Aargus

Environmental - Remediation - Engineering - Laboratories - Drilling

DETAILED ENVIRONMENTAL SITE ASSESSMENT

62-82 Harrow Road, Bexley NSW

Prepared for

St Basils Homes

28th August 2013

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Approved By: Mark Kelly

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Environmental Manager

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REFERENCES

- ANZECC/NHMRC (1992) – "Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites". Australian and New Zealand Environment and Conservation Council and the National Health and Medical Research Council, Canberra.
- NSW EPA "Sampling Design Guidelines" (1995). NSW Environment Protection Authority, Sydney.
- NSW EPA "Guidelines for Assessing Service Station Sites" (1994). NSW Environment Protection Authority, Sydney.
- NSW DEC "Guidelines for the NSW Site Auditor Scheme" (2006). NSW Environment Protection Authority, Sydney.
- NSW EPA "Guidelines for Consultants Reporting on Contaminated Sites" (2011). NSW Environment Protection Authority, Sydney.
- National Environment Protection Council "Guideline on the Investigation Levels for Soil and Groundwater", NEPM, 1999.
- National Environmental Protection (Assessment of Site Contamination) Measure, NEPC Schedule B series, 1999.
- ANZECC National Water Quality Management Strategy "Australian Water Quality Guidelines for Fresh and Marine Waters", 1992.
- NSW DECC (2009) – "Waste Classification Guidelines, Part 1: Classifying Waste".
- Aargus Pty Ltd (2008) – "Environmental Site Assessment – St George Bowling Club, Bexley NSW"

ABBREVIATIONS

AIP	Australian Institute of Petroleum Ltd
ADWG	Australian Drinking Water Guidelines
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
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
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
PSH	Phase Separated Hydrocarbon
QA/QC	Quality Assurance / Quality Control
RAC	Remediation Acceptance Criteria
RAP	Site Remediation 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 St Basils Homes to undertake a Detailed Environmental Site Assessment (DESA) for the property located at 62-82 Harrow Road, Bexley NSW. It is understood that the site is proposed to be developed into a residential aged care facility with single basement parking and open spaces. A DESA was requested by Rockdale City Council to determine the potential for onsite contamination.

The historical information indicates that the site has predominantly been used as a bowling club since the early 1900's until recently, when activities associated with the club ceased in 2005. The adjoining properties have been predominantly used for residential purposes over this period of time.

A previous Environmental Site Assessment conducted by Aargus (June 2008) involved a desktop study and laboratory analysis of the historical land uses of the site, with the objective of identifying potentially contaminating activities that could have taken place at the site including; the storage of raw materials, dangerous goods, storage and disposal of waste products and materials for the proposed development in relation to compliance with current NSW and Local Council environmental regulatory criteria. The June 2008 assessment has been utilised in compiling this current DESA.

From the site history review and the site inspection, the areas of environmental concern were found to be:

- Imported fill of unknown origin (introduced to level the bowling greens).
- Possible pesticide and other chemical treatment of the bowling greens.

In accordance with the NSW EPA "Sampling Design Guidelines" (September 1995) a minimum of twenty (20) sampling points for a site area of 8,305m^2 is to be adopted, however a set of twenty-four (24) primary soil samples were submitted for analysis on the differing fill and natural soil profiles during the June 2008 investigation. An additional nine (9) soil samples were collected during this investigation (June 2013) to update site conditions to accord to the changed proposed development of the site. Therefore a total of 33 samples were collected.

Laboratory results for the soil samples analysed were generally lower than the relevant regulatory guideline criteria adopted, those being HIL ‘A’ *Residential with gardens and accessible soil including children's day-care centres, preschools, primary schools, townhouses and villas*, the HIL ‘E’ *parks, recreational open space, playing fields including secondary schools* and the NSW EPA Service Station criteria.

Based on the information collected and laboratory results of this investigation, it is considered that the risks to human health and the environment associated with soil contamination in areas where soils are to be retained are low within the context of the proposed use of the site for the proposed development. The site is therefore considered ***to be suitable*** for the proposed residential aged care facility development.

Any soils requiring removal from the site, as part of future site works, should be classified in accordance with the “Waste Classification Guidelines, Part 1: Classifying Waste” NSW DECC (2009).

Reference should be made to the Limitations of Assessment at the end of the report and Appendix O, which set out details of the limitations of the assessment.

1 INTRODUCTION

Aargus Pty Ltd (Aargus) was appointed by St Basils Homes to undertake a Detailed Environmental Site Assessment (DESA) for the property located at 62-82 Harrow Road, Bexley NSW. The location of the property is presented in Figure 1 of Appendix A.

It is understood that the site is proposed for re-development into a three-storey residential aged care facility comprising 171 beds and adaptive reuse of the bowling clubhouse. Features of the proposal include:

- Basement parking level comprising 77 parking spaces, ambulance and loading bays, and ancillary utility spaces accessed from Goyen Avenue;
- Two new three-storey buildings comprising low and high care rooms and dementia care rooms, lounge rooms, dining room and kitchen, nurses stations and entry lobbies accessed from Bowlers Avenue and Goyen Avenue;
- Restoration and adaptive reuse of the Bowling Club building as an entry/office, drop-in centre, café, resident facilities and staff amenities; and
- Provision of a Chapel and landscaping of the grounds.

The proposed development plans can be found in Appendix B.

A DESA was requested by Rockdale City Council to determine the potential for onsite contamination.

This report was prepared with reference to the NSW Environment Protection Authority (EPA) "*Guidelines for Consultants Reporting on Contaminated Sites*" (2011).

2 OBJECTIVES

The objective of this DESA was to assess the potential for the soils and groundwater to have been impacted by on-site or off-site current and past activities and to assess the suitability of the site for redevelopment into a residential aged care facility with single basement parking and open spaces.

3 SCOPE OF WORKS

The scope of works for this DESA includes:

- Research and review of the information available, including previous environmental investigations, current and historical titles information, review of aerial photographs, groundwater bore searches, EPA notices, council records, anecdotal evidence, site survey and site records on waste management practices;
- Site walkover, including research of the location of sewers, drains, holding tanks and pits, spills, patches of discoloured vegetation, etc.;
- Development of a preliminary conceptual site model to demonstrate the interactions between potential sources of contamination, exposure pathways and human/environmental receptors identified;
- A targeted soil boring/sampling investigative study – formulating and conducting a sampling plan and borehole investigation; the soil samples are taken and submitted for analysis on particular contaminants;
- Laboratory analysis and results from sample analysis – findings and comparison to regulatory guidelines;
- Quality Assurance/Quality Control (QA/QC) – all QA/QC procedures were undertaken in accordance with the Aargus Quality Assurance/Quality Control manual; and
- Recommendations for additional investigations should any data gaps be identified, or possible strategies for the management of the site, where relevant.

4 SITE CONDITION AND SURROUNDING ENVIRONMENT

4.1 Site Identification

The site is currently registered as Lot 174 in DP715467, and is located at 62-82 Harrow Road, Bexley NSW as shown in Figure 2 of Appendix A. Site identification information is summarised in the table below.

Table 1: Site Identification

Street Address	**62-82 Harrow Road, Bexley**
Lot and DP Number	Lot 174 in DP715467
Local Government Area	Rockdale City Council
Parish	St George
County	Cumberland
Current Site Owner	St Basils Homes
Approx. Site Area	6,804m^2
Zoning	RE2 Private Recreation
Coordinates (N corner)*	327344.986E, 6241748.293N

* reference GDA94-MGA56

4.2 Site Description

A site visit was carried out on Tuesday 11th June 2013 by an Aargus field scientist/engineer to inspect the site for any potential sources of contamination and document any observations made regarding the current site conditions.

At the time of the site inspection, the following observations were made:

- The site is rectangular in shape, measuring about 70.52 metres (m) along the Harrow Road frontage and 114 metres along Bowlers Avenue frontage. The total area covers approximately 8,305m^2.
- The site was occupied by a disused bowling clubhouse, three greens (approx. 600m^2) no longer in use and a carpark (approx. 800m^2).
- A brick and timber building previously utilised as a clubhouse.

- A brick and metal clad garage.
- Other features noted included a garden area next to the clubhouse towards the Harrow Road side. Small garden beds are also located at the front of the clubhouse towards the south.
- The site surfaces were predominantly green lawn areas, with the exception of the carpark area, which was asphalt.
- There were no signs of plant distress or any other visible indicators of potential contamination.
- No chemical storage was noted within the site.
- There were no visual indicators of underground storage tanks (past or present).
- The only site discharges include stormwater and sewer. Stormwater run-off from the site is collected by the collection drains on Harrow Road. Sewer is presumably connected to the regional network.

The site features are presented in Figure 2 of Appendix A and site photographs are included in Appendix C.

4.3 Topography and Surface Waters

The regional topography has the site placed on the side slope of a ridgeline. Therefore, the general slope of the area is towards the southeast.

Site stormwater runoff is expected to flow via stormwater drains into Botany Bay to the south east of the site. On and off site migration from surface areas are not considered to be of environmental concern.

4.4 Surrounding Land Uses

The surrounding land uses identified are described in Table 2 below:

Table 2: Surrounding Land Uses

Orientation	Description
North	Bowlers Avenue, then low density residential
South	Goyan Avenue, then low density residential
East	Medium density residential
West	Harrow Road, then medium density residential

In summary, the surrounding land uses comprised of residential properties and is unlikely to have an impact on the site.

4.5 Local Geology

The Geological Map of Sydney (Geological Series Sheet 9130, Scale 1:100,000, 1983), published by the Department of Mineral Resources indicates the residual soils within the site to be underlain by Wianamatta Shale comprising black to grey Ashfield shale and laminite

4.6 Acid Sulfate Soils

To determine whether there is a potential for acid sulphate soils to be present within the site, reference was made to the NSW Department of Land & Water Conservation (DLWC) Acid Sulphate Soil Risk Maps (Edition Two, December 1997, Scale 1:250,000), in particular the map of “Botany Bay”. A review of the map indicated that there was “No Known Occurrence” of acid sulphate soil materials within the soil profile.

The decision to classify certain areas as Acid Sulphate Soils (ASS) is based on a number of geomorphic conditions and site criteria. The following points are used to determine if ASS are likely to exist (extracted from ASSMAC (1998) Acid Sulphate Soils Assessment Guidelines):

- Sediments of recent geological age (Holocene) ~ 10 000 y.o.
- Soil horizons less than 5m AHD (Australian Height Datum).
- Marine or estuarine sediments and tidal lakes.
- In coastal wetlands or back swamp areas; waterlogged or scalded areas; interdune swales or coastal sand dunes.
- In areas where the dominant vegetation is mangroves, reeds, rushes and other swamp tolerant and marine vegetation.
- In areas identified in geological descriptions or in maps bearing sulphide minerals, coal deposits or former marine shales/sediments.
- Deeper older estuarine sediments >10m below the ground surface, Holocene or Pleistocene age.

None of these indicators were identified during field investigations.

4.7 Local Hydrogeology

A search of the Department of Natural Resources (DNR) borehole database information revealed six (6) groundwater bores within a 500m radius of the site. A copy of the groundwater bore search records can be found in Appendix D.

A summary of the relevant information provided by the registered groundwater bore record search is provided in the following table.

Table 3: Summary of Registered Groundwater Bore Records

GW Bore ID	Location	Intended Purpose	Depth (m bgl)	Standing Water Level (m bgl)	Water Bearing Zones
GW106955	300m Northeast	Domestic	4.20	No details	2.60-4.20m
GW107580	400m Northeast	Domestic	20.00	No details	No details
GW109958	500m Northwest	Monitoring	5.20	No details	No details
GW109959	500m Northwest	Monitoring	5.90	No details	No details
GW109960	500m Northwest	Monitoring	8.00	No details	No details
GW109961	500m Northwest	Monitoring	5.80	No details	No details

4.8 Sensitive Receptors

To address the potential impacts of contamination that may be present on site, the following sensitive receptors closest to the site were identified:

- Residents and the general public with access to the site and adjacent properties;
- Recreational users at Seaforth Park, located approximately 200m southwest of the site; and
- Groundwater extraction wells for drinking water located approximately 400m north east of the site.

5 SITE HISTORY

5.1 Land Titles

A review of historical documents held at the NSW Department of Lands offices was undertaken to identify the current and previous land owners and potential land uses.

The site is currently registered as Lot 174 in DP715467. The results of the title search are summarised in the following table.

Table 4: Land Title Information

Year	Owners
2012-Present	St Basils Homes
2006	Tenetur Pty Limited
1920	The Commercial Bank of Australia Limited
1919	St George Bowling & Recreation Club Limited
1906	Bridget Slattery (widow)
1890	James Gillen (labourer)
1888	Arthur Gilder
1888	John Lennon
1885	Thomas Luck (labourer) & Elizabeth Luck (joint tenants)
1888	Daniel Clarke
1883	David Bedford
1883	William Kenwood

In summary, the site was owned by a number of private owners between 1883 and 1919, thereafter St George Bowling & Recreation Club Limited, The Commonwealth Bank of Australia Limited and Tenetur Pty Ltd took ownership until 2012. The current owners, St Basils Homes, purchased the property in 2012.

5.2 Aerial Photographs

A number of aerial photographs obtained from the NSW Department of Lands were reviewed as part of this DESA. Descriptions of the site and surrounding areas from each aerial photograph reviewed are presented in the table below:

Table 5: Summary of Historical Aerial Photos

Date	Description of Site	Surrounding Land
1930	St George Bowling and Recreation Club appears to be present on site.	N: Bowlers Avenue, then low density residential S: Goyan Avenue, then low density residential E: Low density residential W: Harrow Road, then low density residential
1951	The site remains predominantly unchanged.	The adjoining properties appear similar to the previous photograph
1978	The site remains predominantly unchanged.	The adjoining properties appear similar to the previous photograph
2008	The site appears to be disused and vacated with building structures still visible.	The adjoining properties appear similar to the present day.

In summary, the 1930 aerial photograph revealed that the bowling club occupied the site, whilst residential properties were visible either adjoining the site or beyond the adjoining roads. The site and the adjoining properties remained predominantly unchanged until 2008, where the site appeared to be no longer in use.

5.3 EPA Records

The NSW EPA publishes records of contaminated sites under Section 58 of the Contaminated Land Management (CLM) Act 1997. The notices relate to investigation and/or remediation of site contamination considered to pose a significant risk of harm under the definition in the CLM Act.

A search of the database revealed that the subject site is not listed. However, there are three (3) listed properties within the Rockdale local government area, as shown in the Table below.

Table 6: Summary of EPA Records

Issued Date of Notice	**Suburb**	**Address**	**Site Name**
19 March 2004	Brighton-le-sands	General Holmes Drive	Cook Park
19 March 2004	Brighton-le-sands	2 General Holmes Drive	Shell Service Station
27 July 2011	Turrella	61 Turrella Street	Solvent Recycler and Distributor

These sites are downgradient and some distance away from the site, therefore are not of concern to the site.

It should be noted that the DEC record of Notices for Contaminated Land does not provide a record of all contaminated land in NSW.

Reference should be made to Appendix E – EPA Summary for a copy of the search.

5.4 WorkCover NSW Records

No WorkCover search was undertaken for the site.

5.5 Council Records

No Council search was undertaken for this site

5.6 Spill & Loss History

It was indicated by site personal at the time of the site walkover, that to their knowledge no serious land or water contamination had occurred.

The site has been predominantly utilised for recreation, that being lawn bowls, in which chemicals may have been used to maintain the bowling greens. The storage of chemicals may have existed in the past, in particular within the garage in the north eastern corner of the site. The garage was locked at the time of the inspection.

At the time of the inspections, the sealed surfaces of the concrete slab were in a reasonably good condition. In addition, there were no visible signs of oil and/or chemical staining (with the exception of some minor staining in the car parking area accessed from Harrow Road), indicating that any spills (if they did occur at all) were cleaned up immediately and did not penetrate the existing slab.

5.7 Summary of Historical Land Use

The 1930 aerial photograph revealed that the bowling club occupied the site, whilst residential properties were visible either adjoining the site or beyond the adjoining roads. The site and the adjoining properties remained predominantly unchanged until 2008, where the site appeared to be no longer in use.

6 SUMMARY OF PREVIOUS REPORTS

6.1 General

The following previous investigation was undertaken for the site:

- Aargus (June 2008), "*Environmental Site Assessment - St George Bowling Club Bexley NSW*", Ref: E2252.

A summary of the findings from the investigation is provided in the following sub-section and the full report is included in Appendix F.

6.2 Aargus June 2008 – ESA

The investigation involved a desktop study and laboratory analysis of the historical land uses of the site, with the objective of identifying potentially contaminating activities that could have taken place at the site including; the storage of raw materials, dangerous goods, storage and disposal of waste products and materials for the proposed development in relation to compliance with current NSW and Local Council environmental regulatory criteria.

The historical information indicates that the site has predominantly been a bowling club since the early 1900's until recently, when activities associated with the club ceased. The adjoining properties have been predominantly used for residential purposes over this period.

From the site history review and the site inspection, the areas of environmental concern were found to be:

- Imported fill of unknown origin (introduced to level the bowling greens).
- Possible pesticide and other chemical treatment of the bowling greens.

To reach our stated objectives, a set of twenty-four (24) primary soil samples were submitted for analysis on the differing fill and natural soil profiles. Two QA/QC intra-laboratory duplicate samples, one QA/QC rinsate sample and one QA/QC inter-laboratory duplicate sample were collected. Analytical results and QA/QC interpretation met relevant DQOs. The results are therefore considered a reliable basis for the following conclusions and recommendations.

Laboratory results for the soil samples analysed were generally lower than the relevant regulatory guideline criteria adopted, those being HIL ‘D’ *residential use with minimal access to the soil (HIL ‘D’)* and the NSW EPA Service Station criteria

7 AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

Based on the site inspection, site history, previous reports and review of available information from the desktop study, the potential areas of environmental concern (AEC) and their associated chemicals of concern (CoC) for the site were identified. These are summarised in the following table.

Table 7: Summary of Potential Areas and Chemicals of Concern

Potential AEC	**Description of potentially contaminating activity**	**Potential CoCs**	**Significance of Contamination**	**Justification**
Entire site	Importation of fill material of unknown origin	Metals, TPH, BTEX, PAH, OCP, PCB	Low	Minimal fill is expected within the site.
Car parking areas	Leaks from vehicles	Metals, TPH, BTEX, PAH	Low	Minimal staining was noted on the sealed surfaces which were in a reasonable condition.
Whole site	Potential for pesticides to have been sprayed or injected on or underneath concrete slabs and within garden beds.	OCP	Low	If use of pesticides has occurred, the impact is likely to have been localised.

8 DATA QUALITY OBJECTIVES

8.1 Step 1 – State the Problem

8.1.1 Problem Statement

The site is proposed to be redevelopment into a residential aged care facility with a single basement parking and open spaces.

Previous investigations identified potential contaminants of concern those being imported fill of unknown origin and historical pesticide and chemical use on the bowling greens which may pose risks to the human and environmental receptors identified in Section 4.

Based on the results of the previous investigation undertaken in June 2008 it was considered that the risks to human health and the environment associate with soil contamination at the site are low in the context of the proposed use of the site as a high density residential development. Since the last investigation and this investigation (June 2013), the proposed land use has changed from HIL'D' to now HIL 'A' & HIL 'E'.

8.1.2 Objectives

The objective of the DESA is to assess the suitability of the site for the proposed development.

8.1.3 Project Team

The nominated core project team and their responsibilities are listed in the table below.

Table 8: Project Team and Responsibilities

Project Team Member	Responsibilities
Mark Kelly – Environmental Manager	Project Director
Con Kariotoglou	Project Manager
Samer Ghanem – Environmental Technician	Field Representative

Please refer to Appendix G for a copy of the relevant CVs.

8.1.4 Preliminary Conceptual Site Model

Table 9: Conceptual Site Model

Source	Receptor	Potential Pathways	Complete Pathways	Significance	Justification
Hydrocarbon spills and leakages from car parking areas or placement of uncontrolled fill	Site end users	Dermal contact or ingestion	Yes	Low	Minimal staining was noted and absorbed onto sealed surfaces. Minimal fill is expected across the site.
		Inhalation	No	Low	No odours were noted.
Contaminants present within uncontrolled fill material	Site end users	Dermal contact or ingestion	No	Low	Minimal fill is expected across the site and there is currently no pathway between current site end users and the soils beneath the existing building.
	The aquatic environment	Vertical migration of impacted groundwater	Yes	Low	No groundwater was observed during drilling and impacted soils are unlikely to have migrated down to the groundwater table based on current data.

8.2 Step 2 - Identify the Decisions

The decisions required to address the contamination problem are as follows:

- Does the site or is the site likely to present a risk of harm to humans or the environment?
- Is the site currently suitable for the proposed land use being residential with access to soil and open spaces?
- Is there a potential for offsite migration issues?
- If not, does the site require further investigation and/or remediation works?

8.3 Step 3 - Identify Inputs to the Decision

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

- Findings from previous contaminated land reports prepared for the site as summarised in Section 6 of this report;
- Identification of potential areas and contaminants of concern as detailed in Section 7 of this report;
- Selection of soil assessment criteria from appropriate guidelines as detailed in Section 9 of this report;
- Collection of soil samples from site; and
- Comparison and interpretation of results again the adopted soil assessment criteria.

8.4 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 Plans (refer to Figure 1). The site is currently registered as Lot 174 in DP715467 with an area of approximately 8,305m^2;

- The vertical extent of the study boundary is defined by the maximum depth of drilling of 1.5m below ground level (BGL); and
- The following areas of potential environmental concern to target specific contaminating activities, as shown in Table 7 and described in Section 7:
  - Imported fill of unknown origin (introduced to level the bowling greens).
  - Possible pesticide and other chemical treatment of the bowling greens.

8.5 Step 5 – Develop a Decision Rule

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 1999 Guidelines.

Table 10: 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	MGT RPD’s <30% SGS RPD’s <30%
Laboratory Control Samples	Recovery targets - MGT: 70% to 130% Recovery targets - SGS: 60% to 140%
Surrogate Spike	Recovery targets: 60% to 140%

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 investigation; and
- If the measured concentrations of soil and groundwater samples analysed meet their respective validation criteria, then no additional assessment is required is required.

8.6 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 suitable for the proposed residential development when it is actually not; and
- Deciding that the site is not suitable for the proposed residential development when it actually is.

