the bailer with well water;

- Emptying the bailer through the bottom-emptying device (BED) collects the samples. The sample is discharged down the side of the sample bottle to minimise entry turbulence;
- Collect samples for volatile organics first, followed by semi-volatiles, other organics and then inorganics;
- The flow from the BED is adjusted so that a relatively low flow rate is maintained.

3.6 Low flow purging

Purging large volumes of water can be impractical, hazardous or may adversely affect the contaminant distribution in the sub-surface (e.g. through dilution). Low-flow purging involves minimal disturbance of the water column and aquifer and is preferable to the removal of a number of bore volumes. This method removes only small volumes of water, typically at rates of 0.1 to 1.0L/min, at a discrete depth within the bore.

Low-flow purging consists essentially of the following steps:

- The pump inlet is carefully and slowly placed in the middle or slightly above the middle of the screened interval at the point where the contaminant concentration is required (dedicated pumps, such as bladder pumps, are ideal for low-flow sampling). Placement of the pump inlet too close to the bottom of the bore can cause increased entrainment of solids, which have collected in the bore over time.
- Purging begins, typically at a rate of 0.1 to 1.0L/min, although higher rates may be possible provident the rate of purging does not cause significant draw down in the bore.
- During purging, groundwater stabilisation parameters should be measured and recorded to determine when they stabilise.
- When parameters have stabilised, the sample may be collected, at a rate slower or equal to purge rate.

3.7 Labelling of water samples

The water samples are identified with the same information than soil samples. GW4/2 is the sample collected from well GW4, and 2 refers to the sample number from this well, i.e. second time the well is sampled.

3.8 Sampling containers

Water samples are generally collected in bottles and containers provided by the laboratory who will analyse the samples. These are generally plastic bottles for inorganic analysis, and amber glass bottles for organic analysis. Vials are used to collect samples to be analysed for volatile organics. Sampling containers have appropriate preservatives added.

The bottles are filled to overflowing so as to remove air bubbles as much as possible prior to firmly screwing on the container cap. When performing purge and trap analyses, the vials are filled to 100% of their capacity. For headspace analyses, the vials are filled to approximately 75% of their capacity.

3.9 Well surveying

If the survey for location and elevation of a groundwater well is required, it should be done by a licensed surveyor, or alternatively by an Aargus environmental engineer / scientist if the level of precision required can be obtained by the use of Aargus field equipment.

If the location is given by a licensed surveyor, it is generally given to the nearest 0.1m and referenced to the Australian Map Grid (AMG) coordinates.

If the elevation is given by a licensed surveyor, the top of the standpipe and the ground surface adjacent to the standpipe are generally given to the nearest 0.01m and may be referenced to the Australian Height Datum (AHD). Relative levels (RLs) can be used if general contours are required.

4 SURFACE WATERS AND STORMWATER SAMPLING

4.1 Surface waters

Surface water samples are collected by hand, using automatic samplers, batch samplers or continuous samplers which can be installed to take samples at discrete time intervals or continuously. For well mixed surface water samples (up to 1m depth) a sample bottle is immersed by hand covered by a glove below the surface. Samples are also taken with sample poles that have extension arms so that more representative samples can be taken. For areas where access is difficult, samples can be collected using a retractable sample extension pole (sample bottle on the end) or in a bucket and transferred to sample bottles immediately following collection.

Other methods such as pumping systems, depth samplers, automatic samplers, and integrating systems are all relatively similar with water samples being supplied to a discharge point where samples can be collected in appropriate bottles.

4.2 Stormwater

The monitoring of stormwater quality is generally required prior to reject waters into stormwater drains. Field measurements are generally carried out using a Hanna Multiprobe prior to the discharge of the water to stormwater. The water parameters measured include pH, electrical conductivity (EC, in mS/cm) and Total Dissolved Solids (TDS).

If sampling is required, samples to be analysed for inorganic compounds are collected in plastic bottles, and samples to be analysed for organic compounds are collected in amber glass bottles. The bottles are filled to overflowing so as to remove air bubbles as much as possible prior to firmly screwing on the container cap. Sample containers may have preservatives added, in accordance with the laboratory recommendations.

Vials are used for volatile organic analysis. When performing purge and trap analysis, the vials should be filled to 100% of their capacity, whereas for headspace measurements, the vials should be filled to approximately 75% of their capacity..

4.3 Filtration devices

Water filtration devices may be required to filter surface water before it is discharged to the stormwater network, in order to remove suspended solids in water. One of the most simple and commonly used filtration device consists of between two to four retention sedimentation bays with a geotextile covering the inlet and outlet hoses.

Litter traps (wire or plastic grids or netting) may also be used to remove larger particles or debris. Other techniques to reduce the amount of suspended matter in water include wet basins, artificial wetlands, infiltration trenches and basins, sand filters and porous pavements. Some of these latter methods are also likely to reduce the bacterial levels in water.

The use of these filtration devices does not preclude carrying out monitoring of water quality following treatment and prior to discharge, particularly to the stormwater system.

5 FIELD TESTING

5.1 Field measurements

Field measurement of soils and groundwater parameters provides a rapid means of assessing certain aspects of soil and water quality. They are generally taken to:

- Ensure that formation water is being sampled
- Ensure screening of soils prepares samples for laboratory testing
- Provide on-site measurements for soil and water quality parameters that are sensitive to sampling and may change rapidly (e.g. temperature, pH, redox and dissolved oxygen (DO)).
- Compare with laboratory measurements of these parameters to assist in the interpretation of analytical results of other parameters (e.g. check for chemical changes due to holding time, preservation and transport).

Field measurements may be taken either in-situ or after groundwater has been extracted from a bore. Field measurements should be taken immediately before collecting each sample.

pH and dissolved oxygen meters need to be calibrated before every use, in accordance with the manufacturer's instructions. If field meters are to be used over several hours, periodic readings of a reference solution must be made to ensure calibration is stable.

5.2 PID Photo Ionisation Detector

Photo Ionisation Detector (PID) measurements are used to provide indicative field measurements of the amount of ionisable vapours released from a soil or water sample into the head space above the sample.

The procedure for field screening of samples using the PID is as follows:

- Prior to testing commencing, the PID is calibrated using standard laboratory calibration gas. The battery of the PID should also be sufficiently charged for the duration of the testing;

- The background concentrations of total ionisable compounds in the ambient air in the vicinity of the work area are established prior to the commencement of site activities. Background measurements are normally taken approximately 5 to 10m upwind of the work area. The readings are observed before and after each measurement of a sample to ensure that the PID is operating correctly. The maximums, fluctuations and other relevant comments are recorded.

- A glass sample jar is filled with the soil sample to be tested. The jar should not be filled more than 3/4 full;

- The jar is sealed with aluminium foil or plastic wrap and the lid is screwed;

- At least 20 minutes after placing the sample into the sampling jar, check that the PID reading is constant and similar to the background. Insert the top of the PID through the foil or plastic wrap in order to measure the ionisable vapour concentrations in the airspace above the sample;

- Monitor and record the PID readings noting fluctuations and maximum readings;

- Monitor the readings after returning the PID to a location with background concentrations. Interchangeable, clean, in-line filters for the PID probe are available to allow rapid decontamination of the unit in the field if background readings measured by the instrument are significantly greater than the background air concentration initially established;

- If perforations are present in the aluminium foil prior to analysis reseal the jar and test after having waited again for at least 20minutes.

An alternative acceptable method is to place the soil to be tested in a disposable zip loc plastic bag and test the sample by punching a hole in the bag with the PID tube to sample the gas from the bag.

6 ACID SULFATE SOILS

6.1 Desktop Classification

An initial review of Acid Sulphate Soils (ASS) Planning Maps is undertaken to identify the likelihood and risk of ASS being present at the site. The following geomorphic conditions of the site are also checked as an indication of the presence of

ASS: sediments of recent geological age (Holocene) ~ 6000 to 10 000 years old; soil horizons less than 5m AHD (Australian Height Datum); marine or estuarine sediments and tidal lakes; coastal wetlands or back swamp areas; waterlogged or scalded areas; inter-dune swales or coastal sand dunes; areas where the dominant vegetation is mangroves, reeds, rushes and other swamp tolerant and marine vegetation; areas identified in geological descriptions or in maps bearing sulfide minerals, coal deposits or former marine shales/sediments; and deeper older estuarine sediments >10m below the ground surface.

6.2 Site Walkover

The presence on site of hydrogen sulphide odours, acid scalds, flocculated iron, monosulfidic sludges, salt crusts, stressed vegetation, corrosion of concrete and/or steel structures and water logged soils are noted as cues for the presence of ASS.

6.3 Visual Classification

Visual indicators taken into account for the presence of ASS are the presence of jarosite (pale yellow colour) horizons or mottling, unripe muds (waterlogged, soft, blue grey or dark greenish grey in colour), silty sands and sands (mid to dark grey in colour) and the presence of shells.

6.4 Sample Collection

Samples are collected to at least one metre below the depth of the proposed excavation or estimated drop in the water table, or two metres below ground level, whichever is deepest. Samples are collected from every soil horizon or every 0.25m. Large shells, stones and fragments of wood, charcoal and other matter are noted, but removed from the sample. Small roots are not removed from the sample. If laboratory analysis is required, samples are sent for laboratory testing within 24 hours of sampling.

6.5 Field Testing

The field pH peroxide test (pH_{FOX}) is used to obtain an indication of the presence of oxidisable sulphur in the soil. The procedure for this test is as follows:

- A small sample of soil (<100g) is collected in a glass jar and split into two sub-samples. One sub-sample is made into a 1:5 (soil : deionised water) solution in order to measure field soil pH and electrical conductivity (EC) analysis. If the resulting pH is less than 4 (pH_F<4), the sample is identified as actual acid sulphate soil (AASS)

- The second sub-sample is made into a 1:5 (soil : Hydrogen Peroxide) solution to measure pH of oxidised soil. Sodium Hydroxide (NaOH)-adjusted analytical (30%) grade Hydrogen Peroxide (H_2O_2) is used as the soil oxidising agent. A mobile electronic pH/EC probe is used to measure soil pH.

- The presence of oxidisable sulphides, organic matter or manganese in the sample, will trigger a chemical reaction. The type of effervescence and any colour change is noted with the final pH measured to give an indication of the potential change in pH should the soil remain exposed to oxygen. If the resulting pH is less than 3 ($pH_{FOX}<3$) or if pH_{FOX} is at least one unit less than the $pH_{F,}$ this suggests that the soil tested is potential acid sulfate soil (PASS).

6.6 Laboratory Testing

When the field test suggests that the material tested contains ASS or PASS, this should be confirmed by laboratory analysis (POCAS/SPOCAS or TOS testing).

7 NOISE MONITORING

Measurements are taken at a range of times during the day in order to assess the trends in noise emission over time. Noise is measured using a hand-held Rion NA-29 Sound Level Meter with digital microphone. Some noise meters change and appropriate equipment which is calibrated is used for all monitoring. The reference level of the meter is checked before and after the measurements using a Rion NC-73 Sound Level Calibrator to ensure there is no significant drift. Noise measurements are made over a 15-minute interval using the “fast” response of the sound level meter. 5dB would be added if the noise is substantially tonal or impulsive in character. Measurements should be adapted to the type of noise being measured i.e. construction, occupation, club, etc.

8 DUST MONITORING

Sampling is conducted at locations of potential concern. The deposit gauge static sampler contains a glass funnel measuring approximately 150mm with the angle of the cones sides being 60 degrees, placed into a rubber stoppers in the mouth of a five-litre glass receptacle. The deposit gauge is placed in a stand so that the height of the funnel of the deposit gauge is between 1.8 and 2.2m above ground level. A

quantity of 7.8g copper sulfate pentahydrate dissolved in water is placed in the glass receptacle in order to prevent algal growth.

Exposure periods vary depending on the purpose of the investigation but typically the period is 30 ±2 days. Samples are usually analysed for measured soils: total solids, insoluble solids, ash and combustible solids.

Dust can also be measured using a High Volume Air Sampler. Such sampler should be located at least 2 metre away from any structures so that an undisturbed sample can be collected. HVASs can be used indoors or outdoors.

9 ASBESTOS INSPECTION, FIELDWORK AND SAMPLING

9.1 Assessment of soils that may contain asbestos contamination

Soils that are assessed as part of an environmental site assessment may be in-situ fill soils or stockpiled soils. The site/area-specific assessment for asbestos should be made in accordance with standard site investigation procedures with care taken during the site inspection stage. Details regarding assessment for asbestos are found within the WA Department of Health guidance (DoH 2009a) guidelines and draft NEPM 2011 guidelines. The assessment process may move from a preliminary site investigation to a more comprehensive detailed site investigation where required and indicators for asbestos are present. For most cases, a detailed environmental site assessment may not be needed if no soil contamination is found other than asbestos as a management approach will be preferred and qualitative assessment of the lateral extent of soil contamination will be sufficient. The severity of Asbestos risk can be calculated using the Aargus Asbestos Risk Assessment Hazard Level sheet found in the attachments of this document.

Assessment would normally require a sampling and analysis plan (SAP) to support the investigations and also any validation sampling that occurs. A site asbestos management plan (AMP) may be required to protect the public and workers during the assessment phase, as well as long term users of the site.

Initial inspections during site and soil assessments should be grid-based as far as practical in the first instance to detect any visible asbestos. The identified areas should then be surveyed in more detail along with suspect locations indicated as a result of the desktop study. enHealth 2005 *(Appendix V: Sample inspection and investigation form)* provides an asbestos visual inspection checklist. Relevant

guidelines recommend that such an approach be used to assist the systematic collection of relevant data.

Site inspection methods should be adopted to prevent further degradation or distribution of asbestos. This may include: restricted on-site use of vehicles and equipment; minimal disturbance of stockpiled or discarded materials; and the use of equipment and footwear scrub-down areas.

The most likely presence of asbestos, if present, will be visible on the surface and in significant quantities. The main exception is free fibre which will be hard to identify unless in bulk. An experienced inspector (Aargus OH&S scientist or experienced senior) is likely to identify asbestos as such, but confirmation of representative samples by analysis is appropriate if there is any uncertainty.

If the surface is heavily vegetated, then confidence in the visual inspection will be lessened. Some careful vegetation clearance may help to clarify the situation.

The inspection should also include any asbestos-containing structures, especially if in poor repair, footprints of demolished structures, and debris that has been dumped on the site, particularly demolition waste

The condition, quantities and location of the asbestos should be evaluated in general terms to inform initial remediation and management decisions. The following basic approach is generally appropriate:

- Where there is good historic information on the sources of the asbestos contamination, the estimated surface area of contamination can be considered equivalent to the visually delineated area of impact, and up to 1 m in all directions to account for uncertainty;
- The depth of contamination may be inferred from the desktop investigation, or later informed by targeted sampling. In either case, an additional 30 cm should be incorporated to account for uncertainty;
- The condition of ACM (Asbestos Cement Material) should be considered equivalent to the most degraded samples found in an area, noting that this may vary across different areas;
- Where significant amounts of free asbestos fibres may have been exposed over time, the immediate surrounding area should also be considered contaminated.

9.2 Preliminary Site Investigation

Sampling during the PSI is not normally recommended, since either a management strategy may be adequately defined based on other PSI investigation findings or because it is evident that a detailed site investigation (DSI) will be necessary anyway. Limited PSI sampling may be appropriate for the following reasons:

- To form part of the initial site or soil assessment;
- To confirm that asbestos is present/absent, including as free fibre;
- To roughly delineate the contamination's lateral and vertical extent;
- To inform the Sampling and Analysis Plan for the Detailed Site Investigation;
- To obtain a preliminary idea of appropriate management options;
- For air sampling, to ascertain what additional site-control measures are warranted or if immediate response actions are required.

PSI sampling would most likely be surface hand-picking or targeted sampling (also in accordance with general site/area soil assessment requirements as part of standard site assessments). Any sampling should be based on a Sampling and Analysis Program.

Fragments if found must be inspected by an appropriately qualified and experienced asbestos consultant (Aargus OH&S scientist or experienced senior). The default assumption should be that any suspect material does contain asbestos and appropriate management action should be initiated. Where confirmation is required regarding the nature of the fibre in the ACM, identification by transmission electron microscopy is the favoured method to determine if the suspect material in the cement matrix is asbestos.

9.3 Detailed Site Assessment

A DSI is an investigation which confirms and delineates potential or actual contamination through a comprehensive sampling program. These form part of the standard Aargus sampling protocols for site and soil assessments and elements specific to asbestos are provided below as additional items to review when taking asbestos into consideration.

A DSI is not usually required if the contamination is demonstrated to be ACM in limited quantities sitting on the soil surface (simple surface impact). Hand-picking as

outlined below may be sufficient to manage this type of contamination. The AMP can be used instead for management purposes just for asbestos, although this will depend on site-specific circumstances, especially the remediation approach proposed. A DSI should only be undertaken when delineation of asbestos impacts must be accurate, such as if:

- The remediation or management approach requires asbestos to be removed or relocated from an area;
- Asbestos contamination is due to friable or free-fibre generating material;
- Land uses are to be determined and delineated according to the extent and nature of asbestos contamination.

A DSI may also help resolve uncertain findings from the PSI, or to help assess the likely effectiveness of alternative remediation and management strategies.

Care is necessary during the DSI to ensure that sampling and monitoring results are not compromised due to poor site management practices, specifically:

- Sampling should follow removal of any asbestos material that may be actively generating asbestos free fibres, such as exposed ACM products in poor condition;
- Investigations should follow any planned demolition of asbestos-containing structures or buildings, or removal of asbestos from within them, unless the demolition is closely monitored and the associated removal site is professionally validated;
- All equipment operation, vehicle movements and dust during the sampling and monitoring regime need to be carefully managed.

Qualitative assessment may be sufficient to determine that the distribution of ACM is limited and that no further action, or limited action such as removal of minor surface material, is all that is required. Where there is a concern (and a need to determine) that the level of ACM may exceed the screening criterion, quantitative assessment using a graivimetric approach may be undertaken to assess the site-specific risk. This more detailed assessment may also be carried out when ongoing management of the site under regulatory controls is a potential requirement. This approach should be checked first as in general a zero tolerance of asbestos is the preferred regulatory approach at the moment.

Detailed site assessment should be undertaken for sensitive land uses where asbestos contamination (using a gravimetric approach) is likely to approach or exceed screening criteria. This may involve a quantitative, thorough; and well-argued risk assessment involving a detailed test pit and trenching program based on site history where it is available, and appraisal of the relevant site-specific risk issues.

9.4 Sampling of Asbestos

Surface distribution - ACM fragments are often present as surface deposits on sites from past poor demolition and building practices. While isolated fragments across the surface of a site are usually of low concern, any surface material may present a risk of exposure over time from decay through corrosive weathering or abrasion by vehicle traffic and other activities. There should be no visible ACM fragments greater than 7mm x 7mm on the surface or in the top 10cm of soil, which can be achieved by multi-directional raking or tilling and hand picking (as described below). When cohesive soils or a large surface area is involved it may be more practical to skim the top 10cm of soil for disposal in accordance with regulatory requirements. The exposed surface of the site can then be further visually assessed by an appropriately qualified and experienced professional on a systematic basis where some localised hand picking or additional earthworks may be required.

ACM through a soil profile, test pits or boreholes may reveal the presence of ACM in fill through a soil profile. This can be quantified on a gravimetric basis and compared to the screening criteria in Schedule B1 of the NEPM.

Judgmental sampling targets particular areas of a site based on known or likely contamination, which is the preferred approach. It depends heavily on a thorough PSI and should reflect the state of the site at that time. Judgmental sampling can help avoid unnecessary broad area sampling. Judgmental sampling may need to be augmented or substituted by grid sampling.

Grid sampling is most appropriate when asbestos contamination is widespread or may be present at unknown locations. If the contamination is buried then test pits in particular and/or boreholes are used for either the judgmental or grid-based regimes.

The following situations are especially relevant to judgmental sampling:

- If contamination ‘hot spots’ are identified by the PSI, a sampling strategy is required to confirm their extent, which if indicated to be sub-surface should include test pits and stratified sampling methods;
- The SAP provides for opportunistic (discretionary) sampling to be conducted as necessary, for example, when unexpected suspect asbestos products or unusual soil strata are encountered;
- Areas that will remain covered by hardstand do not require sampling. However, if asbestos is likely, its presence will be assumed unless sampling indicates otherwise. If sampling cannot readily meet the recommended density because of hardstands, targeted sampling in key locations is suitable to allow limited characterisation of sub-surface contamination;
- If structures containing asbestos have been removed, the former ‘footprint’

should be investigated, unless the removal was properly managed and documented. In addition to a visual inspection, sub-surface sampling should only be necessary if the structure was partially buried, for instance, asbestos fencing, or subsequent soil disturbance has occurred. Sampling below 30 cm depth is not generally warranted. Sampling should extend laterally up to 50 cm outside the footprint perimeter, and include soak-wells. A sampling interval of 5-10 m along and within the footprint perimeter is recommended, aligned with any adjacent grid sampling pattern;

- Disused sub-surface asbestos structures and products, such as former service trenches or piping, may be localised areas of potential contamination. If not properly documented, these should be delineated by sampling, although validation sampling would suffice if structure removal is undertaken.

Hand-picking (Emu bob) primarily refers to the visual inspection of the soil surface and manual collection of ACM, as outlined below.

Process

- Can use a rake to sample down to a depth of 10cm;
- Most suitable for ACM, and possibly for low levels of FA (Friable Asbestos);
- Relevant where contamination is known or considered only to be on or near the soil surface and may be attributed to a defined event;
- Limited application for deeper contamination or if there is surface vegetation or debris. Raking may be difficult except in sand or loose fill;
- Used to characterise the extent and level of contamination, whilst concurrently reducing its impact.

Method

- Locations and weights of asbestos material should be recorded;
- Rake teeth should be <7mm spaced apart and >10 cm long;
- At least 2 passes of picking (and of raking if appropriate) made with 90^{o} direction change between each and using a grid pattern;
- Material should not be further damaged or buried by the process;
- % contamination may be calculated, using 1 cm as soil depth for handpicking or using the rake teeth length as appropriate;

- Final visual inspection of the area should not detect surface ACM.

Tilling refers to a process of mechanically turning over surface soils to facilitate the presentation and collection of asbestos fragments. The process and its implementation are outlined below.

Process

- Most suitable for ACM, not for fibre-generating materials;
- Generally conducted across the entire zone of suspected impact;
- Relevant for contamination within top 30cm of soil;
- Limited application for deeper contamination or if there is surface vegetation or debris;
- Used to characterise the extent and level of contamination, whilst concurrently reducing ACM impact.

Method

- Usually preceded by hand-picking;
- Locations and weights of asbestos material should be recorded;
- Soils should be pre-wet to the tilling depth, and the dust controlled;
- Rotor blades should present ACM optimally for 1 or 2 spotters closely following depending on speed, till breadth and contamination level;
- At least 2 passes with 90^{o} direction change using a grid pattern;
- Material should not be further damaged or buried from the process;
- Evaluated areas normally cannot be considered representative of other locations;
- Percentage contamination may be calculated using an estimate of the average impact depth as well as the area involved;
- Final visual inspection of the area should not detect surface ACM.

Screening is applied to both the small-scale separation of ACM fragments from localised soil samples and the large-scale treatment of an area to detect and quantify asbestos contamination, with concomitant remediation. This Section deals with large-scale mechanical screening. The process and its implementation are outlined below.

Process

- Most suitable for minor ACM impact, not for fibre-generating materials;
- Other sampling methods are preferable because of potential dust/fibre generation;
- Generally conducted across the entire zone of suspected impact;
- Relevant for larger volumes of reasonably accessible and delineated contamination;
- Used to effectively characterise the extent and level of contamination, whilst concurrently reducing ACM impact.

Method

- May be preceded by hand-picking if appropriate;
- Oversized ACM may be removed by 'screening down' from larger mesh sizes to the final screening mesh;
- Final mesh size of <7mm is recommended. Anything larger will require validation sampling;
- ACM weights/concentrations should be closely correlated to locations or stockpiles to allow re-sampling or segregation if required;
- Impacted soil should not be mixed with other soil in a way that might compromise the concentration calculations;
- Soils should be pre-wet and procedure subject to strong dust/fibre control and monitoring measures as outlined in a Dust Management Plan;
- Evaluated areas normally cannot be considered representative of other locations;
- Percentage contamination may be calculated using the weight of ACM found

for a particular strata, area or volume;

- Final visual inspection of the stockpile surface should not detect ACM.

Test Pits and Trenching is used if asbestos extends below surface soils (>30cm), especially if contamination distribution is uncertain. Aargus recommends use of test pits instead of boreholes (where machines are available) because buried ACM and FA can be more readily identified, differing strata distinguished and there is more sampling flexibility. Specified large sample sizes should be used for both methods with reliance put on visual methods of asbestos detection and concentration calculation wherever possible. The process and its implementation are outlined below.

Process

- Suitable for all asbestos types, but especially ACM, and FA if fibre disturbance is manageable;
- Relevant if contamination is buried and of unknown location and depth.