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 laid out within the Aargus protocols;
- The acceptable limits for laboratory QA/QC parameters are based upon the laboratory reported acceptable limits and those stated within the NEPM 1999 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 the relevant threshold level; that is, it is acceptable for individuals to exceed the guideline, but the cumulative mean of the data set of soil sample results should 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.

8.7 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;
- Preparation of Sampling, Analytical and Quality Plan (SAQP) to satisfy the Data Quality Objectives;
- An assessment of the Data Quality Indicators to determine if the field procedures and laboratory analytical results are reliable; and
- 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.
- In accordance with the NSW EPA "Sampling Design Guidelines" (September 1995) a minimum of twenty (20) sampling points for a site area of 8,305m^2 is to be adopted, however a set of twenty-four (24) primary soil samples were submitted for analysis on the differing fill and natural soil profiles during the June 2008 investigation. An additional nine (9) soil samples were collected during this investigation (June 2013) to update site conditions to accord to the changed proposed development of the site. Therefore a total of 33 samples were collected.

9 SITE ASSESSMENT CRITERIA

9.1 Soils

9.1.1 Soil Assessment Criteria

The selection of appropriate health-based site assessment criteria for soils was based on the following guiding documents:

- NEPC (1999), “National Environmental Protection (Assessment of Site Contamination) Measure (NEPM)”;
- NSW DEC (2006), “Guidelines for the NSW Auditor Scheme (2nd Edition)”; and
- NSW EPA (1994), “Guidelines for Assessing Service Station Sites”.

The NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme* and the NEPM present health-based investigation levels for different land uses (e.g. industrial / commercial, residential, recreational etc.) as well as provisional phytotoxicity based investigation levels.

The EPA guidelines indicate that the assessment of soil test results and comparison with defined soil criteria should include consideration of a number of factors such as:

1. Land uses, e.g. residential, agricultural/horticultural, recreation or commercial/industrial;
2. Potential child occupancy;
3. Potential environmental effects including leaching into groundwater;
4. Single or multiple contaminants;
5. Depth of contamination;
6. Level and distribution of contamination;
7. Bioavailability of contaminant(s), e.g. Related to speciation, route of exposure;
8. Toxicological assessment of the contaminant(s), e.g. Toxic kinetics, carcinogenicity, acute and chronic toxicity;

9. Physico-chemical properties of the contaminant(s);
10. State of the site surface, e.g. paved or grassed exposed;
11. Potential exposure pathways; and
12. Uncertainties with the sampling methodology and toxicological assessment.

At the time of this report, it was understood that the proposed redevelopment of the site into a residential aged care facility with a single basement parking level and open spaces. On this basis, soil investigation results will be assessed against the following criteria:

- **HIL 'A' -** *Residential use with gardens and accessible soils, including children's day-care centres, preschools, primary schools, townhouses, and villas.*
- **HIL 'E' -** *parks, recreational open space, playing fields including secondary schools*

The NEPM (1999) Guidelines do not include investigation levels for volatile fractions of TPH and BTEX. The NSW EPA (1994) "*Guidelines for Assessing Service Station Sites*" provide an indication of acceptable clean-up levels for petroleum hydrocarbons compounds at service station sites to be reused for sensitive land-uses. The NSW EPA has recommended that these threshold values should also be used to assess the suitability of sites for less stringent uses, such as residential with minimal access to the soil or parklands.

For semi-volatile petroleum hydrocarbons (C_{16} – C_{35} and >C_{35}) investigation levels are provided in the NSW DEC (2006) guidelines, however, these are based on the NEPM health-based criteria, which require the laboratory analysis to unequivocally differentiate between aromatic and aliphatic compounds. The NSW EPA guidelines will be applied in the first instance as broad criteria to assess TPH concentrations. If significant TPH impacts are recorded in soil, aromatic/aliphatic criteria from NSW DEC (2006) may be utilised to assess the speciation of TPH.

Full details of the site assessment criteria for each potential contaminant of concern in soils identified in Section 7 are presented in the Table H1 of Appendix H.

9.1.2 Composite Soil Samples

Concentrations of analytes are assessed against the Adjusted criteria. If the concentration of an analyte for a composite sample is in excess of the Adjusted criteria, then all sub-samples of the failed composite sample(s) will be analysed individually. The purpose of this is to identify any potentially contaminated sub-samples within the failed composite samples.

Adjustment of the criteria for composite samples was based on Method 1, Section 6, of the EPA "Sampling Design Guidelines for Contaminated Sites" 1995. The Adjusted criteria were calculated by dividing the criteria by three.

9.1.3 Waste Classification

To assess the waste classification of materials to be disposed of off-site, the NSW EPA refers to the NSW DECC (2009) Waste Classification Guidelines, Part 1: Classifying Waste.

To classify a non-liquid waste as General Solid Waste or Restricted Solid Waste, the threshold values of the “total concentration without TCLP” (referred to as CT in the text), or the threshold values for the “leachable and total concentration” together can be used.

Full details of the assessment criteria for waste classification are presented in the Table H2 of Appendix H.

10 FIELD INVESTIGATIONS

10.1 General Methodology

The soil investigation was carried out on Tuesday 11th June 2013 and was designed to meet the Data Quality Objectives. The fieldwork procedures adopted were carried out in general accordance with the Aargus fieldwork protocols (refer to Appendix I), which are based on industry accepted standard practice.

Samples were taken from subsurface locations using a hand trowel to a depth 0-0.1m

10.2 Soil Investigation

10.2.1 Sampling Density and Depths

Nine sampling locations (A1 to A9) were collected on a semi-regular grid over the site to provide general site coverage with consideration given to accessibility, site features and the proposed development zones. The sample locations are shown in Figure 2 of Appendix A.

It is considered that the number of sampling points adopted, twenty-four during the June 2008 assessment together with the nine from this assessment, meets the minimum requirements of the NSW EPA “Sampling Design Guidelines” (1995) for a site area of 8,305m^2 and to detect a hotspot diameter of 21.2m.

Boreholes were advanced through fill material and terminated at least 0.1m into topsoils to allow for the collection of at least one soil sample from fill material soils.

10.2.2 Sampling Methodology

Soil sampling was carried out in general accordance with Aargus Fieldwork Protocols. In summary:

- Soil samples were collected using a hand trowel; and
- Samples were transferred into clean laboratory supplied containers using a hand trowel.

10.2.3 Laboratory Analysis

Soil samples were submitted to their respective laboratories as specified in Section 13.2. The following table lists the number of primary and QA/QC soil samples that were analysed for various contaminants.

Table 11: Laboratory Analysis Schedule - Soils

Analyte / Analyte Group		TYPE	SAMPLING DATE	Heavy Metals
Sample	Depth (m)			
A1	0-0.1	F	11.06.2013	✓
A2	0-0.1	F	11.06.2013	✓
A3	0-0.1	F	11.06.2013	✓
A4	0-0.1	F	11.06.2013	✓
A5	0-0.1	F	11.06.2013	✓
A6	0-0.1	F	11.06.2013	✓
A7	0-0.1	F	11.06.2013	✓
A8	0-0.1	F	11.06.2013	✓
A9	0-0.1	F	11.06.2013	✓
X1	0-0.1	F	11.06.2013	✓
X2	0-0.1	F	11.06.2013	✓
X3	0-0.1	F	11.06.2013	✓
Y1	0-0.1	F	11.06.2013	✓
Y2	0-0.1	F	11.06.2013	✓
Y3	0-0.1	F	11.06.2013	✓

Notes
MET-8: arsenic, cadmium, chromium, copper, lead,
F,T,N: Fill, Topsoil, Natural
X Duplicate (Blind)
Y Split Sample

Table 12: Laboratory Analysis Schedule – Composite Soils

Composite Sample	Sub-Samples All (0.-0.1m)	Analyte
		OCP
Composite A	A1 + A2 + A3	✓
Composite B	A4 + A5 + A6	✓
Composite C	A7 + A8 + A9	✓
Duplicate AD1	X1 + X2 + X3	✓
Split ASS1	Y1 + Y2 + Y3	✓

OCP = Organochlorine Pesticides

11 QUALITY ASSURANCE/QUALITY CONTROL

11.1 Field QA/QC

11.1.1 Field Duplicates

Duplicates of primary samples were collected to enable the assessment of variability in analyte concentrations between samples collected from the same sampling point. The tables below list the duplicate soil and groundwater samples collected with their corresponding primary samples.

Table 13: Soil Field Duplicate Samples

Primary Sample ID	Sample Depth (m bgl)	Blind Duplicate ID	Split Duplicate ID
A1	0-0.1	X1	
A2	0-0.1	X2	
A3	0-0.1	X3	
A4	0-0.1		Y1
A5	0-0.1		Y2
A6	0-0.1		Y3

11.1.2 Rinsates

Rinsate samples recovered for each day in which sampling took place to identify possible cross contamination between the sampling locations are listed in the table below.

Table 14: Rinsate Samples

Sample ID	**Equipment Type**	**Sample Media**	**Date Collected**
AR1	Hand Trowel	Soil	11 June 2013

11.1.3 Sample Handling, Storage and Transport

The following sampling handling, storage and transport procedures were adopted to ensure sample integrity:

- All samples were collected in laboratory supplied containers. A list of sample preservation methods and the types of sample containers used are attached in Appendix J.
- All soil sample containers were placed immediately into a chilled cooler box and dispatched to their respective analytical laboratories on the same day. If this was not possible, samples were temporarily held overnight in the Aargus office refrigerator at a temperature of no greater than 4 ºC and dispatched the following day.
- A Chain of Custody form (COC) was completed for all samples collected and included with the samples for transport to their respective laboratories for chemical analysis. Copies of COCs are included in Appendix K.
- All glass bottles were individually bubble wrapped for protection and insulated containers/coolers were used for sample shipment.
- Disposable nitrile gloves were used for OH&S purposes and were changed between every sample location.

11.1.4 Decontamination Procedures

The decontamination of non-dedicated sampling equipment was achieved by washing with phosphate-free detergent and tap water, followed by a final rinse with distilled water. Decontamination was conducted after the collection of samples at each sample location. A clean pair of disposable gloves was used when handling each sample.

The trowels were decontaminated between sampling locations by physically removing soil material between boreholes, washing the trowel with Decon 90 and rinsing with water.

11.2 Laboratory QA/QC

11.2.1 Laboratories Used

The following NATA-accredited laboratories were commissioned to carry out laboratory analysis of soil and groundwater samples collected:

- Primary Laboratory - Eurofins MGT (Sydney); and
- SGS Environmental (Sydney)

These laboratories also operate Quality Systems that are designed to comply with ISO/IEC 17025.

All primary samples, blind duplicates, rinsate samples, trip blank/spikes were dispatched to the primary laboratory. All split samples were dispatched to the secondary laboratory.

Laboratory Certificates of Analysis are included in Appendix K.

11.2.2 Holding Times

The following table lists the allowable holding times adopted in accordance with Schedule B(3) of The National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) prepared by the National Environment Protection Council (NEPC), the Standard Methods for the Examination of Water and Wastewater (APHA) and/or the laboratories.

Table 15: Holding Times

ANALYTE – Soil	HOLDING TIME
Metals *	6 months
Mercury	28 days
Chromium VI	7 days
Organochlorine Pesticides (OCP)	14 days
ANALYTE – Water	**HOLDING TIME**
Metals *	6 months
Mercury	30 days
Chromium VI	28 days (preserved)

11.2.3 Test Methods and Practical Quantitation Limits

The test methods adopted by Eurofins MGT – Sydney and SGS Laboratories (Sydney) are listed in Appendix J and Practical Quantitation Limits (PQLs) are specified within the Laboratory Certificates of Analysis included in Appendix K.

The methods used by the laboratories generally comply with those listed in the NEPM and the Australian and New Zealand Environment and Conservation Council (ANZECC)-1996 "*Guidelines for the Laboratory Analysis of Contaminated Soils*". Alternate methods used by the laboratories (i.e. not identified in the NEPM and ANZECC guidelines) have been validated by the laboratories, as recommended in the NEPM and ANZECC guidelines, and endorsed by NATA.

11.3 QA/QC Data Evaluation

A full evaluation of the Data Quality Indicators (DQIs) for both fieldwork and laboratory procedures is presented in Appendix L. In summary, the findings of the QA/QC evaluation indicated the following:

- Data Completeness – The data set is considered to be adequately complete.
- Data Comparability – The data set is considered to be adequately comparable. A number of non-conformances were identified, but were unlikely to affect the outcome of the assessment, those being:
  - The analytical methods used for each analyte within each laboratory were the same, but differed between the primary and the secondary laboratories. However, all analytical methods used were endorsed by NATA and were unlikely to affect the outcome of the results;
  - Sample PQL's were the same within each laboratory but differed between Eurofins MGT and SGS in a number of analytes.
- Data Representativeness – The data set is considered to be adequately representative.
- Data Precision – The data set is considered to be adequately precise. A number of non-conformances were identified, but were unlikely to affect the outcome of the assessment, those being:
  - Refer to Tables 1 to 6 in Appendix N for discussion in regards to the RPD's of the field samples. In general, the high RPD's were likely to be associated with the heterogeneity between soil samples collected.
- Data Accuracy – The data set is considered to be adequately precise. One non-conformances was identified, but was unlikely to affect the outcome of the assessment.

The sampling methods (including sample preservation, transport and decontamination procedures) and laboratory methods followed during this investigation works were consistent with Aargus protocols and were found to meet the DQOs for this project.

It is therefore considered that the data is sufficiently precise and accurate and that the results can be used for the purpose of this project.

12 FIELD OBSERVATIONS

12.1 Geology

Based on surface and sub-surface conditions observed during the intrusive investigation, the surface and sub-surface profile across the site is summarised in the table below.

Table 16: Summary of Geological Observations

Geological Unit	**Lithological Description**	**Depth Ranges:** **Top to Base (m bgl)**
Fill	Brown to dark brown sandy loams	Ground level to 0.5m
Natural Soils (Residual)	Clayey sands	0.5m to 1.5m

The following additional observations were made:

- No hydrocarbon staining was observed within any of the borehole locations.
- No hydrocarbon odours were encountered within A1 to A9.
- No fibre-containing fragments or sheeting were observed in any of the borehole samples.

We recommend that this section be read in conjunction with Figure 2 (Site Plan) in Appendix A, the Daily Work Sheets in Appendix M.

13 LABORATORY RESULTS

13.1 General

A comparison of soil laboratory results against their respective assessment criteria (as specified in Section 9) are presented in tables in Appendix N. Certificates of laboratory analysis are attached in Appendix K. A discussion of the results is presented in the following sub-sections.

13.2 Soil Results

13.2.1 Heavy Metals

As indicated in Table A, the concentrations of the discrete heavy metals were below the adopted assessment criteria, those being the HIL ‘A’ & HIL ‘E’.

13.2.2 TPH & BTEX

As indicated in Table B, the TPH & BTEX concentrations were below the suggested levels in the EPA Service Station.

13.2.3 B(a)P, PAH

As indicated in Table C, the concentrations of B(a)P & Total PAH were below the adopted assessment criteria, those being the HIL ‘A’ & HIL ‘E’.

13.2.4 OCP, PCB

As indicated in Table D, the concentrations of the discrete OCP & PCB samples were below the adopted assessment criteria, those being the HIL ‘A’ & HIL ‘E’.

As indicated in Table E, the concentrations of the composite OCP samples were below the adjusted adopted assessment criteria, those being the HIL ‘A’.

14 SITE CHARACTERISATION

14.1 Soils

All laboratory results for heavy metals, TPH, BTEX, PAH, OCP, PCB were either below their respective PQLs or the assessment criteria of HIL ‘A’, HIL ‘E’ & NSW EPA Service Station.

14.2 CSM

The Conceptual Site Model (CSM) presented in the table below provides a representation of the linkages between the following elements:

- Potential contamination sources and their associated contaminants of concern identified in Section 7.1
- Potential human and environmental receptors identified in Section 4.5; and
- Potential and complete exposure pathways.

Table 17: Conceptual Site Model

Source	Receptor	Potential Pathways	Complete Pathways	Significance	Justification
Hydrocarbon spills and leakages from car parking areas or placement of uncontrolled fill	Site end users	Dermal contact or ingestion	Yes	Low	No TPH, BTEX and/or PAH concentrations were above the assessment criteria.
		Inhalation	No	Low	No volatile fractions of TPH or BTEX were measured based on the results of the laboratory analysis.
Contaminants present within uncontrolled fill material	Site end users	Dermal contact or ingestion	No	Low	No samples could be collected from beneath the existing building footprint. However, there is currently no pathway between current site end users and the soils beneath the existing building.
	The aquatic environment	Vertical migration of impacted groundwater	Yes	Low	No groundwater was observed during drilling and impacted soils are unlikely to have migrated down to the groundwater table based on current data.

14.3 Data Gaps

Based on the findings of the investigation and the CSM, there are no data gaps identified for the site.

15 CONCLUSIONS AND RECOMMENDATIONS

Based on the information collected and laboratory results of this investigation, it is considered that the risks to human health and the environment associated with soil contamination in areas where soils are to be retained are low within the context of the proposed use of the site for a residential aged care facility development with open spaces. The site is therefore considered ***to be suitable*** for the proposed residential aged care facility with a single level basement and open spaces.

Any soils requiring removal from the site, as part of future site works, should be classified in accordance with the "Waste Classification Guidelines, Part 1: Classifying Waste" NSW DECC (2009).

If during any potential site 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 the environmental consultant should be notified immediately to set up a response to this unexpected occurrence.

Thank you for the opportunity to undertake this work. We would be pleased to provide further information on any aspects of this report.

For and on behalf of

Aargus Pty Ltd

Written by:

Con Kariotoglou
WHS Project Manager

Reviewed By:

Mark Kelly

Mark Kelly
Environmental Manager

16 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. There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site. In addition, site characteristics may change at any time in response to variations in natural conditions, chemical reactions, truck movement or contractor movement of soils 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 or writing the report and is valid (for the purposes of management or 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.

Whilst this report provides a review of site conditions encountered at sampling locations within the investigation, it should be noted that if materials are proposed to moved from site - 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 all material removed from a site must be accompanied by an appropriate waste classification report and materials are disposed of appropriately. An environmental or validation report does not constitute a waste classification report and results are treated differently. 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. If material is to be removed from a site, before disposal of any material to a licensed landfill is undertaken, the site owner must ensure an appropriate waste classification exists for all materials on the site planning to be removed, the waste producer will need to obtain prior consent from the licensed landfill/recycler. The receiving site should check to ensure that the material received matches the description provided in the report.

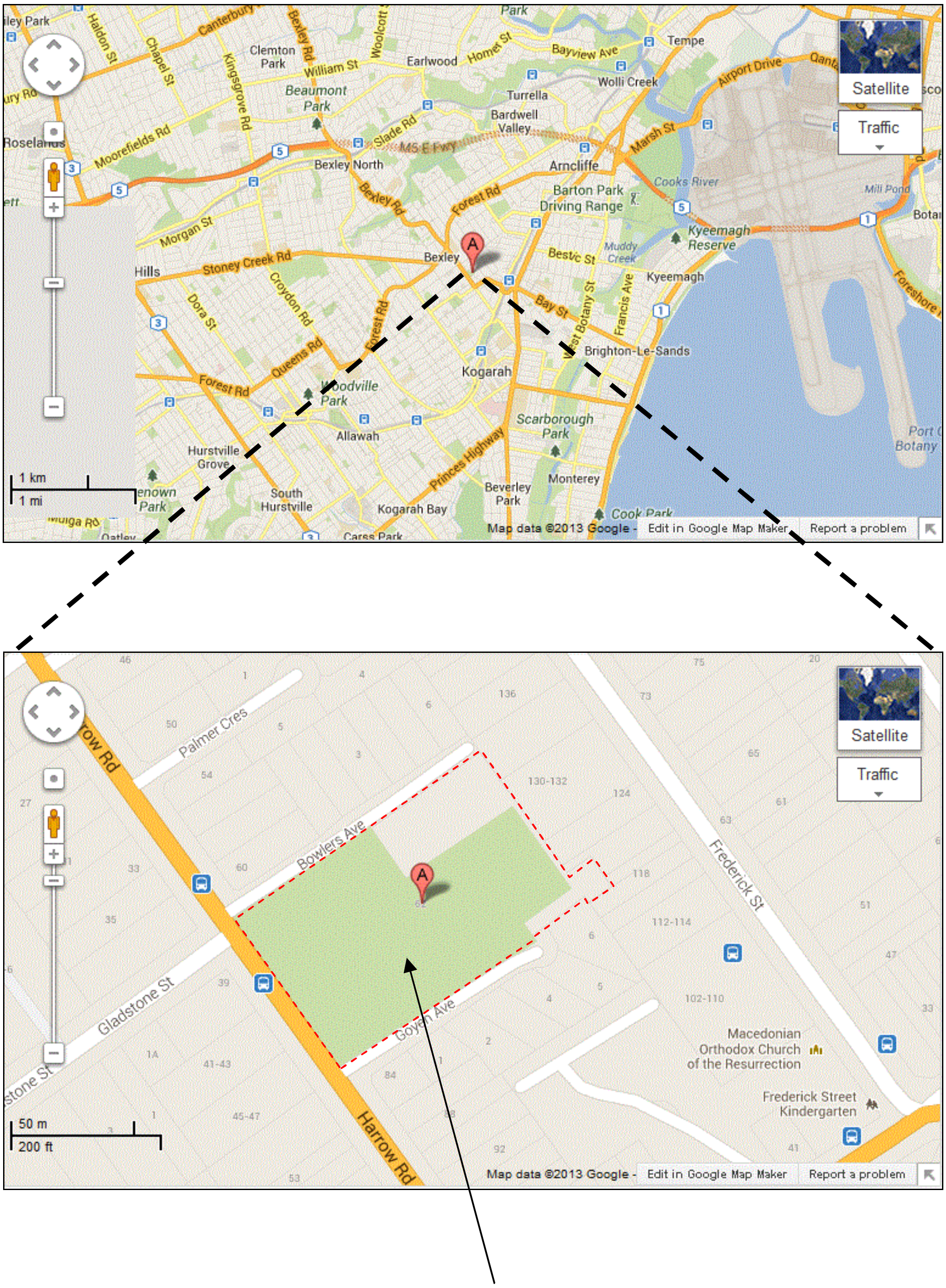
Opinions are judgements, which are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions.