Method

- Sampling should be conducted to 30cm below the likely lower limit of potential contamination unless this is greater than 3m;
- Suspect asbestos material or construction debris should be targeted and all sample locations noted;
- Precautions are necessary to protect workers and public from wall collapse or hole hazards, and potential fibre release from excavation/sampling.

ACM & FA

- At least one 10L sample from each relevant stratum (or per 1m depth) of one wall, and discretionary samples from other suspect spots;
- Sample screened manually on-site through a <7mm sieve or spread out for inspection on a contrasting colour material (recommended for FA);
- Identified ACM and FA weighed to calculate asbestos soil concentration for individual samples.

AF (Asbestos Fines)

- At least one wetted 500ml sample from each relevant stratum or 1m depth (if thick) of one wall, and discretionary samples from other suspect spots;
- May be done with ACM/FA sampling, or at another wall position; Whole sample submitted for laboratory analysis.

Boreholes are used generally during the site sampling process but where suspect asbestos is present and if equipment is available, TPs are recommended. Borehole sampling may be appropriate where physical obstructions may limit soil access or generation of asbestos contaminated dust is a potential problem. The sample taking and assessment is similar to that for TPs. The process and its implementation are outlined below.

Process

- Suitable for all asbestos types;
- Relevant if contamination is buried and of unknown location and depth

Method

- Sampling should be conducted to 30cm below the likely lower limit of potential contamination unless this is greater than 3m;
- Suspect asbestos material or construction debris should be targeted and all sample locations/ depths noted.

ACM & FA

- Corer diameter should be at least 15cm;
- At least one 10L sample if practical from each relevant stratum (or per 1m depth) of core. Cross-strata samples are permissible provided that asbestos detections are further investigated;
- Sample screened manually on-site through a <7mm sieve or spread out for inspection on a contrasting colour material (recommended for FA);
- Identified ACM and FA weighed to calculate asbestos soil concentration for individual samples.

AF

- At least one wetted 500ml sample from each relevant stratum (or per 1m depth);
- May be done with ACM/FA sampling;
- Whole sample submitted for laboratory analysis.

Soil stockpiles intended for use on-site and of unknown quality should be assessed for asbestos contamination. Aargus intends to adopt a conservative approach to stockpile assessment and use because of associated uncertainties and risks.

If the stockpiles originated on the site from areas not likely to be contaminated, for instance, no indication of building activity or waste, the assessment can consist of a close visual examination and hand-picking over the whole stockpile surface. If any asbestos is found or the soil came from asbestos suspect areas on site, then the stockpiles should normally be considered contaminated. These stockpiles and any imported soil, aggregate or crushed material of unknown quality should not be used as "clean" fill without further investigation and management if necessary.

The sampling regime outlined below can be used to assess better the level and nature of contamination. This is designed to be consistent with the sampling density included in standard site and soil assessments for an area likely to be contaminated.

Process

- Suitable for all asbestos types;
- Confidence in results is not as high as with other sampling procedures.

Method

- Sampling should be spread over the whole stockpile surface at a minimum rate of 14 locations per 1,000 m^3;
- If soil is subject to a conveyor process (not recommended for FA or AF) then a minimum of 1 sample should be taken per 70m^3 of material;
- Suspect asbestos material or construction debris should be targeted and all sample locations noted.

ACM and FA

- At least one 10L sample from each location;
- Sample screened manually on-site through a <7mm sieve or spread out inspection on a contrasting colour fabric (recommended for FA);
- Identified ACM and FA weighed to calculate asbestos soil concentration for individual samples.

AF

- At least one wetted 500ml sample from each location;
- May be done with ACM/FA sampling, or at another spot;
- Whole sample submitted for laboratory analysis.

For ACM, if the contamination is below the investigation criteria then the stockpile may be used on the site as non-contaminated fill, subject to suitable controls. Controls should include closely monitoring the installation process for asbestos and visual inspection and hand-pick sampling of the new soil surface and also the stockpile footprint. It may also be appropriate to undertake test pit sampling of the installed material. Depending on the results, it may be necessary to remediate the installed soil and stockpile footprint.

If any free fibre or FA is found in the stockpile, it would not normally be useable as "clean" fill and would be regarded as contaminated unless extensive sampling demonstrates otherwise.

Air quality monitoring (AQM) for asbestos fibre, dust and other contaminant emissions should be considered during the DSI, remediation and site development processes. Asbestos fibre and dust (as a surrogate for asbestos fibre) are of particular interest.

10 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

10.1 Introduction

Inaccuracies in sampling and analytical programs can result from many causes, including collection of unrepresentative samples, unanticipated interferences

between elements during laboratory analyses, equipment malfunctions and operator error. Inappropriate sampling, preservation, handling, storage and analytical techniques can also reduce the precision and accuracy of results.

The Australian Standard AS4482.1-2005 *Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds* has documented procedures for quality assurance (QA) and quality control (QC) for sampling and analysis to ensure that the required degree of accuracy and precision is obtained. The Australian Standard also recommends the use of two laboratories for the implementation of a QA program for the analyses in addition to the QC procedures followed by the primary laboratory.

10.2 Field QAQC samples

General

Procedures for duplicate sampling should be identical to those used for routine sampling and duplicate samples will be despatched for analysis for the same parameters using the same methods as the routine samples. No homogenisation of samples which may induce the loss of volatile compounds (such as BTEX) should occur. Whenever possible, the selection of samples for duplicate analyses should be biased towards samples believed to contain the contaminant of concern.

Intra-laboratory duplicates

Intra-laboratory duplicate samples, also referred to as Blind duplicates, are used to assess the variation in analyte concentration between samples collected from the same sampling point and / or also the repeatability of the laboratory analyses. Samples are split in the field to form a primary sample and a QC duplicate (intra-laboratory replicate) sample. The intra-laboratory duplicates are taken from a larger than normal quantity of soil collected from the same sampling point, removed from the ground in a single action, and divided into two vessels. These samples are submitted to the laboratory as two individual samples without any indication to the laboratory that they have been duplicated.

Intra-laboratory duplicate samples should be collected at a rate of approximately 1 in 20 soil samples and analysed for the full suite of analytes. At least one intra-laboratory duplicate sample should be included in each batch of samples.

Inter-laboratory duplicates

Inter-laboratory duplicate samples, also referred to as Split duplicates, provide a check on the analytical proficiency of the laboratories. The samples are taken from a larger than normal quantity of soil collected from the same sampling point, removed from the ground in a single action, and divided into two vessels. One sample from each set is submitted to a different laboratory for analysis. The same analytes should be determined by both laboratories using the same analytical methods.

Inter-laboratory duplicates should be collected at a rate of approximately 1 in 20 soil samples and analysed for the full suite of analytes. At least one inter-laboratory duplicate sample should be included in each batch of samples.

Blanks

Rinsate Blanks

Rinsate blank samples provide information on the potential for cross-contamination of substances from the sampling equipment used. Rinsate blanks are collected where cross-contamination of samples is likely to impact on the validity of the sampling and assessment process (e.g. when the investigation level of a contaminant is close to the detection limit for this contaminant). They are prepared in the field using empty bottles and the distilled water used during the final rinse of sampling equipment. After completion of the decontamination process, fresh distilled water is poured over the sampling equipment and collected. The distilled water is exposed to the air for approximately the same time the sample would be exposed. The collected water is then transferred to an appropriate sample bottle and the proper preservative added, if required.

One rinsate blank par day and / or one per piece of sampling equipment are collected during the decontamination process, and analysed for the analytes of interest. At least one rinsate blank should be included in each batch of samples. One rinsate blank should be collected for every 50 samples collected and analysed for the full suite of analytes.

Trip Blanks / Spikes

Trip blanks / spikes are a check on the sample contamination originating or lost from sample transport, handling, and shipping. These are samples of soil or water prepared by the laboratory with a zero or known concentration of analytes.

Field Blanks

Field blanks are a check on sample contamination originating from sample transport, handling, shipping, site conditions or sample containers. These are similar to trip blanks except the water is transferred to sample containers on site.

10.3 Laboratory quality assurance / quality control

The laboratories undertake the analyses utilising their own internal procedures and their test methods (for which they are NATA, or equivalent, accredited) and in accordance with their own quality assurance system which forms part of their accreditation.

Laboratory duplicate samples

Laboratory duplicate samples measure precision. These samples are taken from one sample submitted for analytical testing in a batch. The rate of duplicate analysis will be according to the requirements of the laboratory's accreditation but should be at least one per batch. Precision is reported as standard deviation SD or Relative Percent Difference %RPD, being:

$$\%RPD = \frac{(D1 - D2)}{(D1 + D2)} \times 200$$

where: D1: sample concentration and D2: duplicate sample concentration

Replicate data for precision is expected to be less than 30% RPD at concentration levels greater than ten times the EQL, or less than 50% RPD at concentration levels less than ten times the EQL. Sample results with a RPD exceeding 100% require specific discussion. Note that certain methods may allow for threshold limits outside of these limits.

Matrix Spiked Samples

Matrix spiked samples are used to monitor the performance of the analytical methods used, and to assess whether the sample matrix has an effect of on the extraction and analytical techniques. A sample is spiked by adding an aliquot of known concentration of the target analyte(s) to the sample matrix prior to sample extraction and analysis. These samples should be analysed at a rate of approximately 5% of all analyses, or at least one per batch. Matrix spikes are reported as a percent recovery %R, being:

$$\%R = \frac{(SSR-SR)}{SA} \times 100$$

where: SSR: spiked sample result, SR: sample result (blank) and SA: spike added

Recovery data for accuracy is described by control limits specified by the laboratory (generally ranging between 70% and 130%) and referenced to US EPA SW-846 method guidelines values.

Laboratory Blank

Laboratory blanks are used to correct for possible contamination resulting from the preparation or processing of the samples. These are usually an organic or aqueous solution that is as free as possible of analyte and contains all the reagents in the same volume as used in the processing of the samples. Laboratory blanks must be carried through the complete sample preparation procedure and contain the same reagent concentrations in the final solution as in the sample solution used for analysis. Laboratory blanks should be analysed at a rate of once per process batch, and typically at a rate of 5% of all analyses.

Laboratory Control Samples

Laboratory Control Samples, also referred to as Quality Control Check Samples, are used to assess the repeatability and long term accuracy of the laboratory analysis. These are externally prepared and supplied reference material containing representative analytes under investigation. Recovery check portions should be fortified at concentrations that are easily quantified but within the range of concentrations expected for real samples. Laboratory Control samples should be analysed at a rate of one per process batch, and typically at a rate of 5% of analyses. Laboratory control samples are reported as a percent recovery %R, being:

$$\%R = \frac{(SSR-SR)}{SA} \times 100$$

where: SSR: spiked sample result, SR: sample result (blank) and SA: spike added

Recovery data for accuracy is described by control limits specified by the laboratory and referenced to US EPA SW-846 method guidelines values. Ideally, all calculated recovery values should be within the acceptable limits. However, in the event that control limit outliers are reported, professional judgement is used to assess the extent to which such results may affect the overall usability of data.

Surrogates

Surrogates are used to provide a means of checking, for every analysis, that no gross errors have occurred at any stage of the procedure leading to significant analyte losses. Surrogate are quality control monitoring spikes, which are added to all fields and QAQC samples at the beginning of the sample extraction process in the laboratory. Surrogates are closely related to the sample analytes being measured (particularly with regard to extraction, recovery through clean-up procedures and response to chromatography) and are not normally found in the natural environment.

Surrogate spikes will not interfere with quantification of any analytes of interest and may be separately and independently quantified by virtue of, for example, chromatographic separation or production of different mass ions in a GC/MS system. Surrogates are measured as Percent Recovery %R expressed as:

$$\%R = \frac{(SSR)}{SA} \times 100$$

where: SSR: spiked sample result and SA: spike added

Recovery data for accuracy is described by control limits specified by the laboratory and referenced to US EPA SW-846 method guidelines values.

11 DATA QUALITY OBJECTIVES

11.1 General

Data Quality Objectives (DQOs) are defined to ensure that the data is sufficiently accurate and precise to be used for the purpose of the project works. DQOs are defined for a number of areas including:

- sampling methods;
- decontamination procedures;
- sample storage (including nature of the containers) and preservation;
- laboratory analysis, including PQL, recoveries (surrogates, spikes), duplicates;
- preparation of CoC forms;

- document and data completeness; and
- data comparability.

The NSW DEC Contaminated Sites Guidelines for the NSW Site Auditor Scheme (2nd Ed) 2006 also provide a seven step process for Data Quality Objectives (DQOs). These are as follows:

- State the problem
- Identify the decisions
- Identify inputs to the decision
- Define the study boundaries
- Develop a decision rule
- Specify limits on decision errors
- Optimise the design for obtaining data

DQOs must be adopted for all assessments and remediation programmes. The DQO process must be commenced before any investigative works begin on a project.