Appendix O – Important information about your environmental site report should also be read in conjunction with this report.

APPENDIX A

SITE PLANS

LOCALITY MAP



Site Location

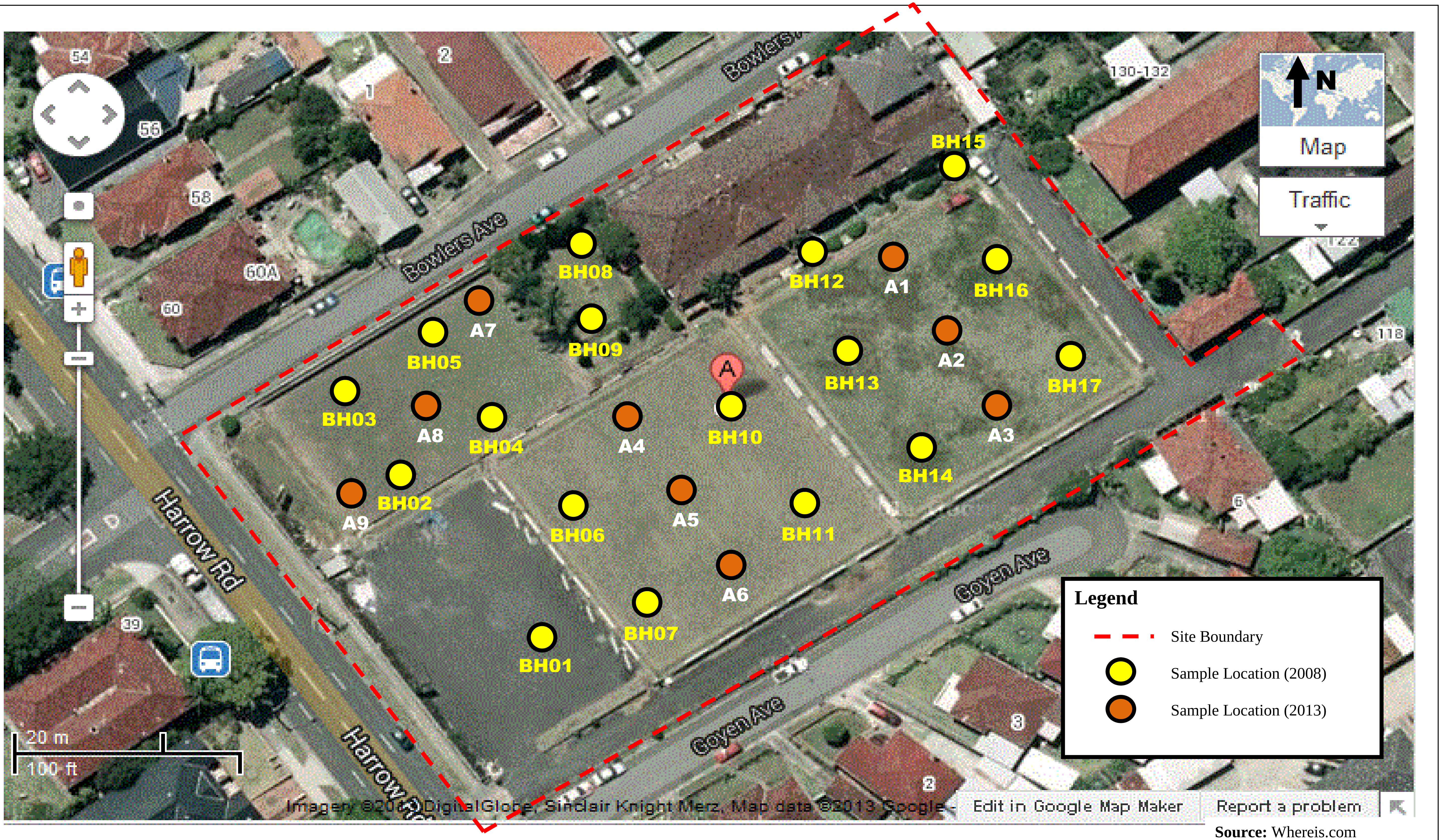
Reference: Google.com & whereis.com

ABN 75 050 212 710 Aargus Pty Limited Environment – Chemicals – Business Development

Drawn	CK	**Detailed Environmental Site Assessment St Basils Homes 62-82 Harrow Road, Bexley NSW**	Figure 1
Approved	MK		
Date	18/06/13		
Scale	N/A		Job No: ES5504

Aargus

SITE PLAN



Legend

▬ ▬	Site Boundary
●	Sample Location (2008)
●	Sample Location (2013)

Source: Whereis.com

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

Drawn	CK
Approved	MK
Date	18.06.2013
Approx. Scale	N/A

Detailed Environmental Site Assessment
St Basils Homes
62-82 Harrow Road, Bexley NSW

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Fig 2

ES5504

APPENDIX B

PROPOSED DEVELOPMENT PLANS

Rev.	Description	By	Date

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Bexley

Key plan

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Drawing title
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Project no. 852 Drawing no. Rev
Drawn A

Drawing status
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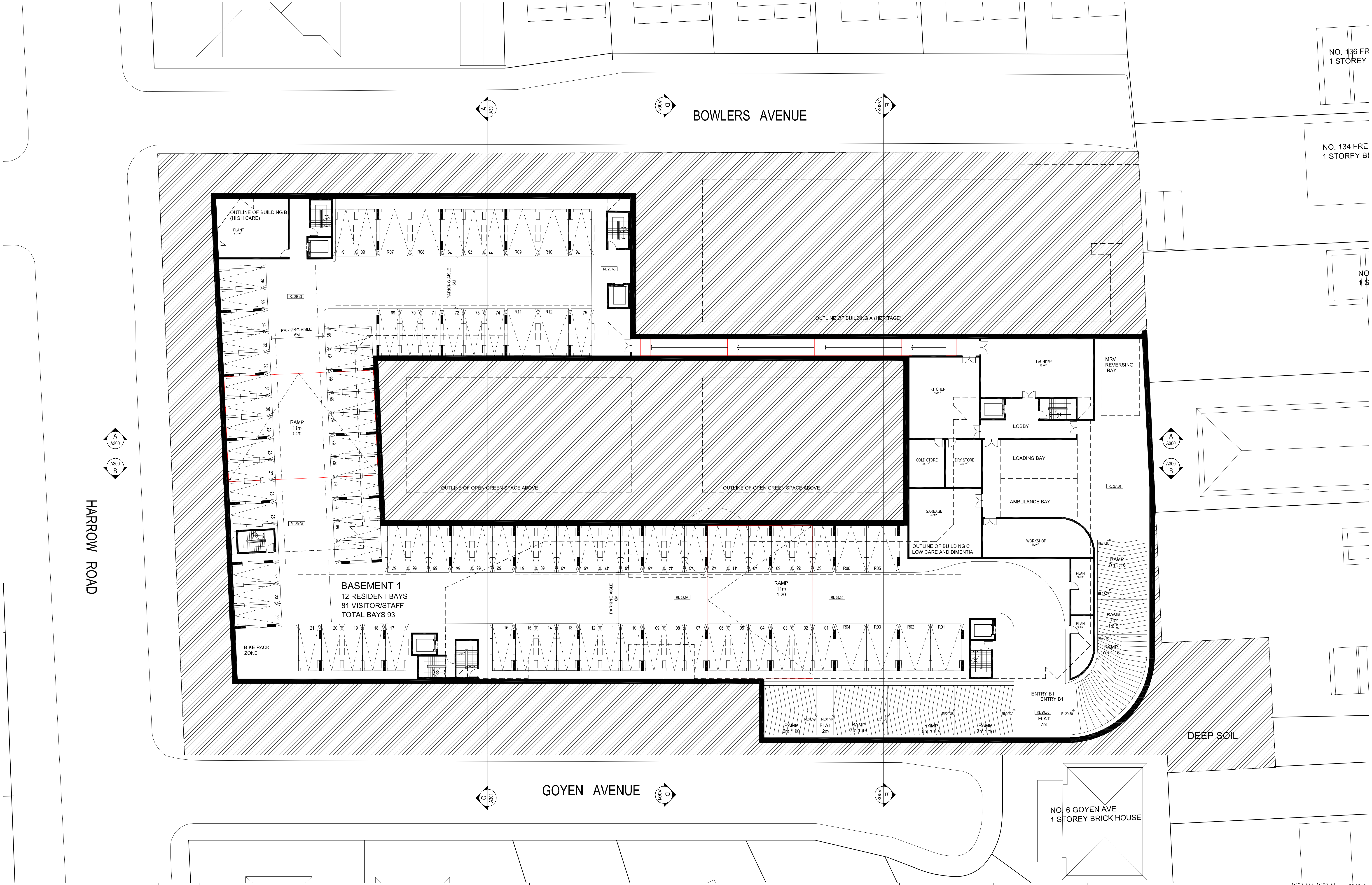

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Key plan

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Drawing title
BASEMENT FLOOR PLAN

Project no. 852
Drawing no. A050
Rev A
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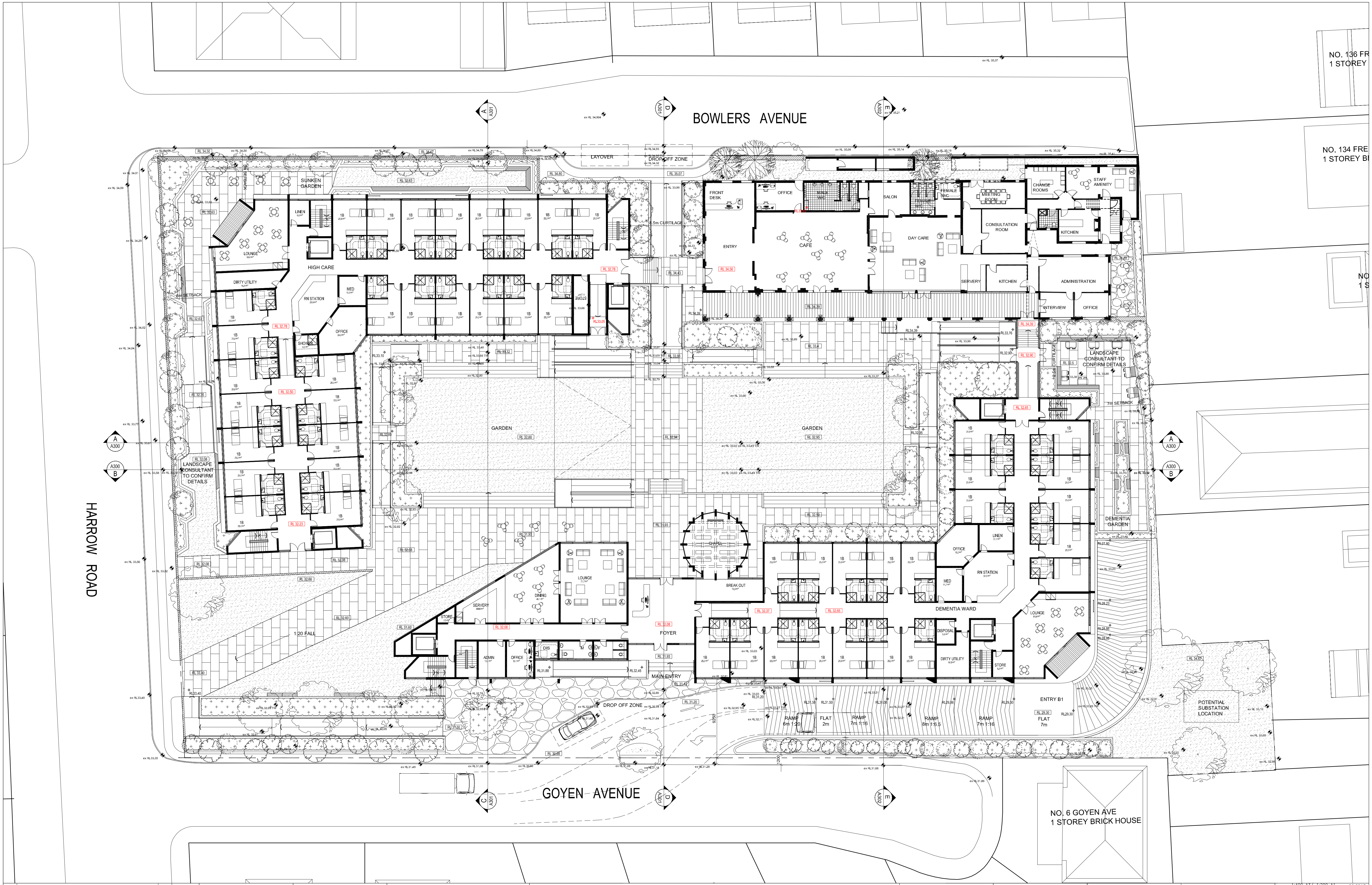

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GROUND FLOOR

Project no. 852
Drawing no.
Rev A
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Drawing status
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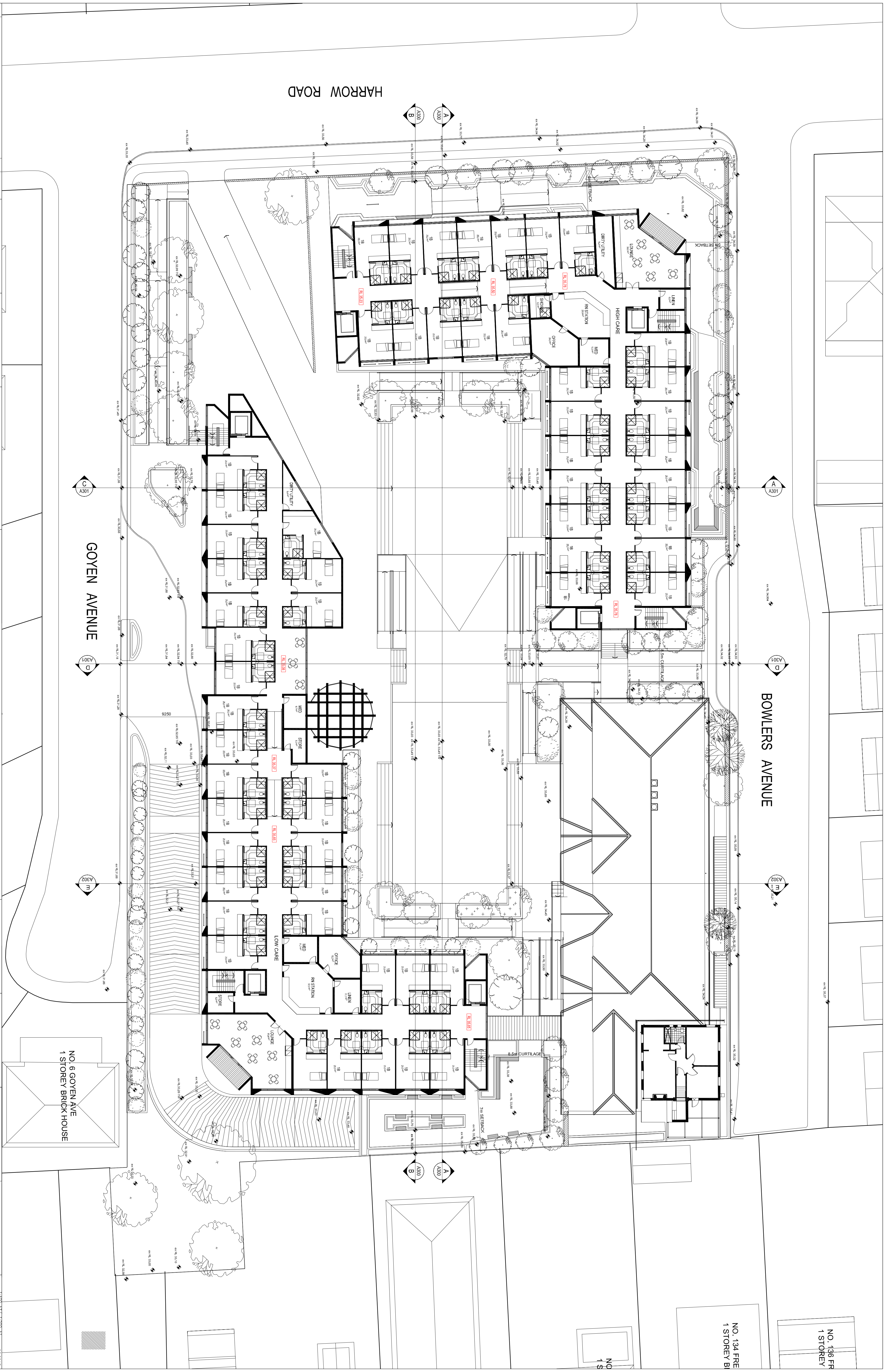

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LEVEL 1 PLAN

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Drawing no. A101
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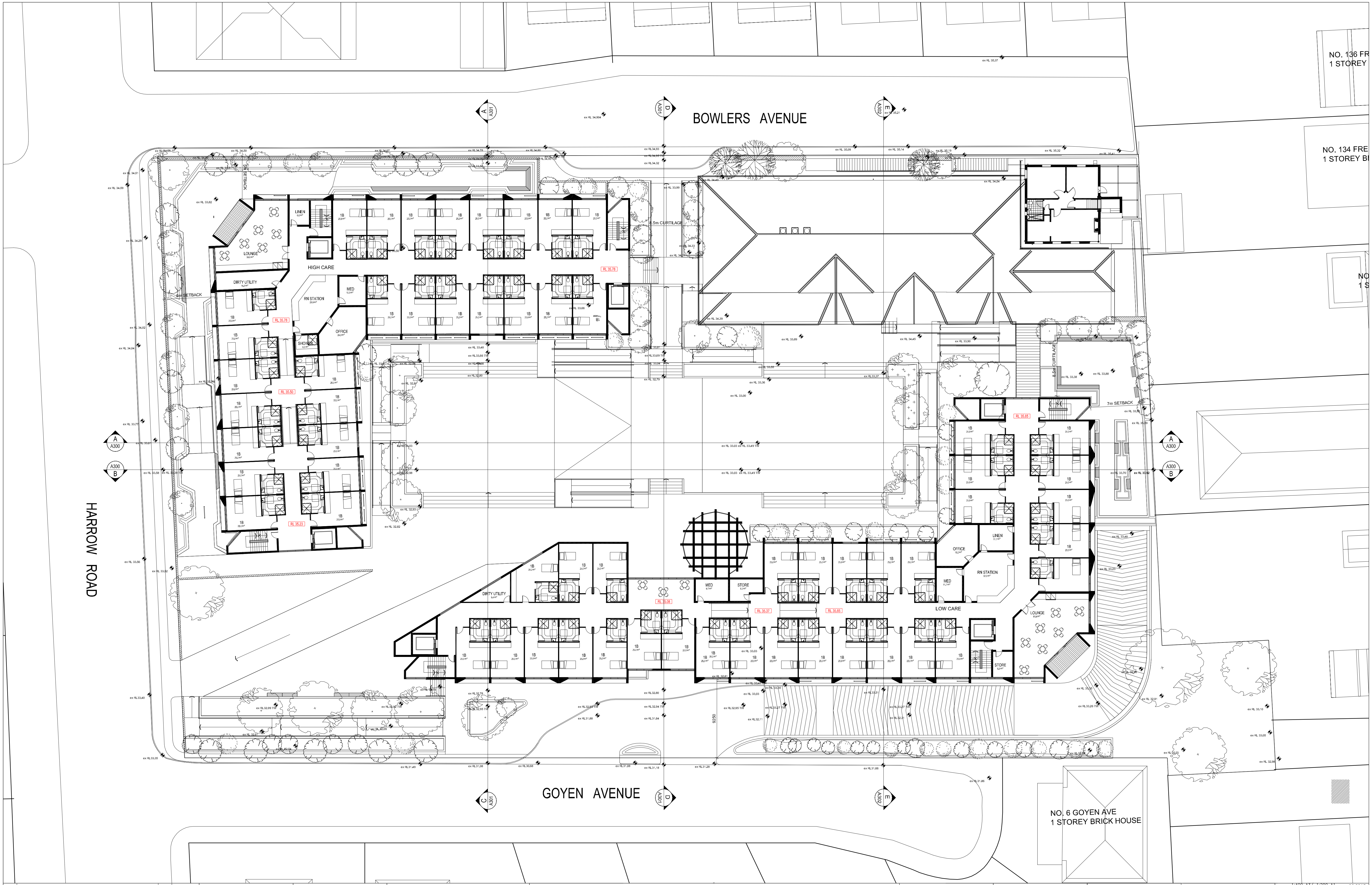

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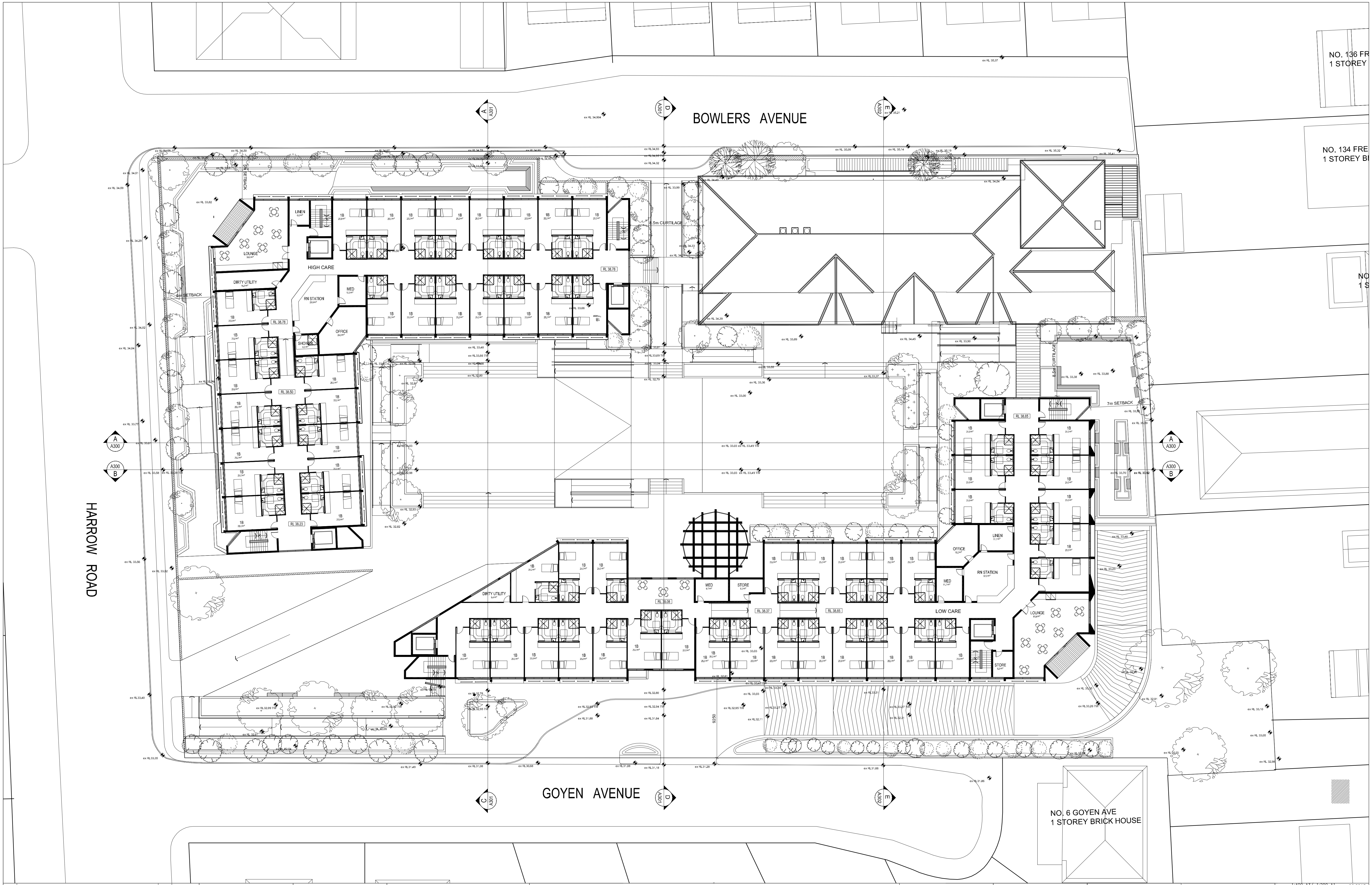
Date 06.2013

Drawing title
LEVEL 1 PLAN

Project no. 852
Drawing no. A101
Rev A
Drawn

Drawing status
DA



Rev.	Description	By	Date

Disclaimer

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BUILDER TO CHECK ALL SITE DIMENSIONS PRIOR TO FABRICATION OF FITMENTS

Legend

Consultants

Client

Architects

tony owen ptnrs
Level 2
12-16 Queen Street
Chippendale NSW 2008
P 6122 9698 2900
F 6122 9699 3018
E info@tonyowen.com.au

Project
ST BASILS

Project address
62-82 Harrow Rd
Bexley

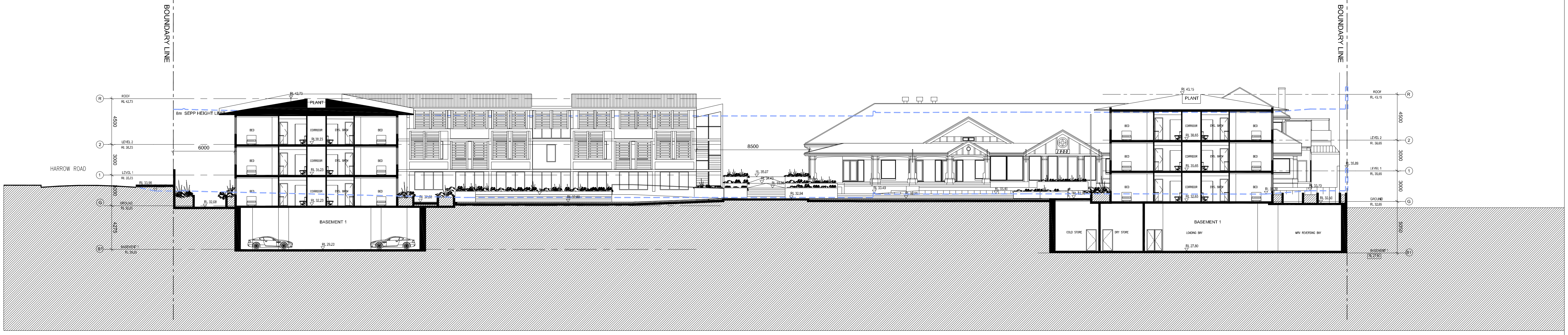
Key plan

Scale 1:400 A3/ 1:200 A1
0 2 4 6 8 10
© 1992-2005
Date 06.2013

Drawing title
LEVEL 2 PLAN

Project no. 852
Drawn
Drawing no. A102
Rev A

Drawing status
DA
FOR CONSTRUCTION



SECTION A-A

SECTION B-B

Rev. Description By Date

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Legend

Consultants

Client

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E info@tonyowen.com.au

Project
ST BASILS

Project address
62-82 Harrow Rd
Bexley

Key plan

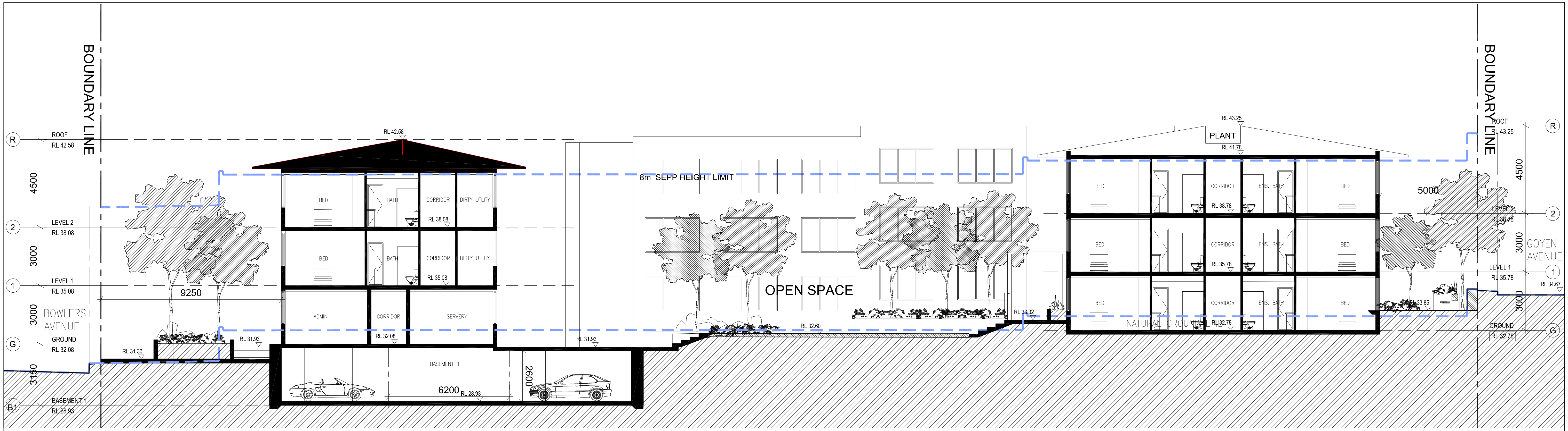
N

Scale 1:400 A3/ 1:200 A1
0 2 4 6 8 10
Date 06.2013

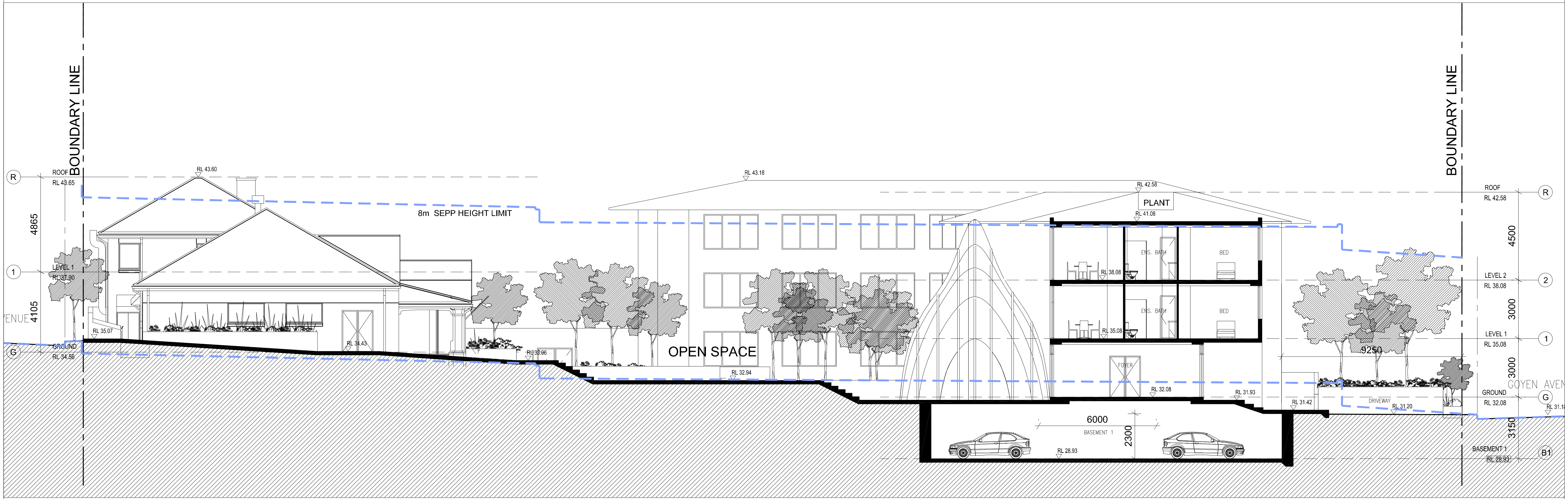
Drawing title
SECTION A-A, B-B

Project no. 852
Drawing no. A300
Rev A
Drawn

Drawing status
DA



SECTION C-C



SECTION D-D

Rev.	Description	By	Date

Disclaimer

Notes

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Legend

Consultants

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Chippendale NSW 2008
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F 6122 9699 3018
E info@tonyowen.com.au

Project
ST BASILS

Project address
62-82 Harrow Rd
Bexley

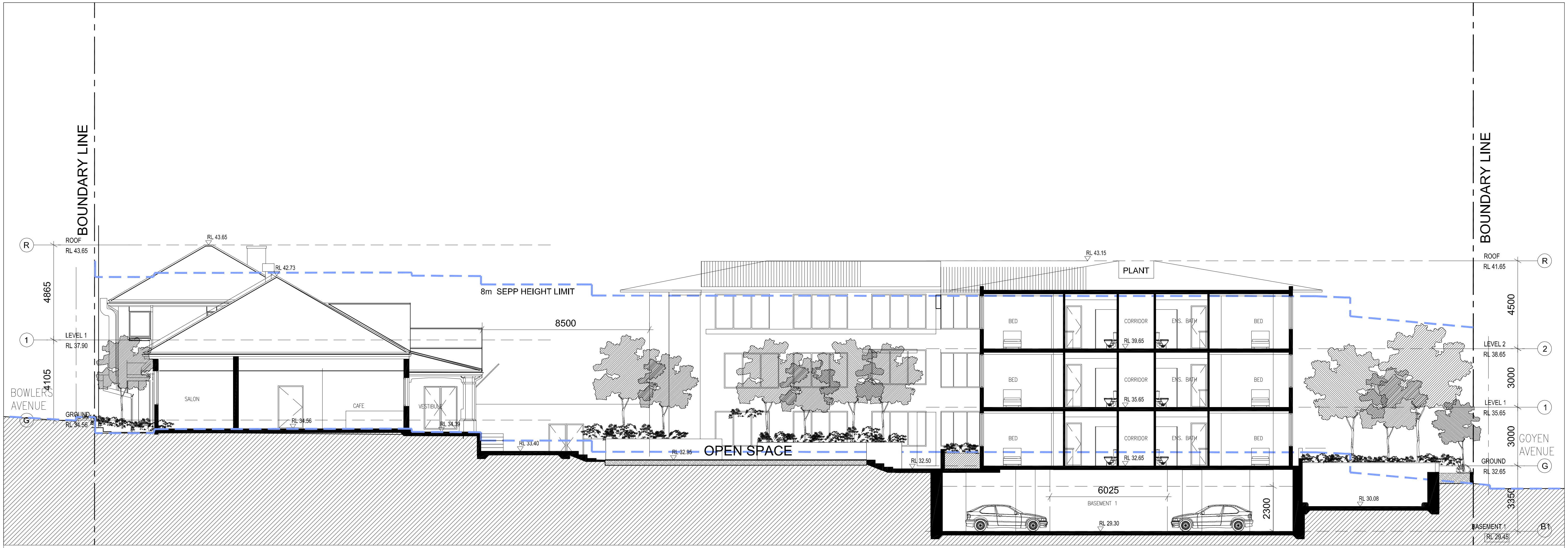
Key plan

Scale 1:400 A3/ 1:200 A1
0 2 4 6 8 10
© 1992-2005
Date 06.2013

Drawing title
SECTION C-C, D-D

Project no. 852
Drawn
Drawing no. A301
Rev A

Drawing status
DA



SECTION E-E

Rev.	Description	By	Date

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BUILDER TO CHECK ALL SITE DIMENSIONS PRIOR TO FABRICATION OF FITMENTS

Legend

Consultants

Client

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Chippendale NSW 2008
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F 6122 9699 3018
E info@tonyowen.com.au

Project
ST BASILS

Project address
62-82 Harrow Rd
Bexley

Key plan

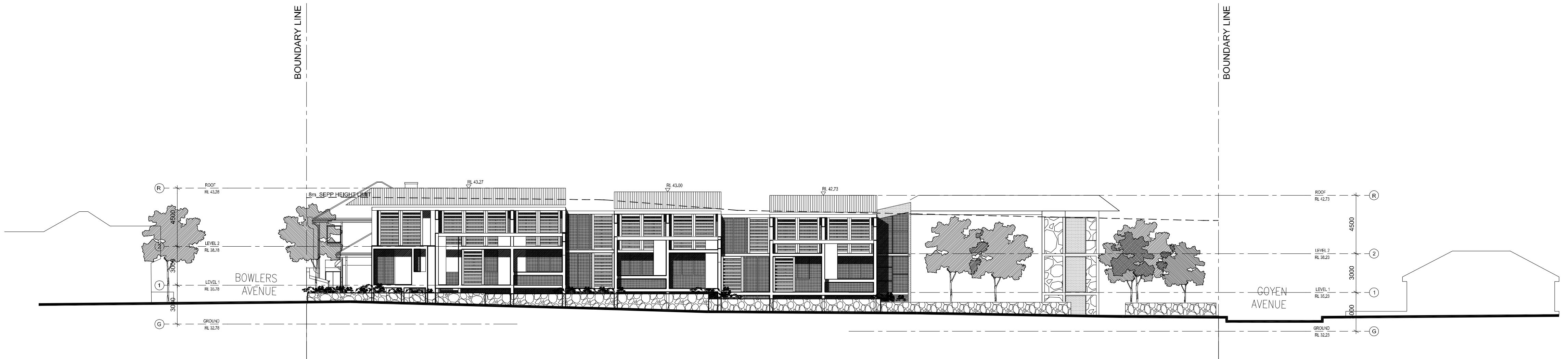
Scale 1:400 A3/ 1:200 A1
0 2 4 6 8 10

Date 06.2013

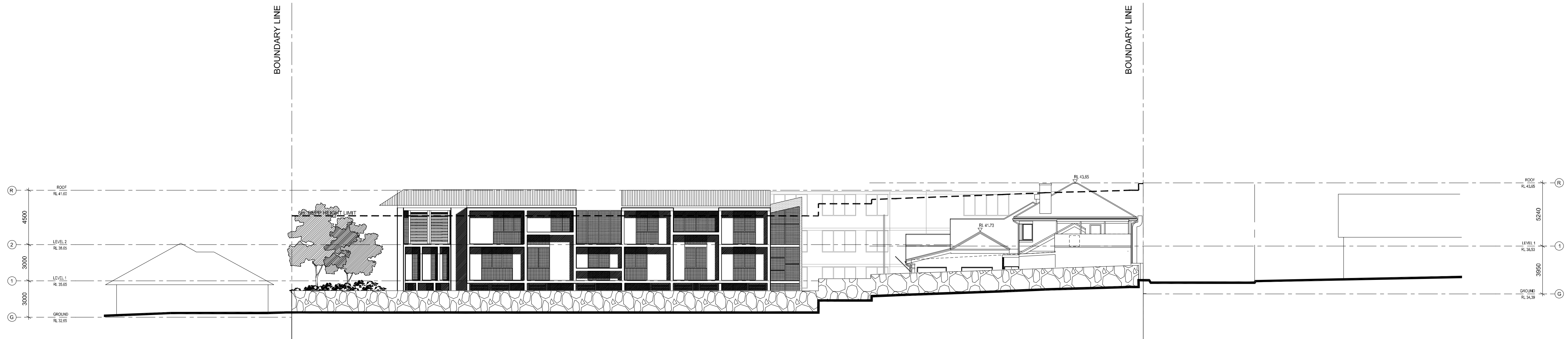
Drawing title
SECTION E-E

Project no. 852
Drawing no. A302
Rev A
Drawn

Drawing status
DA



HARROW RD ELEVATION



REAR ELEVATION

Rev.	Description	By	Date

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BUILDER TO CHECK ALL SITE DIMENSIONS PRIOR TO FABRICATION OF FITMENTS

Legend

Consultants

Client

Architects

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F 6122 9699 3018
E info@tonyowen.com.au

Project
ST BASILS

Project address
62-82 Harrow Rd
Bexley

Key plan

Scale 1:400 A3/ 1:200 A1
0 2 4 6 8 10
© 1992-2005
Date 06.2013

Drawing title
ELEVATIONS

Project no. 852
Drawing no. A400
Rev A
Drawn

Drawing status
DA

APPENDIX C

SITE PHOTOGRAPHS

Aargus

SITE PHOTOGRAPHS

Client	St Basils Homes
Project	Detailed Environmental Site Assessment
Location	62-82 Harrow Road, Bexley NSW
Job No.	ES5504
Checked By	CK

Aargus

Photograph Nº 1

Harrow Road & Goyen Avenue frontage
Looking north

Photograph Nº 2

View of existing building Samples A1 to A3
Looking northwest

Photograph Nº 3

View of existing building Samples A4 to A6
Looking northwest

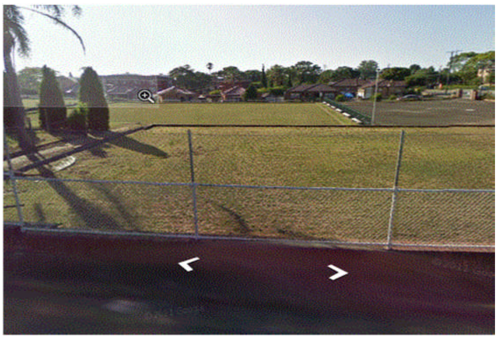
Photograph Nº 4

View of existing building Samples A7 to A9
Looking east

Photograph Nº 5

View of Harrow Road Car Park
Looking northwest

Photograph Nº 6



View of existing lawns

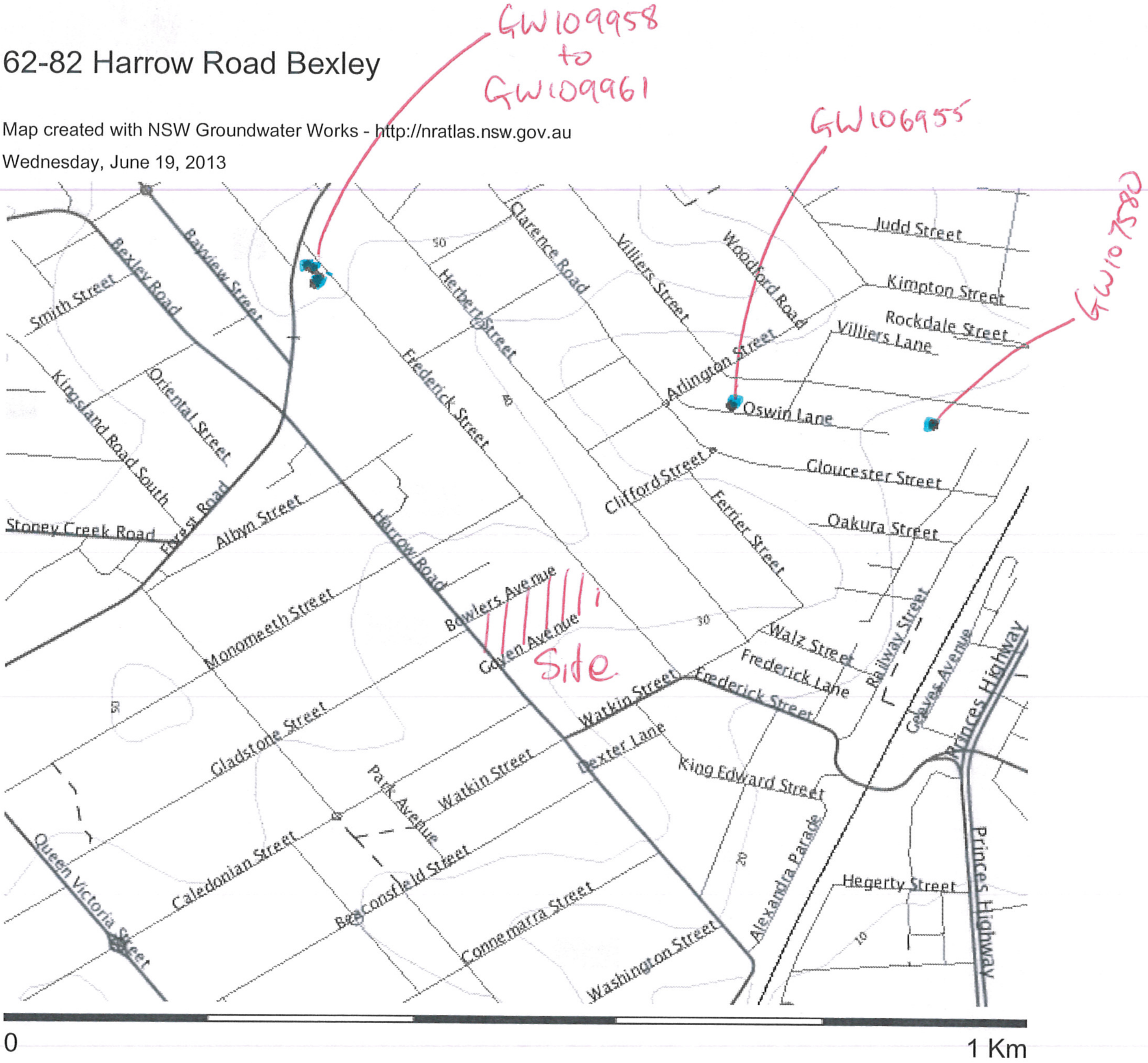
APPENDIX D

GROUNDWATER BORE SEARCH

62-82 Harrow Road Bexley

Map created with NSW Groundwater Works - http://nratlas.nsw.gov.au

Wednesday, June 19, 2013



Legend

Symbol	Layer	Custodian
○	Cities and large towns renderImage: Cannot build image from features	
Cowra ○	Populated places renderImage: Cannot build image from features	
○	Towns	
●	Groundwater Bores	
▨	Catchment Management Authority boundaries	
∧∨	Major rivers	
	Topographic base map	