11.2 Field DQOs

The DQOs for sampling methods, decontamination procedures, sample storage (including nature of the containers) and preservation, preparation of CoC forms, and document and data completeness are the Aargus protocols which have been described in the previous sections of this document.

11.3 Assessment of RPD values for field duplicate samples

The criteria used to assess RPD values for field duplicate samples is based on discussion reported in AS4482.1 1997, a summary of which is presented below:

Table 1: RPD acceptance criteria

Sample type	Typical acceptable RPD
Intra-laboratory duplicate (blind duplicate)	30-50°% (*)
Inter-laboratory duplicate (split duplicate)	30-50% (*)

It is noted that other factors such as sampling technique, sample variability, absolute concentration relative to criteria and laboratory performance should also be considered when evaluating RPD values.

The Australian Standard also states that the variation can be expected to be higher for organic analytes than for inorganics, and for low concentrations of analytes (lower than five times the detection limit). Based on Aargus Pty Ltd experience, RPD up to 70% are considered to be acceptable for organic species. RPD of 100% or more are generally considered to demonstrate poor correlation and should be discussed.

11.4 Laboratory Data Quality Objectives (DQO)

General

Aargus also provides internal laboratory testing for a range of physical parameters. Aargus is NATA certified to conduct these tests.

Labmark is the Aargus-preferred laboratory for the chemical analysis of primary samples. Labmark is accredited by the National Association of Testing Authorities (NATA).

The laboratory generally used by Aargus for analysing inter-duplicate samples is Labmark.

Analytical methods including detection limits are provided on each laboratory report and are checked as part of the data review process.

Laboratory QA/QC

Specific to Labmark, standard QA/QC data includes LCS, MB, CRM (CRM metals only), Laboratory Duplicate (1 in first 5-10 samples, then every tenth sample) and Spike sample (1 in first 5-20 samples, then every 20th sample), and surrogate recovery's (target organics). All QA/QC is reviewed by a senior chemist prior to customer release and includes a DQO comment on final report. Additional QA/QC maybe performed on batches less than 10 samples; however additional charges shall apply at the appropriate analytical rate/sample.

Laboratory analyses DQOs

The following table summarises laboratory analyses DQOs.

Table 2: Laboratory Data Quality Objectives (DQOs)

Laboratory QA/QC Testing	Laboratory QA/QC Acceptance Criteria
Method Blanks	For all inorganic analytes the Method Blanks must be less than the LOR. For organics Method Blanks must contain levels less than or equal to LOR.
Surrogate Spikes	At least two of three routine level soil sample Surrogate Spike recoveries are to be within 70-130% where control charts have not been developed and within the estimated control limited for charted surrogates. Matrix effects may void this as an acceptance criteria. Any recoveries outside these limits will have comment. Water sample Surrogates Spike recoveries are to within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criteria. Any recoveries outside these limits will have comment.
Matrix Spikes	Sample Matrix Spike duplicate recovery RPD to be <30%. In the event that the matrix spike has been applied to samples whose matrix or contamination is problematic to the method then these acceptance criteria apply to the Control Matrix Spike.
Laboratory Control Samples	Control standards must be 80-120% of the accepted value. Control standard recoveries are to be within established control limits or as a default 60-140% unless compound specific limits apply.
Laboratory Duplicate Samples	For Inorganics laboratory duplicates RPD to be <15%. For Organics Laboratory duplicates must have a RPD <30%.

Laboratory QA/QC Testing	Laboratory QA/QC Acceptance Criteria
Calibration of Chromatography Equipment	The calibration check standards must be within +/-15%. The calibration check blanks must be less than the LOR.

Non-compliances

Exceedances of QAQC results outside the DQO should be thoroughly investigated and discussed with the laboratories concerned, and the outcomes of these investigations should be recorded in the project files.

12 Use and calculation of the 95% UCL for site validation purpose

For environmental services, statistical analysis is performed on data. Validation of a site at the completion of remediation works should comply with the recommendations of the applicable guidelines. For a site to be considered uncontaminated or successfully remediated, the typical minimum requirement is that the 95% upper confidence limit (UCL) of the arithmetic average concentration of the contaminant(s) is less than an acceptable limit, eg the threshold value of an health-based investigation level.

The calculation of the 95% UCL of the arithmetic average concentration method requires that the probable average concentration and standard deviation of the contaminant be known. This method is most applicable for validation sampling, where the mean concentration and the standard deviation can be estimated from sampling results. The 95% UCL is calculated as follows:

$$95\%\ UCL = mean + t_{\alpha,n-1} \frac{STDEV}{\sqrt{n}}$$

where

mean	arithmetic average of all sample measurements
$t_{\propto,n-1}$	A test statistic (Student's t at an $\propto$ level of significance and n-1 degrees of freedom)
$\propto$	The probability (in that case chosen to be 0.05) that the 'true' average concentration of the sampling area might exceed the UCL average determined by the above equation
STDEV	Standard deviation of the sample measurements
n	number of samples measurements

13 COPYRIGHT

14 ABBREVIATIONS

ANZECC Council	Australian and New Zealand Environment and Conservation
ASS	Acid Sulfate Soil
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethyl benzene and Xylene
CoC	Chain of Custody
DEC	Department of Conservation (formerly EPA)
DIPNR	Department of Infrastructure Planning and Natural Resources
DQO	Data Quality Objective
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
HIL	Health-Based Soil Investigation Level
LGA	Local Government Area
NEHF	National Environmental Health Forum
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measure
NHMRC	National Health and Medical Research Council
NSL	No Set Limit
OCP/OPP	Organochlorine Pesticides /Organophosphate Pesticides
PAH	Polycyclic Aromatic Hydrocarbon
PASS	Potential Acid Sulfate Soil

PCB	Polychlorinated Biphenyl
PID	Photo Ionisation Detector
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance, Quality Control
RAC	Remediation Acceptance Criteria
RAP	Remediation Action Plan
RPD	Relative Percentage Difference
SAC	Site Assessment Criteria
SVC	Site Validation Criteria
SWL	Standing Water Level
TCLP	Toxicity Characteristics Leaching Procedure
TESA	Targeted Environmental Site Assessment
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
VHC	Volatile Halogenated Compounds
VOC	Volatile Organic Compounds

15 REFERENCES

- ANZECC (1992) – *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites.*
- ANZECC (1996) – *Drinking Water Guidelines.*
- ANZECC (2000) – *Guidelines for Fresh and Marine Waters.*
- Land and Biodiversity committee (2003) – *Minimum Construction requirements for water bores in Australia.*

- National Environment Protection Council (NEPC) (1999) – *National Environmental Protection (Assessment of Site Contamination) Measure.*
- Netherlands Ministry of Spatial Planning, Housing and the Environment (1994 rev. 2000) – *Environmental Quality Objectives in the Netherlands.*
- New South Wales Environment Protection Authority (1994) – *Guidelines for Assessing Service Station Sites.*
- New South Wales Environment Protection Authority (1995) – *Sampling Design Guidelines.*
- New South Wales Environment Protection Authority (1997) – *Guidelines for Consultants Reporting on Contaminated Sites.*
- New South Wales Environment Protection Authority (1998) – *Guidelines for the NSW Site Auditor Scheme.*
- New South Wales Department of Environment & Conservation (2006) – *Guidelines for the NSW Site Auditor Scheme (2nd Ed).*
- New South Wales Environment Protection Authority (1999) – *Guidelines on Significant Risk of Harm from contaminated land and the duty to report.*
- New South Wales Environment Protection Authority (1999) – *Environmental Guidelines: Assessment, Classification & Management of Liquid & Non-liquid Wastes.*
- New South Wales Environment Protection Authority (2005) – *Guidelines for assessing former orchards and market gardens.*
- QLD Department of Environment (DoE) (1998) – *Draft Guidelines for the Assessment & Management of Contaminated Land in Queensland.*
- QLD EPA – Waste Management Branch, Contaminated Land Section – *Details about investigation thresholds and sampling – sent to Aargus on 14 Nov 2000.*
- Standards Australia AS1726-1993 (1993) – *Geotechnical Site Investigations.*
- Standards Australia AS4482.1-1997 (1997) – *Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds.*
- Standards Australia AS5667.11-1998 (1998) – *Water Quality Sampling: Guidance on the Sampling of Groundwaters.*
- Victorian EPA (2000) – *Groundwater Sampling Guidelines*

ATTACHMENTS

Figure 1 Typical Groundwater Monitoring Well Construction Details

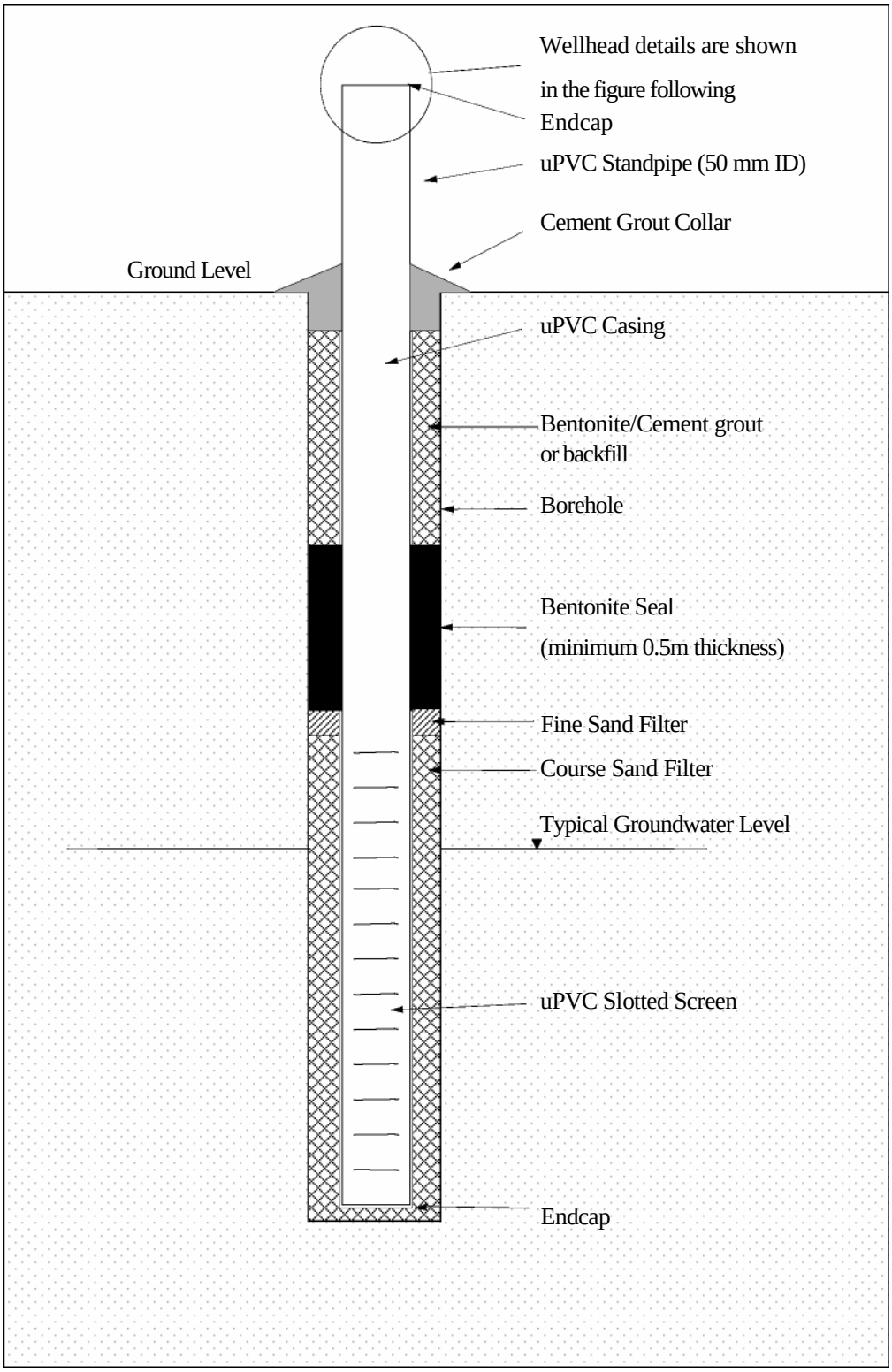
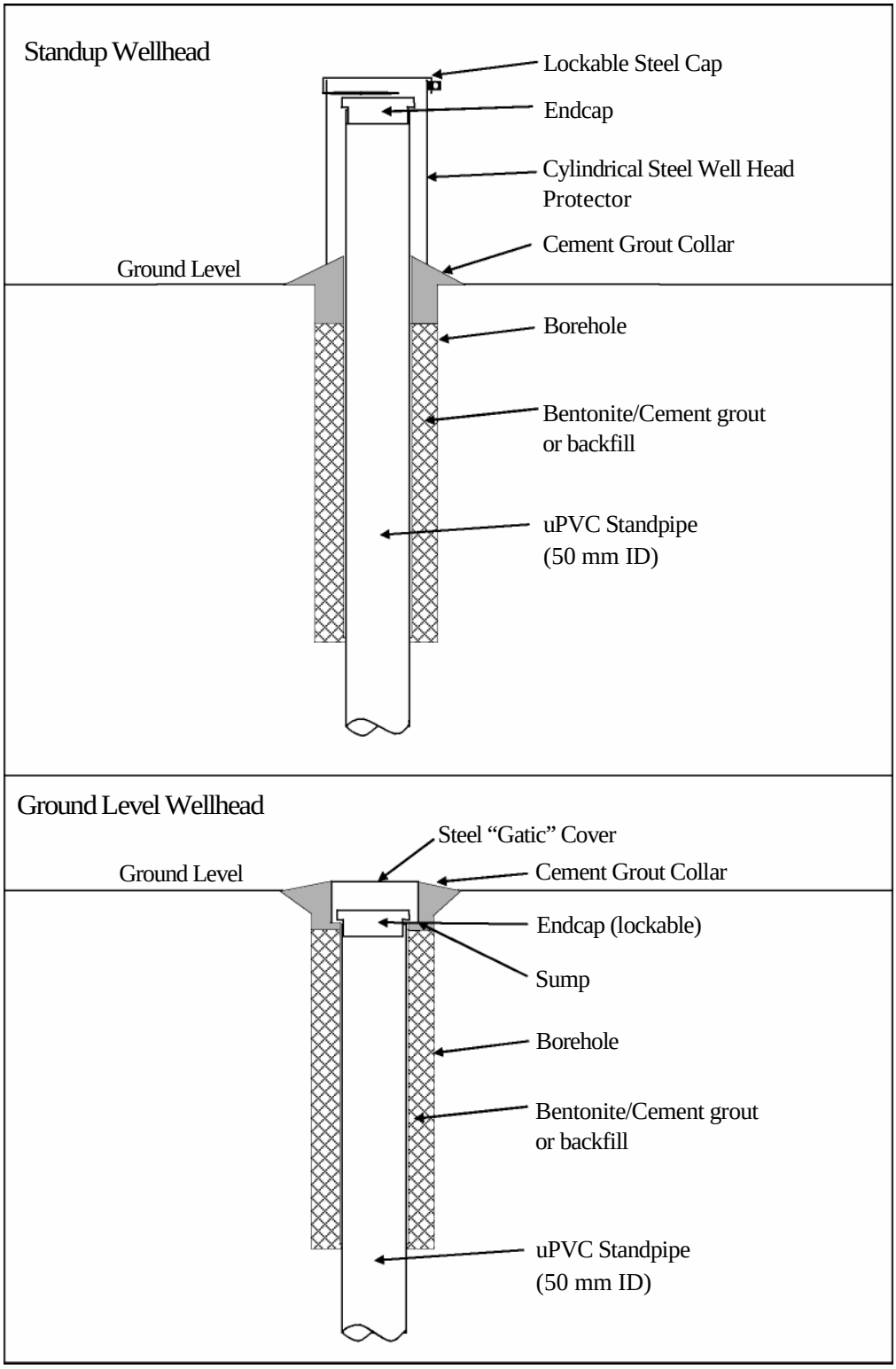