Primary/arterial road
Motorway/freeway
Railway
Runway
Contour
Background

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, June 19, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW106955

Works Details (top)

GROUNDWATER NUMBER	GW106955
LIC-NUM	10WA108920
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Spear
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Jetted - Water
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2005-04-15
FINAL-DEPTH (metres)	4.20
DRILLED-DEPTH (metres)	4.20
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	TISI
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	1.00

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6242038.00
EASTING	327582.00
LATITUDE	33 56' 53"
LONGITUDE	151 8' 3"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	GIS - Geographic Information System
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	4//4376

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	4 4376

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	4.20	700			Jetted - Water
1	1	Casing	P.V.C.	0.00	4.20	640	640		Glued

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
2.60	4.20	1.60				1.00			

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	2.60	2.60	Clay		
2.60	4.20	1.60	Sandy Clay		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW107580

Works Details (top)

GROUNDWATER NUMBER	GW107580
LIC-NUM	10WA109022
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Spear
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2006-10-27
FINAL-DEPTH (metres)	20.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	ORDANOSKI
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6242015.00
EASTING	327849.00
LATITUDE	33 56' 54"
LONGITUDE	151 8' 14"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 799967

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 799967

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, June 19, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW109958

Works Details (top)

GROUNDWATER NUMBER	GW109958
LIC-NUM	10BL601848
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2007-04-12
FINAL-DEPTH (metres)	5.20
DRILLED-DEPTH (metres)	5.20
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MOUSTAFA
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6242227.00
EASTING	327033.00
LATITUDE	33 56' 46"
LONGITUDE	151 7' 42"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1//727973

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 727973

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.20				
1	1	Casing	PVC Class 18	0.00	0.00	50			

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	CONCRETE		
0.20	0.50	0.30	CLAYEY GRAVEL (FILL),MOIST, L/PLASTICITY,D/GREY, CLAY		
0.50	0.70	0.20	CLAYEY GRAVEL,STIFF,LOOSE SAND,MOIST,L/PLASTICITY		
0.70	1.50	0.80	CLAY,MEDIUM STIFF,LOOSE SAND,MOIST,HIGH PLASTICITY,ORANGE BROWN		
1.50	2.50	1.00	CLAYEY SHALE. WEATHERED,STIFF,MEDIUM LOW PLASTICITY,BROWN GREY		
2.50	4.00	1.50	SHALE.WEATHERED.STIFF,DRY,MEDIUM LOW PLASTICITY,BROWN GREY		
4.00	4.50	0.50	CLAY,SOFT,DRY,LOW PLASTICITY,BROWN,GREY		
4.50	5.20	0.70	CLAY,MEDIUM STIFF,SHALE MOIST,M/L/PLASTICITY,RED BROWN		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, June 19, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW109959

Works Details (top)

GROUNDWATER NUMBER	GW109959
LIC-NUM	10BL601848
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2007-04-13
FINAL-DEPTH (metres)	5.90
DRILLED-DEPTH (metres)	5.90
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MOUSTAFA
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6242217.00
EASTING	327028.00
LATITUDE	33 56' 47"
LONGITUDE	151 7' 42"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1//323069

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 727973

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1									

Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW109960

Works Details (top)

GROUNDWATER NUMBER	GW109960
LIC-NUM	10BL601848
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2007-04-13
FINAL-DEPTH (metres)	8.00
DRILLED-DEPTH (metres)	8.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MOUSTAFA
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6242245.00
EASTING	327018.00
LATITUDE	33 56' 46"
LONGITUDE	151 7' 41"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1//727973

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 727973

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	8.00				
1	1	Casing	PVC Class 18	0.00	0.00				

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMM
0.00	0.20	0.20	CONCRETE		
0.20	0.50	0.30	CONCRETE AND CLAYEY GRAVEL,SAND LOOSE,DARK BROWN		
0.50	1.00	0.50	CLAY,SOFT SIGHTLY MOIST,HIGH PLASTICITY,ORANGE BROWN		
1.00	2.50	1.50	CLAYEY SHALE,WEATHERED,STIFF,DRY,M/L/PLASTICITY,BROWN GREY		
2.50	4.00	1.50	SHALE,STIFF,WEATHERED,DRY,M/L/PLASTICITY,BROWN GREY		
4.00	6.00	2.00	CLAYEY SHALE,STIFF,WEATHERED,SOME IRONSTONE AND GRAVEL		
6.00	7.80	1.80	SANDY SHALE,VERY LOOSE,MOIST,M/L/ PLASTICITY,GREY		
7.80	8.00	0.20	CLAYEY SHALE VERY SOFT CLAY,SOME SHALE,DARK GREY BROWN		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, June 19, 2013

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW109961

Works Details (top)

GROUNDWATER NUMBER	GW109961
LIC-NUM	10BL601848
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2007-04-12
FINAL-DEPTH (metres)	5.80
DRILLED-DEPTH (metres)	5.80
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MOUSTAFA
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6242240.00
EASTING	327025.00
LATITUDE	33 56' 46"
LONGITUDE	151 7' 42"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1//727973

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ST GEORGE
PORTION-LOT-DP	1 727973

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.80				
1	1	Casing	PVC Class 18	0.00	0.00				

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COI
0.00	0.20	0.20	CONCRETE		
0.20	0.40	0.20	GRAVELLY SAND,LOOSE,LOW PLASTICIY,DARK GREY		
0.40	1.70	1.30	CLAY.,EDOI, STOFF.SJA;E.DRU.M/L/PLASTICITY,ORANGE,BROWN,GREY		
1.70	2.50	0.80	CLAYEY SHALE,VERY STIFF,DRY,M/L/PLASTICITY,BROWN GREY		
2.50	4.00	1.50	SHALE, MEDIUM STIFF,WEATHERED,DRY, BROWN GREY		
4.00	5.60	1.60	CLAY,VERY SOFT,WEATHERED SHALE,DRY,GREY BROWN		
5.60	5.80	0.20	SHALE HARD DRY LOW PLASTICITY,GREY		

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources (DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

APPENDIX E

NSW EPA RECORDS

NSW Government Environment & Heritage

NSW EPA

You are here: Home > Contaminated land > Record of notices

Search results

Your search for: LGA: Rockdale City Council

Matched 6 notices relating to 3 sites.

Search Again

Refine Search

Suburb	**Address**	**Site Name**	**Notices related to this site**
Brighton-le-sands	General Holmes Drive	Cook Park	5 former
Brighton-le-sands	2 General Holmes Drive	Shell Service Station	3 former
Turrella	61 Turrella Street	Solvent Recycler and Distributor	1 current

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20 June 2013

APPENDIX F

PREVIOUS REPORT

Aargus

Aargus
AUSTRALIA

ACN 063 579 313
Environmental Services - Remediation - Geotechnical Engineering - Drilling

ENVIRONMENTAL SITE ASSESSMENT

St George Bowling Club, Bexley NSW

Prepared for

Tenetur Pty Ltd

June 2008

CONTROLLED DOCUMENT
DISTRIBUTION AND REVISION REGISTER

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- encouraging observance of the document by such personnel
- making the document available for audit

DOCUMENT HISTORY

Revision No.	Revision Date	Description
0	20/06/08	Initial Issue

Issued By: Mark Kelly

Date: 20.06.2008

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REFERENCES

- ANZECC/NHMRC (1992) – "Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites". Australian and New Zealand Environment and Conservation Council and the National Health and Medical Research Council, Canberra.
- NSW EPA "Sampling Design Guidelines" (1995). NSW Environment Protection Authority, Sydney.
- NSW EPA "Guidelines for Assessing Service Station Sites" (1994). NSW Environment Protection Authority, Sydney.
- NSW DEC "Guidelines for the NSW Site Auditor Scheme" (2006). NSW Environment Protection Authority, Sydney.
- NSW EPA "Guidelines for Consultants Reporting on Contaminated Sites" (1997). NSW Environment Protection Authority, Sydney.
- National Environment Protection Council "Guideline on the Investigation Levels for Soil and Groundwater", NEPM, 1999.
- National Environmental Protection (Assessment of Site Contamination) Measure, NEPC Schedule B series, 1999.
- ANZECC National Water Quality Management Strategy "Australian Water Quality Guidelines for Fresh and Marine Waters", 1992.

ABBREVIATIONS

- BTEX - Benzene, Toluene, Ethyl benzene and Xylene
- OCP - Organochlorin Pesticides
- OPP – Organo phosphorous Pesticides
- PAH - Polycyclic Aromatic Hydrocarbons
- TPH - Total Petroleum Hydrocarbons
- VHC – Volatile Halogenated Compounds
- VOC – Volatile Organic Compounds
- PID - Photo Ionisation Detector
- QA/QC - Quality Assurance, Quality Control
- RAP - Remediation Action Plan
- SAC - Site Assessment Criteria
- UCL - Upper Confidence Limit
- UST - Underground Storage Tank
- AST – Aboveground Storage Tank
- PQL – Practical Quantitation Limits
- RPD – Relative Percentage Difference
- DQOs – Data Quality Objectives
- HIL – NSW EPA Health-based Investigation Levels as per “Guidelines for the NSW Site Auditor Scheme”
- CoC – Chain of Custody
- SWL – Standing Water Level.
- DIPNR – Department of Infrastructure Planning and Natural Resources.
- NSL – No Set Limit.
- ND – Not Detected.
- PPM – Parts Per Million.
- NATA – National Australian Testing Authority.

EXECUTIVE SUMMARY

Aargus Pty Ltd was appointed Mr Bill Gravanis of Tenetur Pty Ltd, to conduct an Environmental Site Assessment (ESA) of the St George Bowling Club, Bexley, NSW.

The primary objective of this ESA was to assess the environmental suitability of the site for the proposed development in relation to compliance with current NSW and Local Council environmental regulatory criteria.

The scope of work in preparing this ESA report included review of existing information, soil sampling and analysis, interpretation of results/findings and report preparation in general accordance with NSW EPA '*Guidelines for Consultants Reporting on Contaminated Sites', 1997*.

The historical information indicates that the site has predominantly been a bowling club since the early 1900's until recently, when activities associated with the club ceased. The adjoining properties have been predominantly used for residential purposes over this period.

From the site history review and the site inspection, the areas of environmental concern were found to be:

- Imported fill of unknown origin (introduced to level the bowling greens);
- Possible pesticide and other chemical treatment of the bowling greens.

To reach our stated objectives, a set of seventeen (17) primary soil samples were submitted for analysis on the differing fill and natural soil profiles. Two QA/QC intra-laboratory duplicate samples, one QA/QC rinsate sample and one QA/QC inter-laboratory duplicate sample were collected. Analytical results and QA/QC interpretation met relevant DQOs. The results are therefore considered a reliable basis for the following conclusions and recommendations.

Laboratory results for the soil samples analysed were generally lower than the relevant regulatory guideline criteria adopted, those being HIL 'D' for residential with minimal access to soils and the NSW EPA Service Station criteria.

In Summary

Based on the results of this investigation, it is considered that the risks to human health and the environment associated with soil contamination at the site are low in the context of the proposed use of the site as a high density residential development. The site is therefore considered ***to be suitable*** for the proposed use.

Any soils (fill and natural) requiring removal from the site as part of the excavation for basement construction should be classified in accordance with the ***"Waste Classification Guidelines, Part 1: Classifying Waste" NSW DEC (2008).***

Reference should be made to the *Limitations of Assessment* at the end of the report and Appendix B, which set out details of the limitations of the assessment.

1.0 INTRODUCTION

Aargus Pty Ltd was appointed Mr Bill Gravanis of Tenetur Pty Ltd, to conduct an Environmental Site Assessment (ESA) of the St George Bowling Club, Bexley, NSW.

This assessment was performed in accordance with the Aargus proposal and Aargus Environmental Protocols (refer Appendix F – Aargus Environmental Protocols), and in general accordance to relevant environmental regulatory criteria including the NSW EPA regulatory guidelines and National Environmental Protection (*Assessment of Site Contamination*) Measure, 1999.

2.0 OBJECTIVES

The primary objective of this ESA was to assess the environmental suitability of the site for the proposed development in relation to compliance with current NSW and Local Council environmental regulatory criteria.

In accordance with our instructions, the purpose of this ESA is to:

- Identify the likelihood and/or extent of significant soil contamination occurring from past and present practices on the site; and
- Recommend any further management strategies including any additional investigations and/or remediation; and

Specifically, the ESA will assess:

- Contaminant dispersal in soil and if an impact to groundwater occurs;
- The potential effects of contaminants on public health, the environment and building structures; and
- The adequacy and completeness of all information available to be used in making decisions on site suitability.

3.0 SCOPE OF WORKS

In order to achieve the above objectives the following scope of work was carried out for the ESA:

- Collecting site information, review of historical information and past site practices, (site surveys, site records on waste management practices, NSW Land Titles Office records of ownership, aerial photographs obtained from the NSW Department of Lands, and site interviews);
- A site inspection to identify areas of environmental concern, on-site waste disposal practices and location of sewers, drains, holding tanks, Underground Storage Tanks, Aboveground Storage Tanks and pits, spills and ground discolouration etc.;
- A targeted soil boring/sampling investigative study – formulating and conducting a sampling plan and borehole investigation; the soil samples are taken and submitted for analysis on particular contaminants.;

- Laboratory analysis and results from sample analysis – findings and comparison to regulatory guidelines;
- Quality Assurance/Quality Control (QA/QC) – all QA/QC procedures were undertaken in accordance with the Aargus Quality Assurance/Quality Control manual;
- Interpretation of results and findings; and
- Recommendations and final conclusions drawn from interpretation of the results.

4.0 SITE INFORMATION

4.1 Site Identification

The site is located on Harrow Road, Bexley, NSW, (refer Appendix A – Locality Map). Site identification information is summarised below:

Table 1 – Summary Site Details

Street Address	St George Bowling Club, Bexley
Lot and DP Number	Lot 174 in DP715467
Local Government Area	Rockdale
Parish	St George
County	Cumberland
Site Owner	Tenetur Pty Ltd
Site Area	6,804 m^2

4.2 Site Description

The shape and layout of the site are shown on the Site Plan (Appendix A).

As indicated on the attached plan, the site is rectangular in shape, measuring about 63 metres (m) along the Harrow Road frontage and 108 metres along Bowlers Avenue frontage. The total area covers approximately 6,804m^2.

At the time of the field sampling (6th June 2008), the site was occupied by a disused bowling clubhouse, three greens (approx 1600m^2) no longer in use and a carpark (approx 800m^2). During the sampling period, the following observations were made:

- A brick and timber building utilised as a clubhouse.
- A brick and colorbond garage.

- Other features noted included a garden area next to the clubhouse towards the Harrow Road side. Small garden beds are also located at the front of the clubhouse towards the south.
- The site surfaces were predominantly green lawn areas, with the exception of the carpark area, which was asphalt.
- There were no signs of plant distress or any other visible indicators of potential contamination.
- No chemical storage was noted within the site.
- There were no visual indicators of underground storage tanks (past or present).
- The only site discharges include stormwater and sewer. Stormwater run-off from the site is collected by the collection drains on Harrow Road. Sewer is presumably connected to the regional network.

4.3 Topography and Surface Waters

The regional topography has the site placed on the side slope of a ridgeline. Therefore, the general slope of the area is towards the southeast.

Site stormwater runoff is expected to flow via stormwater drains into Botany Bay to the south east of the site. On and off site migration from surface areas are not considered to be of environmental concern.

4.4 Geology

The Geological Map of Sydney (Geological Series Sheet 9130, Scale 1:100,000, 1983), published by the Department of Mineral Resources indicates the residual soils within the site to be underlain by Wianamatta Shale comprising black to grey Ashfield shale and laminite.

Reference should be made to Section 9.2 for the soil profile within the site.

4.5 Hydrogeology

Department of Natural Resources (DNR) borehole database information indicates that there are two registered bore holes within 2km of the site, located to the north /north east. The bores, GW106955 and GW107580, are both registered as domestic bores.

No groundwater seepage was encountered during the drilling process, with maximum depth drilled being 1.5m BGL.

Groundwater is expected to occur in the shale which underlies the site. It is anticipated that the groundwater flow direction would be towards Botany Bay.

4.6 Surrounding Land Use

The uses of land adjacent to the site are listed below.

To the North	⇒ Bowlers Avenue, then low density residential
To the South	⇒ Goyan Avenue, then low density residential
To the East	⇒ Medium density residential
To the West	⇒ Harrow Road, then medium density residential

The surrounding land use is mostly residential in nature.

4.7 Proposed Development

The proposed development includes the demolition of the existing structures and the construction of a residential unit block with basement car parking.

5.0 SITE HISTORY

5.1 Historical Aerial Photographs

A number of aerial photographs obtained from the NSW Department of Lands were reviewed as part of this ESA. Copies of the aerial photographs are kept in the offices of Aargus and are available for examination upon request. The results of this review are presented in the following table:

The following observations were made by the writer. Due to scale, some of the observations listed are best interpretations only.

Table 2 – Summary of Aerial Photograph Interpretation

Date	Description of Site	Surrounding Land
1930	St George Bowling and Recreation Club appears to be present on site.	N: Bowlers Avenue, then low density residential S: Goyan Avenue, then low density residential E: Low density residential W: Harrow Road, then low density residential
1951	The site remains predominantly unchanged.	The adjoining properties appear similar to the previous photograph

1978	The site remains predominantly unchanged.	The adjoining properties appear similar to the previous photograph
2008	The site appears to be disused and vacated with building structures still visible.	The adjoining properties appear similar to the present day.

In summary, the 1930 aerial photograph revealed that the bowling club occupied the site, whilst residential properties were visible either adjoining the site or beyond the adjoining roads. The site and the adjoining properties remained predominantly unchanged until 2008, where the site appeared to be no longer in use.

5.2 Historical Land Titles

A review of historical documents held at the NSW Department of Lands offices was undertaken to characterise the previous land use and occupiers of the site. Reference should be made to Appendix H – Land Title Information for a summary of the historical land titles information obtained by Aargus.

As reported above, the site is made of Lot 174 in DP715467. The results of the title search are summarised in the following table.

Table 3 – Summary of Historical Land Titles

Year	Owners
2006-Present	Tenetur Pty Limited
1920	The Commercial Bank of Australia Limited
1919	St George Bowling & Recreation Club Limited
1906	Bridget Slattery (widow)
1890	James Gillen (labourer)
1888	Arthur Gilder
1888	John Lennon
1885	Thomas Luck (labourer) & Elizabeth Luck (joint tenants)
1888	Daniel Clarke
1883	David Bedford
1883	William Kenwood

In summary, the site was owned by a number of private owners between 1883 and 1919, thereafter St George Bowling & Recreation Club Limited and The Commonwealth Bank of Australia Limited took ownership until 2006. The current owners, Tenetur Pty Ltd, purchased the property in 2006.

5.3 WorkCover Records

No WorkCover search was undertaken for the site.

5.4 NSW EPA Records

The NSW EPA publishes records of contaminated sites under Section 58 of the Contaminated Land Management (CLM) Act 1997. The notices relate to investigation and/or remediation of site contamination considered to pose a significant risk of harm under the definition in the CLM Act.

A search of the database revealed that the subject site is not listed. However, there are two (2) listed properties within the Rockdale local government area. Both of those properties have current notices listed on the website.

The two properties, Shell Service Station (2 General Holmes Drive) and Cook Park (General Holmes Drive) were located at Brighton-le-sands. Both properties were declared “remediation sites” (19th March 2004) and have a “notice of existence of voluntary remediation proposal” (17th August 2005) on them. The properties have significant petroleum hydrocarbon contamination of groundwater, including separate phase petroleum hydrocarbon, and of soils on-site.

This is not of concern to the site as the two properties are downgradient and more than 2km away.

It should be noted that the DEC record of Notices for Contaminated Land does not provide a record of all contaminated land in NSW.

Reference should be made to Appendix I – EPA Summary for a copy of the search.

5.5 Historical Land Use Summary

The historical information indicates that the site has predominantly been a bowling club since the early 1900’s until recently, when activities associated with the club ceased. The adjoining properties have been predominantly used for residential purposes over this period.

6.0 PREVIOUS ENVIRONMENTAL ASSESSMENTS

No previous environmental assessments or investigations are known to have been undertaken out at the site.

7.0 SITE INSPECTION

The site inspection took into account the surrounding environment and aesthetic issues pertaining to the site.

7.1 Site Walkover

A site walkover was conducted and information regarding the environmental assessment was noted. Aargus took into consideration the following items where they were relevant:

- Description and quality of the building structures;
- Adjoining operations;
- Prior functions and operations within the site;
- Surface water;
- Groundwater;
- Former industrial processes;
- Former raw materials;
- Former raw material transportation;
- Chemicals formerly used on the site;
- Trade waste;
- Hazardous operations;
- Waste Management Practices;
- Underground Storage Tanks;
- Above ground Storage Tanks;
- Review of former roof materials;
- Odour and noise quality; and
- Occupational health and safety.

The main features of the site are presented in the Site Plan (Refer to Appendix A) and site photographs are presented in Appendix H – Site Photographs. The site was predominantly green lawn area of which these surfaces were in a poor condition. There were no USTs, ASTs, wells or boreholes visible. No soil staining or odour was noticed at any of the sampled locations, and the limited vegetation on site was in a healthy condition.

7.2 Chemical Storage

The site has been predominantly utilised for recreation, predominantly lawn bowls, in which chemicals may have been used to maintain the bowling greens. The storage of chemicals may have existed in the past, in particular within the garage in the north eastern corner of the site. The garage was locked at the time of the inspection.

7.3 Trade Waste

Based on the other information gathered regarding the site it was considered unlikely that the site was a scheduled premise under the Pollution Control and Waste regulations. No search was therefore undertaken.

7.4 Hazardous Materials

There was no hazardous material assessment carried out as part of this scope of works, however asbestos was noted within the exterior eaves of the clubhouse. The interior of the clubhouse was obscured and a preliminary assessment could not be undertaken, however, a Hazardous Materials Assessment should be undertaken for the clubhouse due the potential of lead paints, lead based dust, synthetic mineral fibres, PCB capacitors within light fixtures and asbestos bonded material.

7.5 Areas of Environmental Concern

From the above information, site history and the site inspection, the areas of environmental concern were found to be:

- Imported fill of unknown origin to build up bowling green areas;
- Possible pesticide treatments.

Chemicals of concern associated with each of the identified areas are as follows:

- Fill material of unknown quality of origin – general suite of chemicals including heavy metals, TPH, BTEX, PAH, OCP, PCB, Cyanides and Phenols;
- Possible pesticide treatments – OCP's.

The areas of environmental concern are based upon site observations and anecdotal evidence as well as limited historical documentation. The evidence within boreholes taken around the site show limited fill consisting mainly of sandy loams and gravels possibly used to level the site.

8.0 REVIEW OF QUALITY OF DATA

The DQOs were also prepared using Appendix IV of the Site Auditor Guidelines. These require 7 steps. The steps being

a. State the problem
b. Identify the decisions
c. Identify inputs to decision
d. Define the study boundaries
e. Develop a decision rule

f. Specify limits on decision errors
g. Optimise the design for obtaining data

8.1 State the problem

The site requires to be confirmed suitable for the proposed residential development. The site is proposed to be redeveloped and has had some areas of potential concern; those being imported fill of unknown origin and historical pesticide and chemical use on the bowling greens.

8.2 Identify the decisions

The decisions made in completing this assessment are as follows:

- Does the site or is the site likely to present a risk of harm to humans or the environment
- Is the site currently suitable for the proposed land use being residential.
- Is there a potential for soil and groundwater contamination
- Is there a potential for offsite migration issues
- Does the sampling results meet the site criteria proposed
- If not, does the site require remediation works

8.3 Identify inputs to decision

Inputs to the decision include:

- Existing site information
- Site history
- Regional geology, topography and hydrogeology
- Potential contaminants
- Site assessment criteria
- Results as measured against criteria

8.4 Define the study boundaries

The site boundary is identified as the entire boundary of the subject site as shown on the site plan (Appendix A) and known as Lot 174 in DP715467, located at Harrow Road, Bexley, NSW.

8.5 Develop a decision rule

The information obtained through this assessment will be used to characterise the soils on the site in terms of contamination issues and risks to human health and the environment. The decision rule in characterising the site will be as follows:

- Laboratory test results will be measured against the criteria provided within this report

- The site will be deemed not contaminated if the following criteria are fulfilled
    - Soil concentrations are within background levels
    - QA/QC shows data can be relied upon
    - Results generally meet regulatory criteria
    - Results are from NATA accredited laboratories
    - Detection limits are below assessment criteria

8.6 Specify limits on decision errors

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

- The assessment criteria adopted from the guidelines within this report have risk probabilities already incorporated.
- The acceptable limits for inter/intra laboratory duplicate sample comparisons are laid out within our protocols.
- The acceptable limits for laboratory QA/QC parameters are based upon the laboratory reported acceptable limits and those stated within the NEPM 1999 Guidelines.

8.7 Optimise the design for obtaining data

The design for optimising data was achieved by the location and collection of soil samples. Samples were placed systematically at locations equal to the NSW EPA sampling density guidelines (EPA requires 17 locations – the site sampling was conducted at 17 locations). Further to this, only laboratories accredited by NATA for the analysis undertaken were used. The laboratory data was assessed from quality data calculated during this assessment. Field QA/QC protocols adopted and listed within appendices incorporate traceable documentation of procedures used in the sampling and analytical program and in data verification procedures.

9.0 SOIL BORING AND SAMPLING STRATEGY

9.1 Soil sampling

The NSW EPA "Sampling Design Guidelines" (September 1995) shows the minimum number of sampling points for a site of area of approximately 6,800m^2 is seventeen. During this investigation, soil samples were collected from 17 boreholes (BH1 to BH17) located on a semi regular grid over the site (modified to allow accesses to sample locations). All fieldwork and borehole logging was conducted by qualified environmental staff (refer Appendix K – Resumes of Client Team). Boreholes were drilled using a steel hand auger. Sampling was conducted on the 6th June 2008.

To reach our stated objectives, a set of seventeen (17) primary soil samples were submitted for analysis on the differing fill and natural soil profiles. Two QA/QC intra-laboratory duplicate samples and one QA/QC rinsate sample was analysed by the NATA accredited laboratory of LabMark (NATA accreditation number 13542). One QA/QC inter-laboratory duplicate sample was analysed by the NATA accredited laboratory of SGS (NATA accreditation number 2562).

The rationale for sampling depths was based upon the targeting of fill and natural soils on site. Samples were targeted in the homogeneous fill material and then within the natural soil profile. Reference may be made to Table 4 in Section 9.4 – Laboratory Analysis for the soil analysis schedule of the recovered samples. The sample locations were chosen to provide site coverage and also target the most likely areas at which potential contamination could occur.

The approximate locations of the boreholes are shown on Figure 2 in Appendix A.

9.2 Surface and Subsurface Conditions

This section should be read in conjunction with site plan (Refer to Appendix A) and the borehole logs (Refer to Appendix D). There was no staining or odours encountered within the soil profile in each of the boreholes drilled. No asbestos pieces were noted in the borehole samples.

The subsurface conditions across the site comprised Fill, comprising brown to dark brown sandy loams to 0.5m below ground level (BGL), underlain by natural clayey sand to a depth of 1.5m BGL.

No groundwater seepage was encountered during the drilling process, with the maximum depth of drilling being 1.5m.

9.3 Groundwater Sampling

Groundwater sampling was not carried out as part of this assessment.

9.4 Laboratory analysis

The soil samples were selected for analysis based on a combination of sample location and field observations. The soil analysis schedule is shown in the following table.

Table 4 – Schedule of Laboratory Analysis

Analyte / Analyte Group Sample	Depth (m)	TYPE	SAMPLING DATE	DUPLICATE	SPLIT	MET-8	TPH & BTEX	PAH	Phenols	OCP, PCB, Cyanides	TCLP
Bore Hole samples											
BH01	0.5	F	06.06.2008			✓	✓	✓			
BH01	1.5	N	06.06.2008			✓					
BH02	0.5	F	06.06.2008			✓				✓	
BH03	0.5	F	06.06.2008			✓	✓	✓			
BH04	0.5	F	06.06.2008			✓			✓	✓	
BH04	1.5	N	06.06.2008	D1		✓	✓				
BH05	0.5	F	06.06.2008			✓			✓	✓	
BH06	0.5	F	06.06.2008			✓	✓	✓			
BH07	0.5	F	06.06.2008			✓					
BH07	1.5	N	06.06.2008			✓					
BH08	0.5	F	06.06.2008			✓				✓	
BH08	1.5	N	06.06.2008			✓	✓	✓			
BH09	0.5	F	06.06.2008			✓	✓	✓			
BH10	0.5	F	06.06.2008			✓				✓	
BH11	0.5	F	06.06.2008			✓	✓	✓			
BH12	0.5	F	06.06.2008		BH12AF	✓	✓	✓	✓	✓	
BH13	0.5	F	06.06.2008			✓					
BH13	1.5	N	06.06.2008			✓	✓	✓			
BH14	0.5	F	06.06.2008			✓	✓	✓	✓	✓	
BH15	0.5	F	06.06.2008			✓					
BH15	1.5	N	06.06.2008			✓					
BH16	0.5	F	06.06.2008	D2		✓	✓	✓	✓	✓	
BH17	0.5	F	06.06.2008			✓	✓	✓			
BH17	1.5	N	06.06.2008			✓					

Notes		
	MET-8:	arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc
	PAH:	Polycyclic Aromatic Hydrocarbons
	TPH:	Total Petroleum Hydrcarbons
	BTEX:	Benzene, Toluene, Ethyl Benzene, Xylene
	F,N:	Fill, Natural

10.0 QUALITY ASSURANCE / QULAITY CONTROL

10.1 Data Quality Objectives

Data Quality Objectives (DQOs) were created to produce quality assured, accurate and useful data for the sampling plan. Blind samples were split in the field for testing or at the laboratory. Other areas reviewed are:

- sampling methods;
- decontamination procedures;
- sample preservation;
- container type;
- headspace within containers;
- disturbed or undisturbed sampling for organics;
- PQL's;
- preparation of COC forms;
- review of laboratory surrogate and spike % returns; and
- review of Laboratory duplicate results.

LabMark Laboratory (primary laboratory) and SGS (secondary laboratory) performed all analyses using test methods accredited by the National Association of Testing Authorities (NATA). All data quality objectives were reviewed and met and we therefore conclude that the DQOs were satisfactory for our stated objectives.

The Practical Quantitation Limits (PQLs) of the laboratory analyses were less than the threshold guidelines adopted for the purpose of this investigation, and therefore meet DQOs.

The results of all quality checking have been reviewed and are considered adequate in satisfying the reliability of the results and meet Data Quality Objectives (DQOs).

10.2 Field QA/QC

10.2.1 Sampling Procedures

Aargus procedures followed throughout the field investigation are presented in Appendix F – Aargus fieldwork protocols, which are based on industry accepted standard practice. The work was undertaken by appropriately qualified personnel; see Appendix J – Resumes of Client Team.

Soil sampling was carried out using a stainless steel hand auger. The decontamination of sampling equipment was achieved by washing the equipment with phosphate-free detergent and tap water, followed by a final rinse with distilled water. Decontamination was conducted after the collection of samples at each sample location. Soil samples were placed in 250g clean glass jars, leaving no headspace, and closed using Teflon-coated lids. Samples were then stored in an ice brick-cooled esky and transported to the laboratory under chain of custody conditions.

Samples were taken at varying depths as shown in the Borehole Logs (refer Appendix D – Borehole Logs).

10.2.2 Intra-laboratory Duplicates

Two intra-laboratory duplicate samples were collected for the soil and analysed in order to assess the variation in analyte concentration between samples collected from the same sampling point. The duplicate sample frequency was computed using the total number of samples analysed as part of this assessment.

The duplicate sample frequencies computed are presented in the following table.

Table 5 – Soil/Water – Duplicate Sample Analyses

Analyte - Soil	Samples Analysed	Duplicate Samples	Frequency
Metals	17	2	12%

TPH/BTEX	12	2	16%
PAH	12	1	8%
OCP	6	1	16%
PCB	5	1	20%
Phenols	5	1	20%
Cyanides	5	1	20%

The duplicate frequency for the analytical suite adopted complies with the NEPM, which recommends a duplicate frequency of at least 5%.

It is considered that the number of duplicate samples collected is adequate to assess the variation in analyte concentration between samples collected from the same sampling point. A summary of the test results with the Relative Percentage Difference (RPD) is presented in the following table. A discussion of the test data is also presented below.

Table 6 – Duplicates D1 & D2 – RPD's

ANALYTE	BH04N 1.5m mg/kg	DUPLICATE D1 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	<1	1	-
Cadmium	<0.1	<0.1	-
Chromium	2	3	40
Copper	<2	12	-
Nickel	<1	<1	-
Lead	3	18	143
Zinc	<5	5	-
Mercury	<0.05	<0.05	-
TOTAL PETROLEUM HYDROCARBONS (TPH)			
C6 - C9	<10	<10	-
C10 - C14	<50	<50	-
C15 - C28	<100	<100	-
C29-C36	<100	<100	-
BTEX			
Benzene	<0.2	<0.2	-
Toluene	<0.5	<0.5	-
Ethyl Benzene	<0.5	<0.5	-
Total Xylenes	<1.5	<1.5	-

ANALYTE	BH16F 0.5m mg/kg	DUPLICATE D2 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	2	1	67
Cadmium	<0.1	<0.1	-
Chromium	5	3	50
Copper	4	12	100
Nickel	1	<1	-
Lead	6	18	100
Zinc	6	5	18
Mercury	0.37	P	-
TOTAL PETROLEUM HYDROCARBONS (TPH)			
C6 - C9	<10	<10	-
C10 - C14	<50	<50	-
C15 - C28	<100	<100	-
C29-C36	<100	<100	-
BTEX			
Benzene	<0.2	<0.2	-
Toluene	<0.5	<0.5	-
Ethyl Benzene	<0.5	<0.5	-
Total Xylenes	<1.5	<1.5	-
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)			
Benzo(a)Pyrene	<0.5	<0.5	-
Total PAH	<8	<8	-
POLYCHLORINATED BIPHENYLS (PCB)			
Total PCB	<0.5	<0.9	-
PHENOLS			
Total Phenols	<0.5	<0.5	-

The comparisons between the intra-laboratory duplicates and corresponding original samples indicated generally acceptable RPD overall, with the exception of the following:

- Lead (143%) in Duplicate D1.
- Arsenic (67%), Copper (100%) and Lead (100%) in Duplicate D2.

The higher RPD's in Table 6exceeded the DQOs for this project, however this exceedance is not considered to be significant as the concentrations of both samples are at generally low concentrations and the duplicates were prepared from fill samples, therefore heterogeneity of the samples might result in relatively higher RPD.

Overall, the duplicate sample comparisons indicate that the laboratory test data provided by LabMark are of adequate accuracy and reliability for this assessment.

10.2.3 Inter-laboratory Duplicates

One soil sample was collected and analysed in order to assess the variation in analyte concentration between samples collected from the same sampling point. The inter-laboratory duplicate (split) sample frequency was computed using the total number of samples analysed as part of this assessment.

The split sample frequencies computed are presented in the following table.

Table 7 – Soil – Split Sample Analyses

Analyte - Soil	Samples Analysed	Duplicate Samples	Frequency
Metals	9	1	11%
TPH/BTEX	6	1	17%
PAH	6	1	17%
OCP	2	1	50%
PCB	2	1	50%
Phenols	2	1	50%

The split frequency for the analytical suite adopted complies with the NEPM, which recommends a duplicate frequency of at least 5%.

It is considered that the number of split samples collected is adequate to assess the variation in analyte concentration between samples collected from the same sampling point. A summary of the test results with the Relative Percentage Difference (RPD) are presented in the following tables. A discussion of the test data is also presented below.

Table 8 – Split BH12FA – RPD's

ANALYTE	BH12F mg/kg (LABMARK)	SPLIT BH12FA mg/kg (SGS)	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	9	13	36
Cadmium	1.2	0.93	25
Chromium	36	28	25
Copper	37	29	24
Nickel	5	4.2	17
Lead	206	89	79
Zinc	175	110	46
Mercury	1.93	1.9	2
TOTAL PETROLEUM HYDROCARBONS (TPH)			
C6 - C9	<10	<20	-
C10 - C14	<50	<20	-
C15 - C28	<100	<50	-
C29-C36	<100	<50	-
BTEX			
Benzene	<0.2	<0.5	-
Toluene	<0.5	<0.5	-
Ethyl Benzene	<0.5	<0.5	-
Total Xylenes	<1.5	<1.5	-
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)			
Benzo(a)Pyrene	<0.5	0.1	-
Total PAH	<8	<1.8	-
PHENOLS			
Total Phenols	<0.5	0.1	-

The comparisons between the inter-laboratory duplicate and corresponding original sample indicated generally acceptable RPD overall, with the exception of lead (79%).

The higher RPD's exceeded the DQOs for this project, however this exceedance is not considered to be significant as the split was prepared from fill samples, therefore heterogeneity of the samples might result in relatively higher RPD.

Overall, the split sample comparisons indicate that the laboratory test data provided by SGS are of adequate accuracy and reliability for this assessment.

10.2.4 Rinsate

One rinsate sample was recovered over the course of the fieldwork in order to identify possible cross contamination between the sampling locations. The laboratory result for the rinsate samples are presented in the following table.

Table 9 – Rinsate Analysis

ANALYTE	RINSATE VR1 (µg/L) 06.06.2008	Practical Quantitation Limits (PQL)
HEAVY METALS		
Arsenic	<5	1
Cadmium	<0.1	0.1
Chromium	<1	1
Copper	240	1
Nickel	<1	1
Lead	<1	1
Zinc	14	5
Mercury	<0.1	0.1
TOTAL PETROLEUM HYDROCARBONS (TPH)		
C6 - C9	<50	50
C10 - C14	<50	50
C15 - C28	<200	200
C29-C36	<50	50
BTEX		
Benzene	<1	1
Toluene	<1	1
Ethyl Benzene	<1	1
Total Xylenes	<3	3
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)		
Benzo(a)Pyrene	<1	1
Total PAH	<16	16

As indicated in Table 9, the concentrations of the analytes were found to be the same as or not significantly different to the PQL's, with the exception to the concentration of copper and zinc. The concentrations of copper and zinc in the soil samples recovered on that day were all less than the assessment criteria adopted for the site, indicating that cross contamination did not take place.

Overall, the cleaning and decontamination processes adopted in the field were found to be adequate.

10.3 Laboratory QA/QC

Collected soil samples were analysed by LabMark and SGS laboratories. Laboratories used within this study are accredited by the National Association of Testing Authorities (NATA) for the analyses undertaken.

Review of the QAQC results provided with the laboratory reports by this laboratory indicated that the laboratory QAQC was satisfactory for the laboratory analyses undertaken, with exception for the following incidences:

- The zinc matrix spike recovery for sample 161183 (LabMark) was reported at 149%, with the laboratory control sample recovery at 108%. This is not of concern as the samples are within the NEPM specified data quality objective of recoveries range of 70 to 130%.

- Lead in lab number 161188d (LabMark) reported RPD of 83%. A laboratory triplicate was issued and the RPD was 46%. This is not of concern as the concentration of the RPD (metals) is less than 5 times the EQL.

- Metals in lab number 161195d (LabMark) reported RPD between 11% and 112%. A laboratory triplicate was issued and the RPD was between 0% and 75%. This is not of concern as the concentration of the RPD (metals) is between 5 and 10 times the EQL.
- Mercury in lab number 161195d (LabMark) reported RPD of 58%. A laboratory triplicate was issued and the RPD was 66%. This is not of concern as the concentration of the RPD (metals) is between 5 and 10 times the EQL.
-

The Practical Quantitation Limits (PQLs) of the laboratory analyses were less than the threshold guidelines adopted for the purpose of this investigation, and therefore meet DQOs.

The results of all quality checking have been reviewed and are considered adequate in satisfying the reliability of the results and meet Data Quality Objectives (DQOs).

10.4 Conclusion for the QA/QC

The sampling methods (including sample preservation, transport and decontamination procedures) and laboratory methods followed during this investigation works were consistent with Aargus protocols and were found to meet the DQOs for this project. It is therefore considered that the data is sufficiently precise and accurate and that the results can be used for the purpose of this project.

11.0 SITE ASSESSMENT CRITERIA

11.1 Soil

To assess the contamination status of soils at a site, the NSW EPA refers to the document entitled National Environmental Protection Council (1999) *National Environmental Protection (Assessment of Site Contamination) Measure* (NEPM).

As reported above, the site is proposed to be redeveloped into a residential unit development with basement car parking.

With respect to human health, the contamination status of the soils at the site was assessed against the Health Investigation Levels (HIL) of the above-mentioned guidelines for *residential use with minimal access to the soil* (HIL 'D').

The NEPM 1999 does not include investigation levels for TPH and BTEX. For assessing contamination by these compounds at sites used for sensitive land use, such as residential, the NSW EPA refers to the NSW EPA (1994) "*Guidelines for Assessing Service Station Sites*". The NSW EPA has recommended that these threshold values should also be used to assess the suitability of sites for less stringent uses, such as residential with minimal access to the soil or parklands.

The adopted assessment criteria are presented in the following table.

Table 10 – Soil Assessment Criteria

Contaminant	Assessment Criteria (mg/kg)			Source
	HIL 'D'	EIL/PPBIL	NSW EPA	
Inorganics				
Arsenic	400	20	-	NEPM, 1999; NSW EPA, 2006
Cadmium	80	3	-	NEPM, 1999; NSW EPA, 2006
Chromium (III)	48,000	400	-	NEPM, 1999; NSW EPA, 2006
Copper	4,000	100	-	NEPM, 1999; NSW EPA, 2006
Lead	1,200	600	-	NEPM, 1999; NSW EPA, 2006
Zinc	28,000	200	-	NEPM, 1999; NSW EPA, 2006
Nickel	2,400	60	-	NEPM, 1999; NSW EPA, 2006
Mercury	60	1	-	NEPM, 1999; NSW EPA, 2006
Manganese	7,500	500	-	NEPM, 1999; NSW EPA, 2006
Organics				
TPH/BTEX				
C_6 to C_9 Fraction	-	-	65	NSW EPA, 1994
C_{10} to C_{36} Fraction	-	-	1,000	NSW EPA, 1994
Benzene	-	-	1	NSW EPA, 1994
Toluene	-	-	1.4	NSW EPA, 1994
Ethylbenzene	-	-	3.1	NSW EPA, 1994
Total Xylenes	-	-	14	NSW EPA, 1994
PAH				
Benzo(a)pyrene	4	-	-	NEPM, 1999
Total PAH	80	-	-	NEPM, 1999
OCP				
Aldrin + Dieldrin	40	-	-	NEPM, 1999
Chlordane	200	-	-	NEPM, 1999
DDT+DDD+DDE	800	-	-	NEPM, 1999
Heptachlor	40	-	-	NEPM, 1999
PCB (Total)	20	-	-	NEPM, 1999

Contaminant	Assessment Criteria (mg/kg)			Source
Phenol	34,000	70	-	NEPM, 1999; NSW EPA, 2006
Cyanide	1,000	-	-	NEPM, 1999

11.2 Assessment of significant risk of harm

The NSW EPA (1999) *Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report* state that significant risk of harm is probable where:

- Contamination is located in a place where there will be an impact on human health or the environment;
- There is a particularly toxic contaminant which is likely to cause harm, even in small quantities, to anything in which it has contact, even where there is limited exposure;
- A contaminant is present at such concentrations or over such a large area as to present a high probability of harm; and
- The contamination is already causing harm.