Figure 2 Groundwater Wellhead Construction Details



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ASBESTOS RISK ASSESSMENT HAZARD LEVELS

Risk Factor		Description	Rating
Status	Bonded	ACM with Asbestos contained in a stable matrix	1
	Friable	ACM which when dry may become crumbled, pulverised or reduced to powder using hand pressure	4
Condition Risk	Undamaged	No visible signs of damage or deterioration	1
	Fair	Some evidence of damage / deterioration	3
	Poor	ACM which is heavily damaged or deteriorated	5
Management Risk	Satisfactory	ACM which is effectively managed by encapsulation or enclosure	1
	Fair	ACM with limited management	2
	Unsatisfactory	ACM which is not adequately managed	3
Disturbance Potential	Unlikely	Not likely to be disturbed during normal operations	1
	Possible	ACM which may be disturbed during normal operations	3
	Likely	The material is likely to be disturbed during normal operations	5
Location Risk	Low	ACM is present in an open environment (ie. outdoors)	1
	Moderate	ACM is present within a semi-enclosed environment (ie. large factory or wet weather area)	2
	High	ACM is present within an enclosed or indoor environment	3

SEMI-QUALITATIVE RISK ASSESSMENT ALGORITHM

Status + Condition Risk + Management Risk + Disturbance Potential + Location Risk = Risk Score

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ASBESTOS RISK ASSESSMENT SCORE SHEET AND ACTION PRIORITY

Risk Score	Risk Description	Action Priority
5-10	**Low Risk** Products or materials that pose a negligible risk of exposure to Asbestos. ACM occurrences in this category are typically in good condition, are unlikely to be disturbed, and will not readily release Asbestos fibres on contact. These materials should be labelled where practicable. The material should not be unnecessarily disturbed.	**Low Priority** Monitor condition annually. Recommend that airborne fibre monitoring is conducted annually.
11-15	**Moderate Risk** Products or materials that may pose a risk of exposure to Asbestos. Bonded ACM occurrences in this category may be in poor condition, and / or be likely to be disturbed, and may readily release Asbestos fibres on contact. This category may also relate to friable ACM which is adequately managed. These materials should be labelled where practicable. The material should not be unnecessarily disturbed.	**Moderate Priority** Conduct management works within 3-6 months. Monitor condition 6-monthly. Airborne fibre monitoring at least 6-monthly.
16-20	**High Risk** Product or materials that pose an elevated risk of exposure to Asbestos. This category would usually relate to friable ACM which is not adequately managed. Management works will be required immediately. These materials and surrounding areas should be clearly signposted. The material should not be unnecessarily disturbed – an exclusion zone of approximately 5m (at least) may be required.	**High Priority** Conduct make-safe management work immediately. Monitor condition daily and/ or monthly. Regular daily and/or monthly airborne fibre monitoring considered essential.

**References: AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines (Standards Australia, 2009), HG 264 Asbestos: The Survey Guide (UK Health and Safety Executive, 2010), NSW Work Health Safety Regulations 2011, and NSW WorkCover Codes of Practice.*

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APPENDIX F

IMPORTANT INFO ABOUT ENVIRONMENTAL REPORTS

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IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL SITE ASSESSMENT

These notes have been prepared by Aargus (Australia) Pty Ltd and its associated companies using guidelines prepared by ASFE (The Association) of Engineering Firms Practising in the Geo-sciences. They are offered to help you in the interpretation of your Environmental Site Assessment (ESA) reports.

REASONS FOR CONDUCTING AN ESA

ESA's are typically, though not exclusively, carried out in the following circumstances:

- as pre-acquisition assessments, on behalf of either purchaser or vender, when a property is to be sold;
- as pre-development assessments, when a property or area of land is to be redeveloped or have its use changed for example, from a factory to a residential subdivision;
- as pre-development assessments of greenfield sites, to establish "baseline" conditions and assess environmental, geological and hydrological constraints to the development of, for example, a landfill; and
- as audits of the environmental effects of an ongoing operation.

Each of these circumstances requires a specific approach to the assessment of soil and groundwater contamination. In all cases however, the objective is to identify and if possible quantify the risks that unrecognised **c**ontamination poses to the proposed activity. Such risks may be both financial, for example, cleanup costs or limitations on site use, and physical, for example, health risks to site users or the public.

THE LIMITATIONS OF AN ESA

Although the information provided by an ESA could reduce exposure to such risks, no ESA, however, diligently carried out can eliminate them. Even a rigorous professional assessment may fail to detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled.

AN ESA REPORT IS BASED ON A UNIQUE SET OF PROJECT SPECIFIC FACTORS

Your environmental report should not be used:

- when the nature of the proposed development is changed, for example, if a residential development is proposed instead of a commercial one;
- when the size or configuration of the proposed development is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership
- or for application to an adjacent site.

To help avoid costly problems, refer to your consultant to determine how any factors, which have changed subsequent to the date of the report, may affect its recommendations.

ESA "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site assessment identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of contamination, its likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to help minimise its impact. For this reason owners should retain the services of their consultants

through the development stage, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Natural processes and the activity of man change subsurface conditions. As an ESA report is based on conditions, which existed at the time of subsurface exploration, decisions should not be based on an ESA report whose adequacy may have been affected by time. Speak with the consultant to learn if additional tests are advisable.

ESA SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Every study and ESA report is prepared in response to a specific brief to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Other persons should not use a report for any purpose, or by the client for a different purpose. No individual other than the client should apply a report even apparently for its intended purpose without first conferring with the consultant. No person should apply a report for any purpose other than that originally contemplated without first conferring with the consultant.

AN ESA REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when design professionals develop their plans based on misinterpretations of an ESA. To help avoid these problems, the environmental consultant should be retained to work with appropriate design professionals to explain relevant findings and to review the adequacy of their plans and specifications relative to contamination issues.

LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final borehole or test pit logs are developed by environmental scientists, engineers or geologists based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final logs customarily included in our reports. These logs should not under any circumstances be redrawn for inclusion in site remediation or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimise the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To reduce the likelihood of boring log misinterpretation, the complete report must be available to persons or organisations involved in the project, such as contractors, for their use. Those who o not provide such access may proceed under the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing all the available information to persons and organisations such as contractors helps prevent costly construction problems and the adversarial attitudes that may aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because an ESA is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in transmittals. These are not exculpatory clauses designed to foist liabilities onto some other party. Rather, they are definitive clauses that identify where your consultant’s responsibilities begin and end. Their use helps all parties involved recognise their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your ESA report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

APPENDIX G

UNEXPECTED FINDS PROTOCOL

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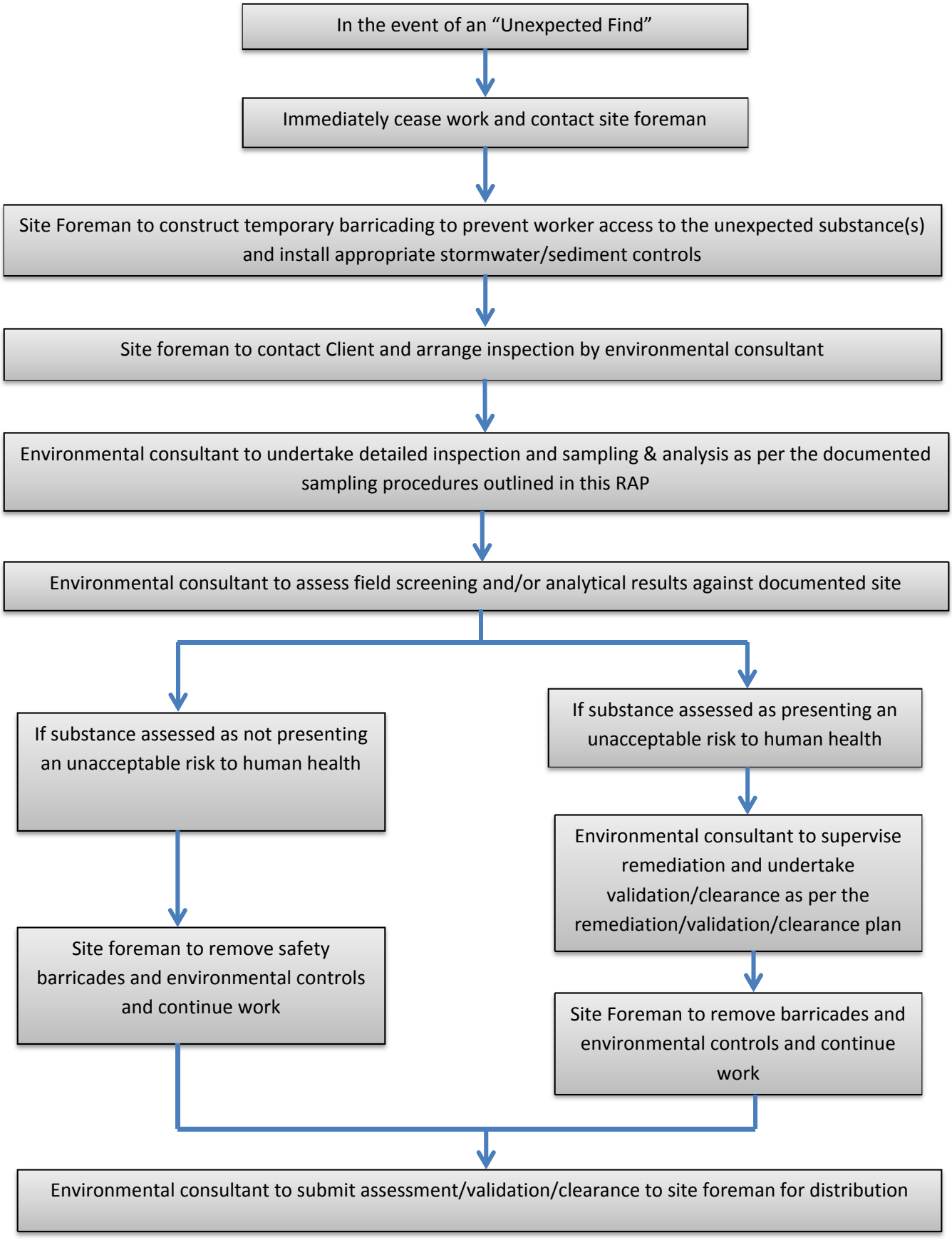
Unexpected Finds Protocol



APPENDIX H

VALIDATION CRITERIA

Table 1A (1) Health-based Investigation Levels (mg/kg)

	Residential A	Residential B	Recreational C	Commercial / Industrial D
Metals & Inorganics				
Arsenic (total)	100	500	300	3,000
Beryllium	60	90	90	500
Boron	4,500	40,000	20,000	300,000
Cadmium	20	150	90	900
Chromium (VI)	100	500	300	3,600
Cobalt	100	600	300	4,000
Copper	6,000	30,000	17,000	240,000
Lead	300	1,200	600	1,500
Manganese	3,800	14,000	19,000	60,000
Mercury (inorganic)	40	120	80	730
Methyl mercury	10	30	13	180
Nickel	400	1,200	1,200	6,000
Selenium	200	1,400	700	10,000
Zinc	7,400	60,000	30,000	400,000
Cyanide (free)	250	300	240	1,500
Polycyclic Aromatic Hydrocarbons				
Carcinogenic PAHs (as BaP TEQ)	3	4	3	40
Total PAHs	300	400	300	4,000
Phenols				
Phenols	3,000	45,000	40,000	240,000
Pentachlorophenol	100	130	120	660
Cresols	400	4,700	4,000	25,000
Organochlorine Pesticides				
DDT+DDD+DDE	240	600	400	3,600
Aldrin & Dieldrin	6	10	10	45
Chlordane	50	90	70	530
Endosulfan	270	400	340	2,000
Endrin	10	20	20	100
Heptachlor	6	10	10	50
HCB	10	15	10	80
Methoxychlor	300	500	400	2,500
Mirex	10	20	20	100
Toxaphene	20	30	30	160
Herbicides				
2,4,5-T	600	900	800	5,000
2,4-D	900	1,600	1,300	9,000
MCPA	600	900	800	5,000
MCPB	600	900	800	5,000
Mecoprop	600	900	800	5,000
Picloram	4,500	6,600	5,700	35,000
Other Pesticides				
Atrazine	320	470	400	2,500

Chlorpyrifos	160	340	250	2,000
Bifenthrin	600	840	730	4,500
Other Organics				
PCBs	1	1	1	7
PBDE Flame Retardants (Br1-Br9)	1	2	2	10

Table 1A(3) Soil HSLs for vapour intrusion (mg/kg)

CHEMICAL	HSL A & HSL B Low – high density residential				HSL C recreational / open space				HSL D Commercial / Industrial				Soil saturation concentration (Cast)
	0 m to <1 m	1 m to <2 m	2 m to <4m	4 m+	0 m to <1 m	1 m to <2 m	2 m to <4m	4 m+	0 m to <1 m	1 m to <2 m	2 m to <4m	4 m+	
SAND													
Toluene	160	220	310	540	NL	NL	NL	NL	NL	NL	NL	NL	560
Ethylbenzene	55	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	64
Xylenes	40	60	95	170	NL	NL	NL	NL	230	NL	NL	NL	300
Naphthalene	3	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	9
Benzene	0.5	0.5	0.5	0.5	NL	NL	NL	NL	3	3	3	3	360
F1	45	70	110	200	NL	NL	NL	NL	260	370	630	NL	950
F2	110	240	440	NL	NL	NL	NL	NL	NL	NL	NL	NL	560
SILT													
Toluene	390	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	640
Ethylbenzene	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	69
Xylenes	95	210	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	330
Naphthalene	4	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	10
Benzene	0.6	0.7	1	2	NL	NL	NL	NL	4	4	6	10	440
F1	40	65	100	190	NL	NL	NL	NL	250	360	590	NL	910
F2	230	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	570
CLAY													
Toluene	480	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	630
Ethylbenzene	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	68
Xylenes	110	310	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	330
Naphthalene	5	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	10
Benzene	0.7	1	2	3	NL	NL	NL	NL	4	6	9	20	430
F1	50	90	150	290	NL	NL	NL	NL	310	480	NL	NL	850
F2	280	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	560

Table 1B(1) Soil-specific added contaminant limits for aged zinc in soil

Zn added contaminant limits (ACL, mg added contaminant/kg)						
Areas of ecological significance						
pH [a]	**CEC [b] (cmol/kg)**					
	5	**10**	**20**	**30**	**40**	**60**
4.0	15	20	20	20	20	20
4.5	20	25	25	25	25	25
5.0	30	40	40	40	40	40
5.5	40	60	60	60	60	60
6.0	50	90	90	90	90	90
6.5	50	90	130	130	130	130
7.0	50	90	130	190	190	190
7.5	50	90	130	210	260	280
Urban residential/public open space [1]						
pH [a]	**CEC [b] (cmol/kg)**					
	5	**10**	**20**	**30**	**40**	**60**
4.0	70	85	85	85	85	85
4.5	100	120	120	120	120	120
5.0	130	180	180	180	180	180
5.5	180	270	270	270	270	270
6.0	230	400	400	400	400	400
6.5	230	400	590	590	590	590
7.0	230	400	700	880	880	880
7.5	230	400	700	960	1200	1300
Commercial/Industrial						
pH [a]	**CEC [b] (cmol/kg)**					
	5	**10**	**20**	**30**	**40**	**60**
4.0	110	130	130	130	130	130
4.5	150	190	190	190	190	190
5.0	210	290	290	290	290	290
5.5	280	420	420	420	420	420
6.0	360	620	620	620	620	620
6.5	360	620	920	920	920	920
7.0	360	620	1100	1400	1400	1400
7.5	360	620	1100	1500	1900	2000

1: Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.

2: Aged values apply to contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.

3: The EIL is calculated from summing the ACL and the ABC.

a: pH measured using the CaCl2 method (Rayment & Higginson 1992).

b: CEC measured using the silver thiourea method (Chabra et al. 1972).

Table 1B(2): Soil-specific added contaminant limits for aged copper in soil

Cu added contaminant limits (ACL, mg added contaminant/kg)					
Aeras of ecological significance					
CEC (cmol/kg)[a] based					
5	**10**	**20**	**30**	**40**	**60**
30	65	70	70	75	80
pH[b] based					
4.5	**5.5**	**6**	**6.5**	**7.5**	**8**
20	45	65	90	190	270
Urban residential/public open space [1]					
CEC (cmol/kg)[a] based					
5	**10**	**20**	**30**	**40**	**60**
95	190	210	220	220	230
pH[b] based					
4.5	**5.5**	**6**	**6.5**	**7.5**	**8**
60	130	190	280	560	800
Commercial/industrial					
CEC (cmol/kg)[a] based					
5	**10**	**20**	**30**	**40**	**60**
140	280	300	320	330	340
pH[b] based					
4.5	**5.5**	**6**	**6.5**	**7.5**	**8**
85	190	280	400	830	1200

1. Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.
2. The lower of the CEC or the pH-based ACLs for the land use and soil conditions is the ACL to be used.
3. Aged values apply to contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.
4. The EIL is calculated from summing the ACL and the ABC.

a = CEC measured using the silver thiourea method (Chabra et al. 1972)

b = pH measured using the CaCl2 method (Rayment & Higginson 1992)

Table 1B(3): Soil-specific added contaminant limits for aged chromium III and nickel in soil

CHEMICAL	Clay content (%clay)	Added contaminant limits (mg aded contaminant/kg) for various land uses		
		Areas of ecological significance	Urban residential and public open space	Commercial and industrial
Chromium III	***1***	60	190	310
	2.5	80	250	420
	5	100	320	530
	≥10	130	400	660
Nickel	CEC[a] ($cmol_c$ /kg)	Areas of ecological significance	Urban residential and public open space	Commercial and industrial
	5	5	30	55
	10	30	170	290
	20	45	270	460
	30	60	350	600
	40	70	420	730
	60	95	560	960

Notes:

1. Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.
2. Aged values apply to contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.
3. The EIL is calculated from summing the ACL and the ABC.

a = CEC measured using the silver thiourea method (Chabra et al. 1972)

Table 1B(4): Generic added contaminant limits for lead in soils irrespective of their physicochemical properties

Pb added contaminant limit (ACL, mg added contaminant/kg) for various land uses			
CHEMICAL	**Area of ecological significance**	**Urban residential and public open space**	**Commercial and industrial**
LEAD	470	1100	1800

Notes:

1. Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.
2. Aged values are applicable to lead contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.
3. The EIL is calculated from summing the ACL and the ABC.

Table 1B(5) Generic EILs for aged As, fresh DDT and fresh naphthalene in soils irrespective of their physicochemical properties

Ecological Investigation Levels (mg total contaminant/kg)			
CHEMICAL	**Areas of ecological significance**	**Urban residential and public open space[1]**	**Commercial and industrial**
Arsenic[2]	40	100	160
DDT[3]	3	480	640
Naphthalene[3]	10	170	370

Notes:

1. Urban residential/public open space is broadly equivalent to the HIL-A, HIL-B and HIL-C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.
2. Aged values are applicable to arsenic contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.
3. Insufficient data was available to calculate aged values for DDT and naphthalene, consequently the values for fresh contamination should be used.
4. Insufficient data was available to calculate ACLs for As, DDT and naphthalene. The EIL should be taken directly from Table 1B(5).

Table 1B(6): ESLs for TPH fractions F1 – F4, BTEX and benzo(a)pyrene in soil

CHEMICAL	Soil texture	ESLs (mg/kg dry soil)		
		Areas of ecological significance	Urban residential and public open space	Commercial and industrial
F1 C6-C10	Coarse/	125*	180*	215*
F2 >C10-C16	Fine	25*	120*	170*
F3 >C16-C34	Coarse	-	300	1700
	Fine	-	1300	2500
F4 >C34-C40	Coarse	-	2800	3300
	Fine	-	5600	6600
Benzene	Coarse	10	50	75
	Fine	10	65	95
Toluene	Coarse	10	85	135
	Fine	65	105	135
Ethylbenzene	Coarse	1.5	70	165
	Fine	40	125	185
Xylenes	Coarse	10	105	180
	Fine	1.6	45	95
Benzo(a)pyrene	Coarse	0.7	0.7	0.7
	Fine	0.7	0.7	0.7

Notes:
ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability.
'-' indicates that insufficient data was available to derive a value.

To obtain F1, subtract the sum of BTEX concentrations from C6-C10 fraction and subtract naphthalene from >C10-C16 to obtain F2.

Table 1 B(7): Management Limits for TPH fractions F1 - F4 in soil

TPH fraction	Soil texture	Management Limits1 (mg/kg dry soil)	
		Residential, parkland and public open space	Commercial and industrial
F1[2] C6- C10	Coarse	700	700
	Fine	800	800
F2[2] >C10-C16	Coarse	1000	1000
	Fine	1000	1000
F3 >C16-C34	Coarse	2500	3500
	Fine	3500	5000
F4 >C34-C40	Coarse	10 000	10 000
	Fine	10 000	10 000

Table 7: Health screening levels for asbestos contamination in soil

Form of asbestos	Health Screening Level (w/w)			
	Residential A[1]	Residential B[2]	Recreational C[3]	Commercial/ Industrial D[4]
Bonded ACM	0.01%	0.04%	0.02%	0.05%
FA and AF (friable asbestos)	0.001%			
All forms of asbestos	No visible asbestos for surface soil			

Notes:

1. Residential A with garden/accessible soil also includes children's day care centres, preschools and primary schools.
2. Residential B with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.
3. Recreational C includes public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and unpaved footpaths.
4. Commercial/industrial D includes premises such as shops, offices, factories and industrial sites.
5. The screening level of 0.001% w/w asbestos in soil for FA and AF (i.e. non-bonded/friable asbestos) only applies where the FA and AF are able to be quantified by gravimetric procedures (refer Section 4.10). This screening level is not applicable to free fibres.