Under the provisions of the Contaminated Land Management Act 1997 (CLMA 1997), owners and/or operators of a site are required to notify the NSW EPA of contamination after they become aware that contamination is presenting a potential significant risk of harm.

More specifically DECC also advises that there is a statutory requirement to notify them when “contaminants are known, or are likely, to be migrating offsite at concentrations exceeding groundwater assessment criteria” (DEC 2004, *Contaminated Sites: Draft Guidelines for the assessment and Management of Groundwater Contamination*).

12.0 ASSESSMENT DISCUSSION

A summary of the test results are presented in the following tables together with the assessment criteria adopted. A discussion of the test data is also presented in the following sub-sections. Reference may be made to Appendix C - Laboratory Certificates for the laboratory certificates.

12.1 Metals

The metals test data for the soil samples is presented in Table 11.

Table 11 – Metals Test Results – Topsoil/Fill and Natural

Analyte		HEAVY METALS (mg/kg)							
Sample Location	Depth (m)	ARSENIC	CADMIUM	CHROMIUM	COPPER	NICKEL	LEAD	ZINC	MERCURY
BH01F	0.5	11	0.3	9	14	3	56	53	0.43
BH01N	1.5	1	<0.1	7	<2	<1	5	<5	<0.05
BH02F	0.5	3	<0.1	9	2	1	15	10	0.1
BH03F	0.5	6	0.1	5	6	1	33	22	0.17
BH04F	0.5	4	0.3	10	8	5	57	32	0.71
BH04N	1.5	<1	<0.1	2	<2	<1	3	<5	<0.05
BH05F	0.5	3	0.3	17	7	3	36	29	2.11
BH06F	0.5	1	0.2	8	4	2	6	7	4.92
BH07F	0.5	6	0.7	15	10	2	27	28	8.43
BH07N	1.5	1	<0.1	6	2	<1	20	<5	0.08
BH08F	0.5	6	0.1	4	5	1	24	34	0.25
BH08N	1.5	3	<0.1	8	<2	<1	3	<5	0.06
BH09F	0.5	5	0.1	7	6	2	27	25	0.59
BH10F	0.5	2	0.2	12	9	4	10	17	1.37
BH11F	0.5	12	0.4	10	10	3	43	79	2.92
BH12F	0.5	9	1.2	36	37	5	206	175	1.93
BH13F	0.5	4	0.5	9	13	8	55	44	0.73
BH13N	1.5	3	<0.1	11	<2	2	3	5	0.07
BH14F	0.5	4	0.9	23	13	6	38	32	10.9
BH15F	0.5	7	0.7	13	12	8	93	61	1.78
BH15N	1.5	2	<0.1	5	4	1	6	6	0.98
BH16F	0.5	3	1.1	24	13	2	36	29	0.37
BH17F	0.5	4	0.3	13	11	5	51	50	1.05
BH17N	1.5	3	<0.1	12	<2	<1	3	<5	0.07
Practical Quantitation Limits (PQL)		1	0.1	1	2	1	2	5	0.05
Waste Criteria - Total Concentration (w/o TCLP)									
CT1 - General Solid Waste		100	20	100	-	40	100	-	4
CT2 - Restricted Solid Waste		400	80	400	-	160	400	-	16
Waste Criteria - Total Concentration (with TCLP)									
SCC1 - General Solid Waste		500	100	1900	-	1050	1500	-	50
SCC2 - Restricted Solid Waste		2000	400	7600	-	4200	6000	-	200
GUIDELINES FOR THE NSW SITE AUDITOR SCHEME (2006)									
Provisional Phytotoxity-Based Investigation Levels		20	3	400/1 [e]	100	60	600	200	1
NATIONAL ENVIRONMENT PROTECTION MEASURE (1999)									
Health Investigation Levels (HIL) [a] (HIL 'A')		100	20	12%/100 [f]	1000	600	300	7000	10/15 [g]
HIL 'D' [b]		400	80	48%/400	4000	2400	1200	28000	40/60
HIL 'E' [c]		200	40	24%/200	2000	600	600	14000	20/30
HIL 'F' [d]		500	100	60%/500	5000	3000	1500	35000	50/75

Notes		
	1	CT1, CT2 : Total concentrations used for defining General Solid Waste and Restricted Solid Waste respectively (without TCLP)
	2	SCC1, SCC2 : Total Concentration used for defining General Solid Waste and Restricted Solid Waste respectively (in conjunction with TCLP)
	a:	Residential with gardens and accessible soil including children's day-care centres, preschools, primary schools, townhouses and villas.
	b:	Residential with minimal opportunities for soil access, including high-rise, apartments and flat
	c:	Parks, recreational open space and playing fields, including secondary schools
	d:	Commercial or industrial development
	e:	400mg/kg for Chromium (+3) and 1mg/kg for Chromium (+6). Chromium (Cr) may exist in a number of states. Cr (+6) is easily reduced to form the most stable Cr (+3) whenever exposed to the atmosphere. Therefore Cr (+3) is adopted for this assessment.
	f:	12% (120000mg/kg) for Chromium (+3) and 100mg/kg for Chromium (+6).
	g:	10mg/kg for Methyl Mercury and 15mg/kg for Inorganic Mercury.

As shown in Table 11, the metal concentrations for the soil samples were well below the assessment criteria adopted, that being HIL 'D' residential with minimal access to soils.

12.2 TPH and BTEX

As indicated in Table 12 below, TPH and BTEX concentrations were all below the suggested Levels in the EPA service station guidelines.

Table 12 – TPH & BTEX Test Results

Analyte		TPH (mg/kg)					BTEX (mg/kg)			
Sample Location	Depth (m)	C6-C9	C10-C14	C15-C28	C29-C36	C10-C36 [a]	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES
BH01F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH03F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH04N	1.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH06F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH08N	1.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH09F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH11F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH12F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH13N	1.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH14F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH16F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH17F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
Practical Quantitation Limits (PQL)		10	50	100	100	NA	0.2	0.5	0.5	1.5
Waste Criteria - Total Concentration (w/o TCLP)										
CT1 - General Solid Waste		NA	-	-	-	NA	10	288	600	1000
CT2 - Restricted Solid Waste		NA	-	-	-	NA	40	1152	2400	4000
Waste Criteria - Total Concentration (with TCLP)										
SCC1 - General Solid Waste		650	-	-	-	10000	18	518	1080	1800
SCC2 - Restricted Solid Waste		2600	-	-	-	40000	72	2073	4320	7200
EPA Levels [b]		65	C10-C36 =1000				1	1.4	3.1	14

Notes		
	1	CT1, CT2 : Total concentrations used for defining General Solid Waste and Restricted Solid Waste respectively (without TCLP).
	2	SCC1, SCC2 : Total Concentration used for defining General Solid Waste and Restricted Solid Waste respectively (in conjunction with TCLP)
	a:	C10-C36 = (C10-C14) + (C15-C28) + (C29-C36); concentrations less than PQL are assumed equal to PQL.
	b:	Contaminated Sites: "Guidelines for Assessing Service Station Sites", 1994, EPA
	NA:	Not Applicable

12.3 Total PAH

As indicated in Table 13 below, the concentrations of benzo(a)pyrene, Total PAH, were well below the assessment criteria adopted, that being HIL ‘D’ residential with minimal access to soils.

Table 13 – B(a)P and PAH Test Results

Analyte		PAH (mg/kg)	
Sample Location	Depth (m)	BENZO(a)PYRENE (mg/kg)	TOTAL PAH (mg/kg)
BH01F	0.5	0.8	6.4
BH03F	0.5	<0.5	1.1
BH04N	1.5	<0.5	<8
BH06F	0.5	<0.5	<8
BH08N	1.5	<0.5	<8
BH09F	0.5	<0.5	<8
BH11F	0.5	<0.5	<8
BH12F	0.5	<0.5	<8
BH13N	1.5	<0.5	<8
BH14F	0.5	<0.5	<8
BH16F	0.5	<0.5	<8
BH17F	0.5	<0.5	<8
Practical Quantitation Limits (PQL)		0.5	NA
Waste Criteria - Total Concentration (w/o TCLP)			
CT1 - General Solid Waste		0.8	NA
CT2 - Restricted Solid Waste		3.2	NA
Waste Criteria - Total Concentration (with TCLP)			
SCC1 - General Solid Waste		10	200
SCC2 - Restricted Solid Waste		23	800
NATIONAL ENVIRONMENT PROTECTION MEASURE (1999)			
Health Investigation Levels (HIL) [a] (HIL 'A')		1	20
HIL 'D' [b]		4	80
HIL 'E' [c]		2	40
HIL 'F' [d]		5	100

Notes		
	1	CT1, CT2 : Total concentrations used for defining General Solid Waste and Restricted Solid Waste respectively (without TCLP).
	2	SCC1, SCC2 : Total Concentration used for defining General Solid Waste and Restricted Solid Waste respectively (in conjunction with TCLP)
	a:	Residential with gardens and accessible soil including children's day-care centres, preschools, primary schools, townhouses and villas.
	b:	Residential with minimal opportunities for soil access, including high-rise, apartments and flat
	c:	Parks, recreational open space and playing fields, including secondary schools
	d:	Commercial or industrial development
	NA:	Not Applicable

12.4 Other Organics

As indicated in Table 14, the concentrations of OCP, PCB, Phenols and Cyanides were well below the assessment criteria adopted, that being HIL 'D' residential with minimal access to soils.

Table 14 – OCP, PCB, Phenols & Cyanides Test Results

Analyte		Organochlorine Pesticides (mg/kg)									
Sample Reference	Depth (m)	HEPTACHLOR	ALDRIN	DIELDRIN	DDD	DDE	DDT	CHLORDANE (trans & cis)	TOTAL PCB (mg/kg)	TOTAL PHENOLS (mg/kg)	TOTAL CYANIDES (mg/kg)
BH02F	0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.1	-	<0.5	<1
BH04F	0.5	-	-	-	-	-	-	-	<0.6	-	-
BH05F	0.5	<0.05	<0.05	0.06	0.05	0.32	0.4	<0.1	<0.6	<0.5	<1
BH08F	0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.1	-	-	-
BH10F	0.5	<0.05	<0.05	0.42	0.18	0.18	<0.2	0.18	-	-	-
BH12F	0.5	<0.05	<0.05	0.07	0.05	0.43	0.3	<0.05	<0.6	<0.5	<1
BH14F	0.5	-	-	-	-	-	-	-	<0.6	<0.5	<1
BH16F	0.5	-	-	-	-	-	-	-	<0.6	<0.5	<1
Practical Quantitation Limits (PQL)		0.05	0.05	0.05	0.05	0.05	0.2	0.1	0.6	0.5	1
NATIONAL ENVIRONMENT PROTECTION MEASURE (1999)											
Health Investigation Levels (HIL) [a] (HIL 'A')		10	10 [e]	10 [e]		200 [f]		50	10	8500	250 [g] / 500 [h]
HIL 'D' [b]		40	40	40		800		200	20	34000	1000 / 2000
HIL 'E' [c]		20	20	20		400		100	40	17000	500 / 1000
HIL 'F' [d]		50	50	50		1000		250	50	42500	1250 / 2500
GUIDELINES FOR THE NSW SITE AUDITOR SCHEME (2006)											
Provosional Phytotoxity-Based Investigation Level (PPBIL)										70	

Notes		
	a:	Residential with gardens and accessible soil including children's day-care centres, preschools, primary schools, townhouses and villas.
	b:	Residential with minimal opportunities for soil access, including high-rise, apartments and flats
	c:	Parks, recreational open space and playing fields, including secondary schools
	d:	Commercial or industrial development
	e:	Aldrin + Dieldrin
	f:	Total of DDD + DDE + DDT
	g:	Cyanide (free)
	h:	Cyanide (complex)

13.0 CONCLUSIONS AND RECOMMENDATIONS

Laboratory results and QA/QC data fulfil the DQOs. The results are therefore considered a reliable basis for the following conclusions and recommendations.

Laboratory results for the soil samples analysed were generally lower than the relevant regulatory guideline criteria adopted, those being HIL 'D' for residential with minimal access to soils and the NSW EPA Service Station criteria.

In Summary

Based on the results of this investigation, it is considered that the risks to human health and the environment associated with soil contamination at the site are low in the context of the proposed use of the site as a residential development. The site is therefore considered ***to be suitable*** for the proposed use.

Any soils (fill and natural) requiring removal from the site as part of the excavation for basement construction should be classified in accordance with the "*Waste Classification Guidelines, Part 1: Classifying Waste" NSW DEC (2008).*

If during any potential site 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 the environmental consultant should be notified immediately to set up a response to this unexpected occurrence.

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

For and behalf of
Aargus Pty Ltd

Con Kariotoglou
Project Manager

Internal review by

Mark Kelly

Mark Kelly
Senior Environmental Geologist

LIMITATIONS OF ASSESSMENT

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue, although subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay.

There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site.

There is no investigation that is thorough enough to preclude the presence of material that presently or in the future, may be considered hazardous at the site. Since regulatory criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

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

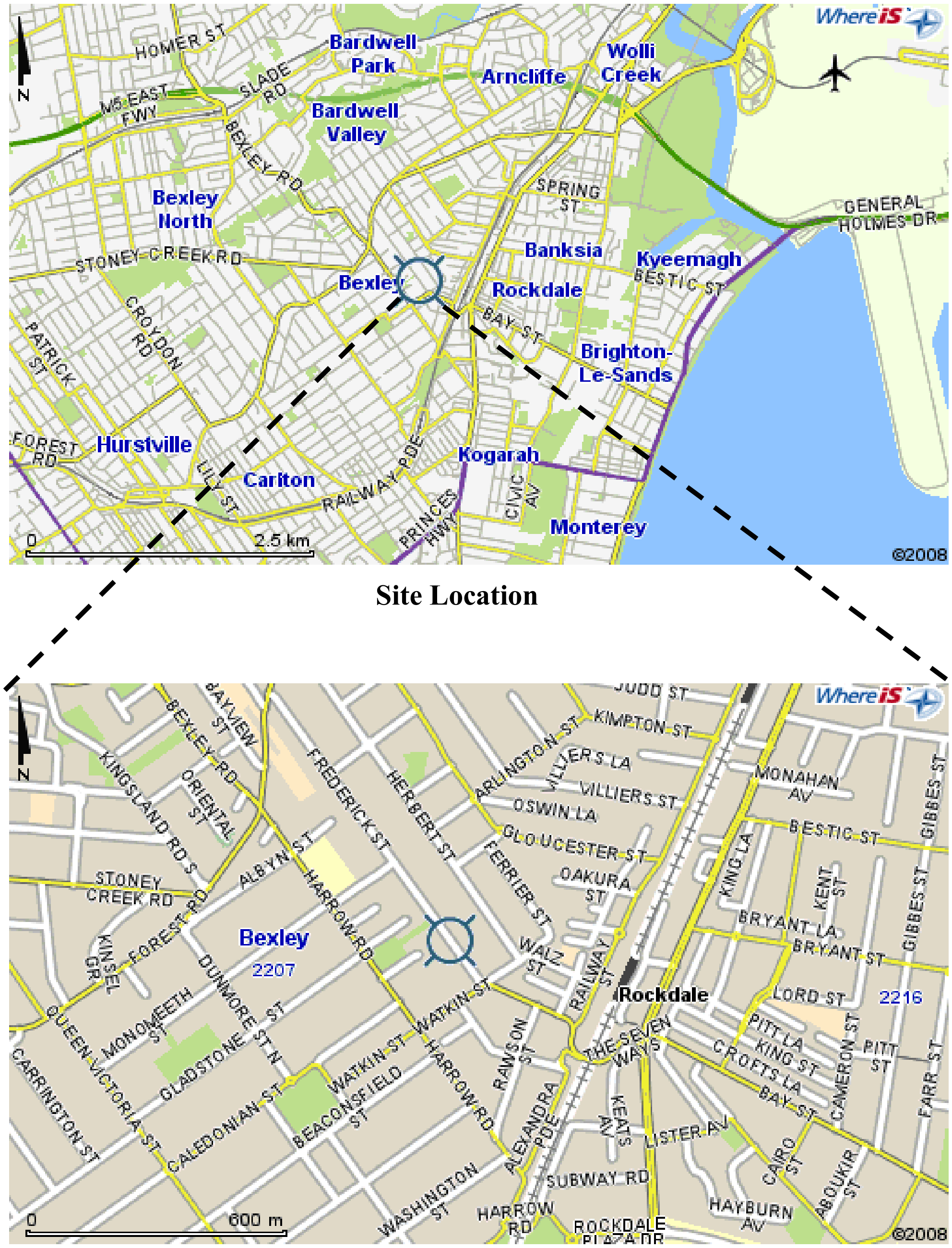
Appendix B – Important information about your environmental report should also be read in conjunction with this report.

APPENDIX A

SITE PLAN & LOCALITY MAP

Aargus

LOCALITY MAP

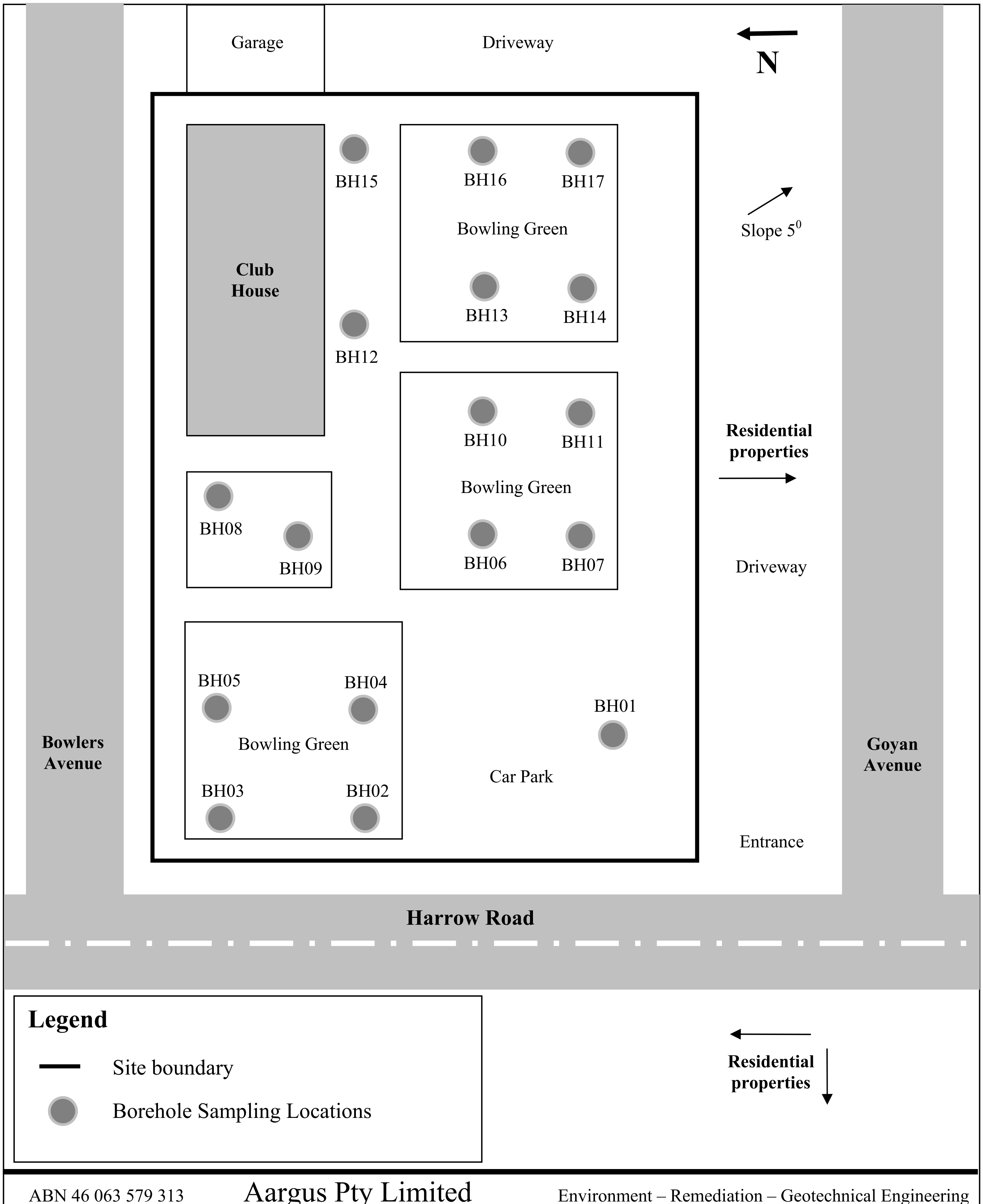


Reference: whereis.com.au (2008)

ABN 46 063 579 313 **Aargus Pty Limited** Environment – Remediation – Geotechnical Engineering

Drawn:	CK	**Tenetur Pty Ltd** **Environmental Site Assessment** **Harrow Road** **Bexley NSW**	Figure 1
Approved:	MK		
Date:	17/06/08		
Scale:	as shown		Job No: E2252

SITE FEATURES



ABN 46 063 579 313 **Aargus Pty Limited** Environment – Remediation – Geotechnical Engineering

Drawn:	CK	**Tenetur Pty Ltd** **Environmental Site Assessment** **Harrow Road** **Bexley NSW**	Figure 2
Approved:	MK		
Date:	17/06/08		
Scale:	NTS		Job No: E2252

APPENDIX B

IMPORTANT INFORMATION ABOUT YOUR ENVIROMENTAL REPORT

IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL REPORT

These notes have been prepared by Aargus Pty Ltd and its associated companies using guidelines prepared by ASFE, an Association of engineering firms that specialize in earth engineering and related applied science services. They are offered to help you in the interpretation of your environmental reports.

REASONS FOR PREPARING AN ENVIRONMENTAL REPORT

An environmental report has been prepared for a specific purpose on the basis of unique project requirements and only applies to the site subject of the study. Environmental reports are typically, though not exclusively, carried out in the following circumstances:

- prior to acquisition, on behalf of either purchaser or vender, when a property is to be sold;
- prior to development, 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;
- prior to development of greenfield sites, to establish "baseline" conditions and assess environmental, geological and hydrological constraints to the development; and
- as an assessment of the environmental effects of ongoing operations.