Table 1: CT1 & CT2 values for classifying waste by chemical assessment without the TCLP test

For disposal requirements for organic and inorganic chemical contaminants not listed below, contact the EPA. Aluminium, barium, boron, chromium (0 and III oxidation states), cobalt, copper, iron, manganese, vanadium and zinc have not been listed with values in this table and need not be tested for.

	Maximum values of *specific contaminant concentration* (SCC) for classification without TCLP		
	General solid waste[1]	**Restricted solid waste**	
Contaminant	**CT1 (mg/kg)**	**CT2 (mg/kg)**	**CAS Registry Number**
Arsenic	100	400	
Benzene	10	40	71-43-2
Benzo(a)pyrene[2]	0.8	3.2	50-32-8
Beryllium	20	80	
Cadmium	20	80	
Carbon tetrachloride	10	40	56-23-5
Chlorobenzene	2,000	8,000	108-90-7
Chloroform	120	480	67-66-3
Chlorpyrifos	4	16	2921-88-2
Chromium (VI)[3]	100	400	
m-Cresol	4,000	16,000	108-39-4
o-Cresol	4,000	16,000	95-48-7
p-Cresol	4,000	16,000	106-44-5
Cresol (total)	4,000	16,000	1319-77-3
Cyanide (amenable)[4]	70	280	
Cyanide (total)	320	1,280	
2,4-D	200	800	94-75-7
1,2-Dichlorobenzene	86	344	95-50-1
1,4-Dichlorobenzene	150	600	106-46-7
1,2-Dichloroethane	10	40	107-06-2
1,1-Dichloroethylene	14	56	75-35-4
Dichloromethane	172	688	75-09-2
2,4-Dinitrotoluene	2.6	10.4	121-14-2
Endosulfan[5]	60	240	See below[5]
Ethylbenzene	600	2,400	100-41-4
Fluoride	3,000	12,000	
Fluroxypyr	40	160	69377-81-7
Lead	100	400	

Contaminant	Maximum values of *specific contaminant concentration* (SCC) for classification without TCLP		CAS Registry Number
	General solid waste[1]	Restricted solid waste	
	CT1 (mg/kg)	CT2 (mg/kg)	
Mercury	4	16	
Methyl ethyl ketone	4,000	16,000	78-93-3
Moderately harmful pesticides[6] (total)	250	1,000	See below[6]
Molybdenum	100	400	
Nickel	40	160	
Nitrobenzene	40	160	98-95-3
C6–C9 petroleum hydrocarbons[7]	650	2,600	
C10–C36 petroleum hydrocarbons[7]	10,000	40,000	
Phenol (non-halogenated)	288	1,152	108-95-2
Picloram	60	240	1918-02-1
Plasticiser compounds[8]	20	80	See below[8]
Polychlorinated biphenyls[9]	<50	<50	1336-36-3
Polycyclic aromatic hydrocarbons (total)[10]	200	800	
Scheduled chemicals[11]	<50	<50	
Selenium	20	80	
Silver	100	400	
Styrene (vinyl benzene)	60	240	100-42-5
Tebuconazole	128	512	107534-96-3
1,2,3,4-Tetrachlorobenzene	10	40	634-66-2
1,1,1,2-Tetrachloroethane	200	800	630-20-6
1,1,2,2-Tetrachloroethane	26	104	79-34-5
Tetrachloroethylene	14	56	127-18-4
Toluene	288	1,152	108-88-3
1,1,1-Trichloroethane	600	2,400	71-55-6
1,1,2-Trichloroethane	24	96	79-00-5
Trichloroethylene	10	40	79-01-6
2,4,5-Trichlorophenol	8,000	32,000	95-95-4
2,4,6-Trichlorophenol	40	160	88-06-2
Triclopyr	40	160	55335-06-3

Contaminant	Maximum values of *specific contaminant concentration* (SCC) for classification without TCLP		CAS Registry Number
	General solid waste[1]	Restricted solid waste	
	CT1 (mg/kg)	CT2 (mg/kg)	
Vinyl chloride	4	16	75-01-4
Xylenes (total)	1,000	4,000	1330-20-7

Notes

1. Values are the same for general solid waste (putrescible) and general solid waste (non-putrescible).
2. There may be a need for the laboratory to concentrate the sample to achieve the TCLP limit value for benzo(a)pyrene with confidence.
3. These limits apply to chromium in the +6 oxidation state only.
4. Analysis for cyanide (amenable) is the established method for assessing potentially leachable cyanide. The EPA may consider other methods if it can be demonstrated that these methods yield the same information.
5. Endosulfan (CAS Registry Number 115-29-7) means the total of Endosulfan I (CAS Registry Number 959-98-8), Endosulfan II (CAS Registry Number 891-86-1) and Endosulfan sulfate (CAS Registry Number 1031-07-8).
6. The following moderately harmful pesticides are to be included in the total values specified:

Moderately harmful pesticides (total)			
Name	CAS Registry Number	Name	CAS Registry Number
Atrazine	1912-24-9	Imidacloprid	138261-41-3
Azoxystrobin	131860-33-8	Indoxacarb	173584-44-6
Bifenthrin	82657-04-3	Malathion (Maldison)	121-75-5
Brodifacoum	56073-10-0	Metalaxyl	57837-19-1
Carboxin	5234-68-4	Metalaxyl-M	70630-17-0
Copper naphthenate	1338-02-9	Methidathion	950-37-8
Cyfluthrin	68359-37-5	3-Methyl-4-chlorophenol	59-50-7
Cyhalothrin	68085-85-8	Methyl chlorpyrifos	5598-13-0
Cypermethrin	52315-07-08	N-Methyl pyrrolidone	872-50-4
Deltamethrin	52918-63-5	2-octylthiazol-3-one	26530-20-1
Dichlofluanid	1085-98-9	Oxyfluorfen	42874-03-3
Dichlorvos	62-73-7	Paraquat dichloride	1910-42-5
Difenoconazole	119446-68-3	Parathion methyl	298-00-0
Dimethoate	60-51-5	Permethrin	52645-53-1
Diquat dibromide	85-00-7	Profenofos	41198-08-7
Emamectin benzoate	137515-75-4 & 155569-91-8	Prometryn	7287-19-6
Ethion	563-12-2	Propargite	2312-35-8
Fenthion	55-38-9	Pentachloronitrobenzene (Quintozene)	82-68-8
Fenitrothion	122-14-5	Simazine	122-34-9
Fipronil	120068-37-3	Thiabendazole	148-79-8

Moderately harmful pesticides (total)			
Name	**CAS Registry Number**	**Name**	**CAS Registry Number**
Fluazifop-P-butyl	79241-46-6	Thiamethoxam	153719-23-4
Fludioxonil	131341-86-1	Thiodicarb	59669-26-0
Glyphosate	1071-83-6	Thiram	137-26-8

7. Approximate range of petroleum hydrocarbon fractions: petrol C6–C9, kerosene C10–C18, diesel C12–C18, and lubricating oils above C18. Laboratory results are reported as four different fractions: C6–C9, C10–C14, C15–C28 and C29–C36. The results of total petroleum hydrocarbons (TPH) (C10–C36) analyses are reported as a sum of the relevant three fractions. Please note that hydrocarbons are defined as molecules that only contain carbon and hydrogen atoms. Prior to TPH (C10–C36) analysis, clean-up may be necessary to remove non-petroleum hydrocarbon compounds. Where the presence of other materials that will interfere with the analysis may be present, such as oils and fats from food sources, you are advised to treat the extract that has been solvent exchanged to hexane with silica gel as described in *USEPA Method 1664A* (USEPA 2000).
8. Plasticiser compounds means the total of di-2-ethyl hexyl phthalate (CAS Registry Number 117-81-7) and di-2-ethyl hexyl adipate (CAS Registry Number 103-23-1) contained within a waste.
9. Polychlorinated biphenyls must be managed in accordance with the EPA's polychlorinated biphenyl (PCB) chemical control order 1997, which is available on the EPA website at www.epa.nsw.gov.au/resources/pesticides/pcbcco1997.pdf.
10. The following polycyclic aromatic hydrocarbons (PAHs) are assessed as the total concentration of 16 USEPA Priority Pollutant PAHs, as follows:

Polycyclic aromatic hydrocarbons (total)			
PAH name	**CAS Registry Number**	**PAH name**	**CAS Registry Number**
Acenaphthene	83-32-9	Chrysene	218-01-9
Acenaphthylene	208-96-8	Dibenzo(a,h)anthracene	53-70-3
Anthracene	120-12-7	Fluoranthene	206-44-0
Benzo(a)anthracene	56-55-3	Fluorene	86-73-7
Benzo(a)pyrene	50-32-8	Indeno(1,2,3-cd)pyrene	193-39-5
Benzo(b)fluoranthene	205-99-2	Naphthalene	91-20-3
Benzo(ghi)perylene	191-24-2	Phenanthrene	85-01-8
Benzo(k)fluoranthene	207-08-9	Pyrene	129-00-0

11. Scheduled chemicals must be managed in accordance with the EPA's scheduled chemical wastes chemical control order 2004, which is available on the EPA website at www.epa.nsw.gov.au/resources/pesticides/scwcco2004.pdf.

    The following scheduled chemicals are to be included in the total values specified:

Scheduled chemicals (total)			
Name	**CAS Registry Number**	**Name**	**CAS Registry Number**
Aldrin	309-00-2	Heptachlor	76-44-8
Alpha-BHC	319-84-6	Heptachlor epoxide	1024-57-3
Beta-BHC	319-85-7	Hexachlorobenzene	118-74-1
Gamma-BHC (Lindane)	58-89-9	Hexachlorophene	70-30-4
Delta-BHC	319-86-8	Isodrin	465-73-6

Scheduled chemicals (total)			
Name	**CAS Registry Number**	**Name**	**CAS Registry Number**
Chlordane	57-74-9	Pentachlorobenzene	608-93-5
DDD	72-54-8	Pentachloronitrobenzene	82-68-8
DDE	72-55-9	Pentachlorophenol	87-86-5
DDT	50-29-3	1,2,4,5-Tetrachlorobenzene	95-94-3
Dieldrin	60-57-1	2,3,4,6-Tetrachlorophenol	58-90-2
Endrin	72-20-8	1,2,4-Trichlorobenzene	120-82-1
Endrin aldehyde	7421-93-4	2,4,5-Trichlorophenoxyacetic acid, salts and esters	93-76-5

Table 2: TCLP and SCC values for classifying waste by chemical assessment

For disposal requirements for organic and inorganic chemical contaminants not listed below, contact the EPA. Aluminium, barium, boron, chromium (0 and III oxidation states), cobalt, copper, iron, manganese, vanadium and zinc have not been listed with values in this table and need not be tested for.

	Maximum values for *leachable concentration* and *specific contaminant concentration* when used together				
	General solid waste[1]		**Restricted solid waste**		
	Leachable concentration	**Specific contaminant concentration**	**Leachable concentration**	**Specific contaminant concentration**	
Contaminant	**TCLP1 (mg/L)**	**SCC1 (mg/kg)**	**TCLP2 (mg/L)**	**SCC2 (mg/kg)**	**CAS Registry Number**
Arsenic	5.0[2]	500	20	2,000	
Benzene	0.5[2]	18	2	72	71-43-2
Benzo(a)pyrene[3]	0.04[4]	10	0.16	23	50-32-8
Beryllium	1.0[5]	100	4	400	
Cadmium	1.0[2]	100	4	400	
Carbon tetrachloride	0.5[2]	18	2	72	56-23-5
Chlorobenzene	100[2]	3,600	400	14,400	108-90-7
Chloroform	6[2]	216	24	864	67-66-3
Chlorpyrifos	0.2	7.5	0.8	30	2921-88-2
Chromium (VI)[6]	5[2]	1,900	20	7,600	
m-Cresol	200[2]	7,200	800	28,800	108-39-4
o-Cresol	200[2]	7,200	800	28,800	95-48-7
p-Cresol	200[2]	7,200	800	28,800	106-44-5
Cresol (total)	200[2]	7,200	800	28,800	1319-77-3
Cyanide (amenable)[7, 8]	3.5[7]	300	14	1,200	
Cyanide (total)[7]	16[7]	5,900	64	23,600	
2,4-D	10[2]	360	40	1,440	94-75-7
1,2-Dichlorobenzene	4.3[2]	155	17.2	620	95-50-1
1,4-Dichlorobenzene	7.5[2]	270	30	1,080	106-46-7
1,2-Dichloroethane	0.5[2]	18	2	72	107-06-2
1,1-Dichloroethylene	0.7[2]	25	2.8	100	75-35-4
Dichloromethane	8.6[2]	310	34.4	1,240	75-09-2
2,4-Dinitrotoluene	0.13[2]	4.68	0.52	18.7	121-14-2
Endosulfan[9]	3	108	12	432	See below[9]

Contaminant	Maximum values for *leachable concentration* and *specific contaminant concentration* when used together				CAS Registry Number
	General solid waste[1]		Restricted solid waste		
	Leachable concentration	Specific contaminant concentration	Leachable concentration	Specific contaminant concentration	
	TCLP1 (mg/L)	SCC1 (mg/kg)	TCLP2 (mg/L)	SCC2 (mg/kg)	
Ethylbenzene	30[10]	1,080	120	4,320	100-41-4
Fluoride	150[10]	10,000	600	40,000	
Fluroxypyr	2	75	8	300	69377-81-7
Lead	5[2]	1,500	20	6,000	
Mercury	0.2[2]	50	0.8	200	
Methyl ethyl ketone	200[2]	7,200	800	28,800	78-93-3
Moderately harmful pesticides[11](total)	N/A[12]	250	N/A[12]	1,000	See below[11]
Molybdenum	5[10]	1,000	20	4,000	
Nickel	2[10]	1,050	8	4,200	
Nitrobenzene	2[2]	72	8	288	98-95-3
C6–C9 petroleum hydrocarbons[13]	N/A[12]	650	N/A[12]	2,600	
C10–C36 petroleum hydrocarbons[13]	N/A[12]	10,000	N/A[12]	40,000	
Phenol (non-halogenated)	14.4[14]	518	57.6	2,073	108-95-2
Picloram	3	110	12	440	1918-02-1
Plasticiser compounds[15]	1	600	4	2,400	See below[15]
Polychlorinated biphenyls[12]	N/A[12]	< 50	N/A[12]	< 50	1336-36-3
Polycyclic aromatic hydrocarbons (total)[16]	N/A[12]	200	N/A[12]	800	
Scheduled chemicals[17]	N/A[12]	< 50	N/A[12]	< 50	See below[17]
Selenium	1[2]	50	4	200	
Silver	5.0[2]	180	20	720	
Styrene (vinyl benzene)	3[10]	108	12	432	100-42-5
Tebuconazole	6.4	230	25.6	920	107534-96-3
1,2,3,4-Tetrachlorobenzene	0.5	18	2	72	634-66-2

Contaminant	Maximum values for *leachable concentration* and *specific contaminant concentration* when used together				CAS Registry Number
	General solid waste[1]		Restricted solid waste		
	Leachable concentration	Specific contaminant concentration	Leachable concentration	Specific contaminant concentration	
	TCLP1 (mg/L)	SCC1 (mg/kg)	TCLP2 (mg/L)	SCC2 (mg/kg)	
1,1,1,2-Tetrachloroethane	10[2]	360	40	1,440	630-20-6
1,1,2,2-Tetrachloroethane	1.3[2]	46.8	5.2	187.2	79-34-5
Tetrachloroethylene	0.7[2]	25.2	2.8	100.8	127-18-4
Toluene	14.4[14]	518	57.6	2,073	108-88-3
1,1,1-Trichloroethane	30[2]	1,080	120	4,320	71-55-6
1,1,2-Trichloroethane	1.2[2]	43.2	4.8	172.8	79-00-5
Trichloroethylene	0.5[2]	18	2	72	79-01-6
2,4,5-Trichlorophenol	400[2]	14,400	1,600	57,600	95-95-4
2,4,6-Trichlorophenol	2[2]	72	8	288	88-06-2
Triclopyr	2	75	8	300	55335-06-3
Vinyl chloride	0.2[2]	7.2	0.8	28.8	75-01-4
Xylenes (total)	50[18]	1,800	200	7,200	1330-20-7

Notes

1. Values are the same for general solid waste (putrescible) and general solid waste (non- putrescible).
2. See *Hazardous Waste Management System: Identification and Listing of Hazardous Waste – Toxicity Characteristics Revisions, Final Rule* (USEPA 2012b) for TCLP levels.
3. There may be a need for the laboratory to concentrate the sample to achieve the TCLP limit value for benzo(a)pyrene with confidence.
4. Calculated from *Hazardous Waste: Identification and Listing* (USEPA 2012a).
5. Calculated from 'Beryllium' in *The Health Risk Assessment and Management of Contaminated Sites* (DiMarco & Buckett 1996).
6. These limits apply to chromium in the +6 oxidation state only.
7. Taken from the *Land Disposal Restrictions for Newly Identified and Listed Hazardous Wastes and Hazardous Soil: Proposed Rule* (USEPA 1993).
8. Analysis for cyanide (amenable) is the established method used to assess the potentially leachable cyanide. The EPA may consider other methods if it can be demonstrated that these methods yield the same information.
9. Endosulfan (CAS Registry Number 115-29-7) means the total of endosulfan I (CAS Registry Number 959-98-8), endosulfan II (CAS Registry Number 891-86-1) and endosulfan sulfate (CAS Registry Number 1031-07-8).
10. Calculated from *Australian Drinking Water Guidelines* (NHMRC 2011).
11. The following moderately harmful pesticides are to be included in the total values specified:

Moderately harmful pesticides (total)			
Name	**CAS Registry Number**	**Name**	**CAS Registry Number**
Atrazine	1912-24-9	Imidacloprid	138261-41-3
Azoxystrobin	131860-33-8	Indoxacarb	173584-44-6
Bifenthrin	82657-04-3	Malathion (Maldison)	121-75-5
Brodifacoum	56073-10-0	Metalaxyl	57837-19-1
Carboxin	5234-68-4	Metalaxyl-M	70630-17-0
Copper naphthenate	1338-02-9	Methidathion	950-37-8
Cyfluthrin	68359-37-5	3-Methyl-4-chlorophenol	59-50-7
Cyhalothrin	68085-85-8	Methyl chlorpyrifos	5598-13-0
Cypermethrin	52315-07-08	N-Methyl pyrrolidone	872-50-4
Deltamethrin	52918-63-5	2-octylthiazol-3-one	26530-20-1
Dichlofluanid	1085-98-9	Oxyfluorfen	42874-03-3
Dichlorvos	62-73-7	Paraquat dichloride	1910-42-5
Difenoconazole	119446-68-3	Parathion methyl	298-00-0
Dimethoate	60-51-5	Permethrin	52645-53-1
Diquat dibromide	85-00-7	Profenofos	41198-08-7
Emamectin benzoate	137515-75-4 & 155569-91-8	Prometryn	7287-19-6
Ethion	563-12-2	Propargite	2312-35-8
Fenthion	55-38-9	Pentachloronitrobenzene (Quintozene)	82-68-8
Fenitrothion	122-14-5	Simazine	122-34-9
Fipronil	120068-37-3	Thiabendazole	148-79-8
Fluazifop-P-butyl	79241-46-6	Thiamethoxam	153719-23-4
Fludioxonil	131341-86-1	Thiodicarb	59669-26-0
Glyphosate	1071-83-6	Thiram	137-26-8

12. No TCLP analysis is required. Moderately harmful pesticides, petroleum hydrocarbons, polychlorinated biphenyls, polycyclic aromatic hydrocarbons and scheduled chemicals are assessed using SCC1 and SCC2.

    Polychlorinated biphenyls must be managed in accordance with the EPA's polychlorinated biphenyl (PCB) chemical control order 1997, which is available on the EPA website at www.epa.nsw.gov.au/resources/pesticides/pcbcco1997.pdf.

13. Approximate range of petroleum hydrocarbon fractions: petrol C6–C9, kerosene C10–C18, diesel C12–C18, and lubricating oils above C18. Laboratory results are reported as four different fractions: C6–C9, C10–C14, C15–C28 and C29–C36. The results of total petroleum hydrocarbons (C10–C36) analyses are reported as a sum of the relevant three fractions. Please note that hydrocarbons are defined as molecules that only contain carbon and hydrogen atoms. Prior to TPH (C10–C36) analysis, clean-up may be necessary to remove non-petroleum hydrocarbon compounds. Where the presence of other materials that will interfere with the analysis may be present, such as oils and fats from food sources, you are advised to treat the extract that has been solvent exchanged to hexane with silica gel as described in USEPA *Method 1664A* (USEPA 2000).
14. Proposed level for phenol and toluene in *Hazardous Waste Management System: Identification and Listing of Hazardous Waste – Toxicity Characteristics Revisions, Final Rule* (USEPA 2012b).

15. Plasticiser compounds means the total of di-2-ethyl hexyl phthalate (CAS Registry Number 117-81-7) and di-2-ethyl hexyl adipate (CAS Registry Number 103-23-1) contained within a waste.
16. The following polycyclic aromatic hydrocarbons are assessed as the total concentration of 16 USEPA Priority Pollutant PAHs, as follows:

Polycyclic aromatic hydrocarbons (total)			
PAH name	**CAS Registry Number**	**PAH name**	**CAS Registry Number**
Acenaphthene	83-32-9	Chrysene	218-01-9
Acenaphthylene	208-96-8	Dibenzo(a,h)anthracene	53-70-3
Anthracene	120-12-7	Fluoranthene	206-44-0
Benzo(a)anthracene	56-55-3	Fluorene	86-73-7
Benzo(a)pyrene	50-32-8	Indeno(1,2,3-cd)pyrene	193-39-5
Benzo(b)fluoranthene	205-99-2	Naphthalene	91-20-3
Benzo(ghi)perylene	191-24-2	Phenanthrene	85-01-8
Benzo(k)fluoranthene	207-08-9	Pyrene	129-00-0

17. Scheduled chemicals must be managed in accordance with the EPA's scheduled chemical wastes chemical control order 2004, which is available on the EPA website at www.epa.nsw.gov.au/resources/pesticides/scwcco2004.pdf.

    The following scheduled chemicals are to be included in the total values specified:

Scheduled chemicals (total)			
Name	**CAS Registry Number**	**Name**	**CAS Registry Number**
Aldrin	309-00-2	Heptachlor	76-44-8
Alpha-BHC	319-84-6	Heptachlor epoxide	1024-57-3
Beta-BHC	319-85-7	Hexachlorobenzene	118-74-1
Gamma-BHC (Lindane)	58-89-9	Hexachlorophene	70-30-4
Delta-BHC	319-86-8	Isodrin	465-73-6
Chlordane	57-74-9	Pentachlorobenzene	608-93-5
DDD	72-54-8	Pentachloronitrobenzene	82-68-8
DDE	72-55-9	Pentachlorophenol	87-86-5
DDT	50-29-3	1,2,4,5-Tetrachlorobenzene	95-94-3
Dieldrin	60-57-1	2,3,4,6-Tetrachlorophenol	58-90-2
Endrin	72-20-8	1,2,4-Trichlorobenzene	120-82-1
Endrin aldehyde	7421-93-4	2,4,5-Trichlorophenoxyacetic acid, salts and esters	93-76-5

18. Calculated from *Guidelines for Drinking Water Quality* (WHO 2011).

Table 3: Summary of criteria for chemical assessment to determine waste classification

Waste classification	Criteria[1] for classification by chemical assessment (any of the alternative options given)	Comments
General solid waste	1. SCC test values ≤ CT1	TCLP test not required
	2. TCLP test values ≤ TCLP1 and SCC test values ≤ SCC1	
	3. TCLP test values ≤ TCLP1 and SCC test values > SCC1[2]	Classify as restricted solid or hazardous (as applicable) If immobilisation approval applies, classify in accordance with that approval
Restricted solid waste	1. SCC test values ≤ CT2	TCLP test not required
	2. TCLP1 < TCLP test values ≤ TCLP2 and SCC test values ≤ SCC2	
	3.TCLP test values ≤ TCLP2 and SCC1 < SCC test values ≤ SCC2	
	4. TCLP1 < TCLP test values ≤ TCLP2 and SCC test values > SCC2[2]	Classify as hazardous. If immobilisation approval applies, classify in accordance with that approval
Hazardous waste	1. TCLP test values > TCLP 2	
	2. TCLP test values ≤ TCLP2 and SCC test values > SCC2	Classify as hazardous if no immobilization approval applies

Notes

1. These criteria apply to each toxic and ecotoxic contaminant present in the waste (see Tables 1 and 2).
2. In certain cases the EPA will consider specific conditions, such as segregation of the waste from all other types of waste in a monofill or monocell in order to achieve a greater margin of safety against a possible failure of the immobilisation in the future. Information about the construction and operation of a monofill/monocell is available in the *Draft Environmental Guidelines for Industrial Waste Landfilling* (EPA 1998).