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 contamination 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 ENVIRONMENTAL REPORT

Although the information provided by an environmental report could reduce exposure to potential risks, these can, however, never be completely eliminated. Even a rigorous professional assessment may fail to detect contamination existing at 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. Subsurface conditions can also change with time, natural processes or the activity of man.

AN ENVIRONMENTAL REPORT IS BASED ON A UNIQUE SET OF PROJECT SPECIFIC FACTORS

The conclusions of an environmental report may change:

- when the nature, location, size or configuration of the development proposed at the site is modified, for example, if a residential development is proposed instead of a commercial one;
- when there is a change of ownership; or
- for an adjacent site.

To help avoid costly and/or time delaying problems, it is advised to refer to the environmental consultant to determine how any factors which have changed subsequent to the date of the report may affect its conclusions and recommendations.

THE CONCLUSIONS OF A REPORT ARE PROFESSIONAL ESTIMATES

A contamination assessment identifies actual subsurface conditions only at those locations where samples were taken, when they were 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 (if any), its likely impact on a proposed development and possible 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. For this reason owners should retain the services of their environmental consultants through the development stage, to identify variances, conduct additional tests which may be required, and to provide advice for the site.

SUBSURFACE CONDITIONS CAN CHANGE

Natural processes and the activity of man can change subsurface conditions. As an environmental report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. It is recommended that you speak with your environmental consultant to see how time may have affected the conditions at the site.

ENVIRONMENTAL REPORTS ARE PREPARED FOR SPECIFIC PURPOSES AND PERSONS

Every environmental 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 for a development application. A report should not be used by other persons 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 environmental consultant. A report should not be used for any purpose other than that originally contemplated without first getting advice from the environmental consultant on this matter.

ENVIRONMENTAL REPORTS MAY BE MISINTERPRETATED

Problems can occur when design professionals develop their plans based on misinterpretations of an environmental report. To help avoiding these problems, the environmental consultant should be retained to work with appropriate design professionals to explain relevant findings and to review the adequacy of plans and specifications in relation to contamination issues.

DATA SHOULD NOT BE SEPARATED FROM THE REPORT

The report should not be copied in part or altered in any way. Logs, figures, field measurements, laboratory data, drawings, photographs, etc are prepared by environmental professionals based upon their interpretation of field conditions, field testing and assessment of laboratory results. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report.

To reduce the likelihood of data misinterpretation, the complete report must be available to persons or organisations involved in the project, such as contractors, for their use. Those who do 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 may help preventing subsequent construction problems.

READ RESPONSIBILITY CLAUSES CLOSELY

Because an environmental report is based on judgement and opinion, it may be less exact than other disciplines. This has resulted in unwarranted claims being lodged against environmental consultants. To help prevent this, 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 the environmental consultant's responsibilities begin and end. Their use helps all parties involved recognise their responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your environmental report, and you are encouraged to read them closely. Your environmental consultant will be able to clarify issues or answer your questions on these matters.

APPENDIX C

LABORATORY CERTIFICATES

LabMark
ENVIRONMENTAL LABORATORIES

CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

ilac-MRA NATA Accreditation No. 13542

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. NATA is a signatory to the APLAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

AQIS
AUSTRALIAN QUARANTINE AND INSPECTION SERVICE

SYDNEY License No. N0356.

Quarantine Approved Premises criteria 5.1 for quarantine containment level 1 (QCI) facilities. Class five criteria cover premises utilised for research, analysis and testing of biological material, soil, animal, plant and human products.

FINAL CERTIFICATE OF ANALYSIS - ENVIRONMENTAL DIVISION

Laboratory Report No:	E038124	Cover Page 1 of 4 plus Sample Results
Client Name:	Aargus Pty. Ltd	
Client Reference:	Bexley	
Contact Name:	Con Kariotoglou	
Chain of Custody No:	ns	Date Received: 10/06/2008
Sample Matrix:	SOIL & WATER	Date Reported: 19/06/2008

This Final Certificate of Analysis consists of sample results, DQI's, method descriptions, laboratory definitions, and internationally recognised NATA accreditation and endorsement. The DQO compliance relates specifically to QA/QC results as performed as part of the sample analysis, and may provide an indication of sample result quality. Transfer of report ownership from Labmark to the client shall only occur once full & final payment has been settled and verified. All report copies may be retracted where full payment has not occured within the agreed settlement period.

QUALITY ASSURANCE CRITERIA

Accuracy:	matrix spike:	1 in first 5-20, then 1 every 20 samples
	lcs, crm, method:	1 per analytical batch
	surrogate spike:	addition per target organic method
Precision:	laboratory duplicate:	1 in first 5-10, then 1 every 10 samples
	laboratory triplicate:	re-extracted & reported when duplicate RPD values exceed acceptance criteria
Holding Times:	soils, waters:	Refer to LabMark Preservation & THT table VOC's 14 days water / soil VAC's 7 days water or 14 days acidified VAC's 14 days soil SVOC's 7 days water, 14 days soil Pesticides 7 days water, 14 days soil Metals 6 months general elements Mercury 28 days
Confirmation:	target organic analysis:	GC/MS, or confirmatory column
Sensitivity:	EQL:	Typically 2-5 x Method Detection Limit (MDL)

QUALITY CONTROL GLOBAL ACCEPTANCE CRITERIA (GAC)

Accuracy:	spike, lcs, crm surrogate:	general analytes 70% - 130% recovery phenol analytes 50% - 130% recovery organophosphorous pesticide analytes 60% - 130% recovery phenoxy acid herbicides, organotin 50% - 130% recovery
	anion/cation bal:	+/- 10% (0-3 meq/l), +/- 5% (>3 meq/l)
Precision:	method blank:	not detected >95% of the reported EQL
	duplicate lab RPD (metals):	0-30% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL)
	duplicate lab RPD:	0-50% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL)

QUALITY CONTROL ANALYTE SPECIFIC ACCEPTANCE CRITERIA (ASAC)

Accuracy:	spike, lcs, crm surrogate:	analyte specific recovery data <3xsd of historical mean
Uncertainty:	spike, lcs:	measurement calculated from historical analyte specific control charts

RESULT ANNOTATION

Data Quality Objective	s:	matrix spike recovery	p:	pending	bcs:	batch specific lcs
Data Quality Indicator	d:	laboratory duplicate	lcs:	laboratory control sample	bmb:	batch specific mb
Estimated Quantitation Limit	t:	laboratory triplicate	crm:	certified reference material		
not applicable	r:	RPD relative % difference	mb:	method blank		

Geoff Weir	Ivan Povolny	Simon Mills
Quality Control (Report signatory)	**Authorising Chemist** (NATA signatory)	**Authorising Chemist** (NATA signatory)
geoff.weir@labmark.com.au	ivan.povolny@labmark.com.au	simon.mills@labmark.com.au

This document is issued in accordance with NATA's accreditation requirements.

NEPC GUIDELINE COMPLIANCE - DQO

1. GENERAL

A. Results relate specifically to samples as received. Sample results are not corrected for matrix spike, lcs, or surrogate recovery data.

B. EQL's are matrix dependant and may be increased due to sample dilution or matrix interference.

C. Laboratory QA/QC samples are specific to this project.

D. Inter-laboratory proficiency results are available upon request. NATA accreditation details available at www.nata.asn.au.

E. VOC spikes & surrogates added to samples during extraction, SVOC spikes & surrogates added prior to extraction.

F. Recovery data outside GAC limits shall be investigated and compared to ASAC (historical mean +/- 3sd). If recovery data <20%, then the relevant results for that compound are considered not reliable.

G. Recovery data (ms, surrogate, crm, lcs) outside ASAC limits shall initiate an investigative action. Anomolous QC data is examined in conjunction with other QC samples and a final decision whether to accept or reject results is provided by the professional judgement of the senior analyst. The USEPA-CLP National Functional Guidelines are referred to for specific recommendations.

H. Extraction (preparation) date refers to the date that sample preparation was initiated. Note that certain methods not requiring sample preparation (eg. VOCs in water, etc) may report a common extraction and analysis date.

I. LabMark shall maintain an official copy of this Certificate of Analysis for all tracable reference purposes.

2. CHAIN OF CUSTODY (COC) & SAMPLE RECEIPT NOTICE (SRN) REQUIREMENTS

A. SRN issued to client upon sample receipt & login verification.

B. Preservation & sampling date details specified on COC and SRN, unless noted.

C. Sample Integrity & Validated Time of Sample Receipt (VTSR) Holding Times verified (preservation may extend holding time, refer to preservation chart).

3. NATA ACCREDITED METHODS

A. NATA accreditation held for each in-house method and sample matrix type reported, unless noted below (Refer to subcontracted test reports for NATA accreditation status).

B. NATA accredited in-house laboratory methods are referenced from NEPC, ASTM, modified USEPA / APHA documents. Corporate Accreditation No. 13542.

C. Subcontracted analyses: Refer to Sample Receipt Notice and additional DQO comments.

Laboratory Report: E038124

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4. QA/QC FREQUENCY COMPLIANCE TABLE SPECIFIC TO THIS REPORT

Matrix: **SOIL**

Page:	Method:	Totals:	#d	%d-ratio	#t	#s	%s-ratio
1	BTEX by P&T	14	2	14%	0	1	7%
1	Volatile TPH by P&T (vTPH)	14	2	14%	0	1	7%
5	Petroleum Hydrocarbons (TPH)	14	2	14%	0	1	7%
9	Polyaromatic Hydrocarbons (PAH)	13	2	15%	0	1	8%
11	Phenols by GC/MS	6	1	17%	0	1	17%
13	Organochlorine Pesticides (OC)	6	1	17%	0	1	17%
15	Polychlorinated Biphenyls (PCB)	6	1	17%	0	1	17%
17	Acid extractable metals (M7)	26	3	12%	2	2	8%
22	Acid extractable mercury	26	3	12%	1	2	8%
27	Total Cyanide	6	1	17%	0	1	17%
28	Moisture	26	--	--	--	--	--

Matrix: **WATER**

Page:	Method:	Totals:	#d	%d-ratio	#t	#s	%s-ratio
4	BTEX by P&T	1	0	0%	0	0	0%
4	Volatile TPH by P&T (vTPH)	1	0	0%	0	0	0%
8	Petroleum Hydrocarbons (TPH)	1	0	0%	0	0	0%
25	Filtered metals (M7)	1	0	0%	0	0	0%
26	Filtered mercury	1	0	0%	0	0	0%

GLOSSARY:

#d	number of discrete duplicate extractions/analyses performed.
%d-ratio	NEPC guideline for laboratory duplicates is 1 in 10 samples (min 10%).
#t	number of triplicate extractions/analyses performed.
#s	number of spiked samples analysed.
%s-ratio	USEPA guideline for laboratory matrix spikes is 1 in 20 samples (min 5%).

Laboratory Report: E038124

5. ADDITIONAL COMMENTS SPECIFIC TO THIS REPORT

A. All tests were conducted by LabMark Environmental Sydney, NATA accreditation No. 13542, Corporate Site No. 13535, unless indicated below.
B. Metals(soil),Zinc matirx spike recovery for sample 161183 reported at 149%, corresponding lcs recovery at 108%.
C. Metals; Lab # 161188d RPD for lead is 83%, triplicate result issued.
D. Metals; Lab # 161195d RPD range is 11%-112%, triplicate results issued.
E. Mercury; Lab # 161195d RPD is 58%, tripicate result issued.

Laboratory QA/QC data shall relate specifically to this report, and may provide an indication of site specific sample result quality. LabMark DOES NOT report NON-RELEVANT BATCH QA/QC data. Acceptance of this self assessment certificate does not preclude any requirement for a QA/QC review by a accredited contaminated site EPA auditor, when and wherever necessary. Laboratory QA/QC self assessment references available upon request.

LabMark
ENVIRONMENTAL LABORATORIES

Laboratory Report No: E038124
Client Name: Aargus Pty. Ltd
Contact Name: Con Kariotoglou
Client Reference: Bexley E2252

Page: 1 of 29
plus cover page
Date: 19/06/08
This report supercedes reports issued on: 18/06/08

Final
Certificate
of Analysis

Laboratory Identification		**161180**	**161183**	**161185**	**161187**	**161191**	**161192**	**161194**	**161195**	**161197**	**161198**
Sample Identification		BH01F	BH03F	BH04N	BH06F	BH08N	BH09F	BH11F	BH12F	BH13N	BH14F
Depth (m)		0.5	0.5	1.5	0.5	1.5	0.5	0.5	0.5	1.5	0.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	18/6/08
Method : E002.2											
BTEX by P&T	**EQL**										
Benzene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- and para-Xylene	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ortho-Xylene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylene	--	--	--	--	--	--	--	--	--	--	--
CDFB (Surr @ 10mg/kg)	--	*89%*	*89%*	*94%*	*92%*	*88%*	*90%*	*91%*	*89%*	*89%*	*92%*
Method : E003.2											
Volatile TPH by P&T (vTPH)	**EQL**										
C6 - C9 Fraction	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E003.2: 8-10g soil extracted with 20ml methanol. Analysis by P&T/GC/FID.
E002.2: 8-10g soil extracted with 20ml methanol. Analysis by P&T/GC/PID/MSD.

Laboratory Identification		**161201**	**161202**	**161204**	**161205**	**161180d**	**161180r**	**161195d**	**161195r**	**161201s**	**lcs**
Sample Identification		BH16F	BH17F	D1	D2	QC	QC	QC	QC	QC	QC
Depth (m)		0.5	0.5	1.5	0.5	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	--	16/6/08	16/6/08
Laboratory Analysis Date		18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	--	18/6/08	--	18/6/08	16/6/08
Method : E002.2											
BTEX by P&T	**EQL**										
Benzene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	<0.2	--	99%	97%
Toluene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	100%	102%
Ethylbenzene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	94%	101%
meta- and para-Xylene	1	<1	<1	<1	<1	<1	--	<1	--	96%	105%
ortho-Xylene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	94%	104%
Total Xylene	--	--	--	--	--	--	--	--	--	--	--
CDFB (Surr @ 10mg/kg)	--	*88%*	*86%*	*91%*	*87%*	*89%*	*0%*	*89%*	*0%*	*87%*	*101%*
Method : E003.2											
Volatile TPH by P&T (vTPH)	**EQL**										
C6 - C9 Fraction	10	<10	<10	<10	<10	<10	--	<10	--	93%	96%

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E003.2: 8-10g soil extracted with 20ml methanol. Analysis by P&T/GC/FID.
E002.2: 8-10g soil extracted with 20ml methanol. Analysis by P&T/GC/PID/MSD.

Laboratory Identification		**mb**										
Sample Identification		QC										
Depth (m)		--										
Sampling Date recorded on COC		--										
Laboratory Extraction (Preparation) Date		16/6/08										
Laboratory Analysis Date		17/6/08										
Method : E002.2												
BTEX by P&T	**EQL**											
Benzene	0.2	<0.2										
Toluene	0.5	<0.5										
Ethylbenzene	0.5	<0.5										
meta- and para-Xylene	1	<1										
ortho-Xylene	0.5	<0.5										
Total Xylene	--	--										
CDFB (Surr @ 10mg/kg)	--	*98%*										
Method : E003.2												
Volatile TPH by P&T (vTPH)	**EQL**											
C6 - C9 Fraction	10	<10										

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E003.2: 8-10g soil extracted with 20ml methanol. Analysis by P&T/GC/FID.
E002.2: 8-10g soil extracted with 20ml methanol. Analysis by P&T/GC/PID/MSD.

Laboratory Identification		**161206**	**lcs**	**mb**							
Sample Identification		Rinsate R1	QC	QC							
Depth (m)		--	--	--							
Sampling Date recorded on COC		6/6/08	--	--							
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08							
Laboratory Analysis Date		17/6/08	17/6/08	17/6/08							
Method : E002.1											
BTEX by P&T	**EQL**										
Benzene	1	<1	97%	<1							
Toluene	1	<1	97%	<1							
Ethylbenzene	1	<1	96%	<1							
meta- & para-Xylene	2	<2	94%	<2							
ortho-Xylene	1	<1	92%	<1							
Total Xylene	--	--	--	--							
4-BFB (Surr @ 100ug/l)	--	*101%*	*101%*	*101%*							
Method : E003.1											
Volatile TPH by P&T (vTPH)	**EQL**										
C6-C9	50	<50	98%	<50							

Results expressed in ug/l unless otherwise specified

Comments:

E002.1: Direct injection into P&T/GC/PID/MSD.
E003.1: Direct injection into P&T/GC/FID.

Laboratory Identification		**161180**	**161183**	**161185**	**161187**	**161191**	**161192**	**161194**	**161195**	**161197**	**161198**
Sample Identification		BH01F	BH03F	BH04N	BH06F	BH08N	BH09F	BH11F	BH12F	BH13N	BH14F
Depth (m)		0.5	0.5	1.5	0.5	1.5	0.5	0.5	0.5	1.5	0.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Method : E006.2											
Petroleum Hydrocarbons (TPH)	**EQL**										
C10 - C14 Fraction	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Sum of TPH C10 - C36	--	--	--	--	--	--	--	--	--	--	--

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E006.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/FID.

Laboratory Identification		**161201**	**161202**	**161204**	**161205**	**161180d**	**161180r**	**161195d**	**161195r**	**161201s**	**lcs**
Sample Identification		BH16F	BH17F	D1	D2	QC	QC	QC	QC	QC	QC
Depth (m)		0.5	0.5	1.5	0.5	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	--	16/6/08	16/6/08
Laboratory Analysis Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	--	16/6/08	16/6/08
Method : E006.2											
Petroleum Hydrocarbons (TPH)	**EQL**										
C10 - C14 Fraction	50	<50	<50	<50	<50	<50	--	<50	--	86%	84%
C15 - C28 Fraction	100	<100	<100	<100	<100	<100	--	<100	--	--	--
C29 - C36 Fraction	100	<100	<100	<100	<100	<100	--	<100	--	--	--
Sum of TPH C10 - C36	--	--	--	--	--	--	--	--	--	--	--

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E006.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/FID.

Laboratory Identification		**mb**									
Sample Identification		QC									
Depth (m)		--									
Sampling Date recorded on COC		--									
Laboratory Extraction (Preparation) Date		16/6/08									
Laboratory Analysis Date		16/6/08									
Method : E006.2											
Petroleum Hydrocarbons (TPH)	**EQL**										
C10 - C14 Fraction	50	<50									
C15 - C28 Fraction	100	<100									
C29 - C36 Fraction	100	<100									
Sum of TPH C10 - C36	--	--									

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E006.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/FID.

Laboratory Identification		**161206**	**lcs**	**mb**								
Sample Identification		Rinsate R1	QC	QC								
Depth (m)		--	--	--								
Sampling Date recorded on COC		6/6/08	--	--								
Laboratory Extraction (Preparation) Date		13/6/08	13/6/08	13/6/08								
Laboratory Analysis Date		16/6/08	16/6/08	16/6/08								
Method : E004.1												
Petroleum Hydrocarbons (TPH)	**EQL**											
C10-C14 Fraction	50	<50	--	<50								
C15-C28 Fraction	200	<200	79%	<200								
C29-C36 Fraction	50	<50	--	<50								
Sum of TPH C10 - C36	--	--	--	--								

Results expressed in ug/l unless otherwise specified

Comments:

E004.1: Triple extraction with DCM. Analysis by GC/FID.

Laboratory Identification		**161180**	**161183**	**161185**	**161187**	**161191**	**161192**	**161194**	**161195**	**161197**	**161198**
Sample Identification		BH01F	BH03F	BH04N	BH06F	BH08N	BH09F	BH11F	BH12F	BH13N	BH14F
Depth (m)		0.5	0.5	1.5	0.5	1.5	0.5	0.5	0.5	1.5	0.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	18/6/08	17/6/08	18/6/08	18/6/08
Method : E007.2											
Polyaromatic Hydrocarbons (PAH)	**EQL**										
Naphthalene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	0.5	1.2	0.6	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	0.5	1.2	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)&(k)fluoranthene	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(a) pyrene	0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a,h)anthracene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of reported PAHs	--	6.4	1.1	--	--	--	0.5	--	--	--	--
2-FBP (Surr @ 5mg/kg)	--	*72%*	*73%*	*75%*	*77%*	*81%*	*76%*	*79%*	*72%*	*73%*	*75%*
TP-d14 (Surr @ 5mg/kg)	--	*86%*	*83%*	*92%*	*88%*	*86%*	*85%*	*90%*	*81%*	*86%*	*86%*

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E007.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/MS.

LabMark
ENVIRONMENTAL LABORATORIES

Laboratory Report No: E038124
Client Name: Aargus Pty. Ltd
Contact Name: Con Kariotoglou
Client Reference: Bexley E2252

Page: 10 of 29
plus cover page
Date: 19/06/08
This report supercedes reports issued on: 18/06/08

Final
Certificate
of Analysis

Laboratory Identification		**161201**	**161202**	**161205**	**161180d**	**161180r**	**161195d**	**161195r**	**161201s**	**lcs**	**mb**
Sample Identification		BH16F	BH17F	D2	QC	QC	QC	QC	QC	QC	QC
Depth (m)		0.5	0.5	0.5	--	--	--	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	--	--	--	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	--	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		18/6/08	18/6/08	18/6/08	18/6/08	--	18/6/08	--	18/6/08	16/6/08	16/6/08
Method : E007.2											
Polyaromatic Hydrocarbons (PAH)	**EQL**										
Naphthalene	0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	84%	88%	<0.5
Acenaphthylene	0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	82%	86%	<0.5
Acenaphthene	0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	83%	87%	<0.5
Fluorene	0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	83%	87%	<0.5
Phenanthrene	0.5	<0.5	<0.5	<0.5	0.9	57%	<0.5	--	88%	90%	<0.5
Anthracene	0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	87%	92%	<0.5
Fluoranthene	0.5	<0.5	<0.5	<0.5	1.9	45%	<0.5	--	101%	91%	<0.5
Pyrene	0.5	<0.5	<0.5	<0.5	1.9	45%	<0.5	--	99%	94%	<0.5
Benz(a)anthracene	0.5	<0.5	<0.5	<0.5	0.8	29%	<0.5	--	76%	78%	<0.5
Chrysene	0.5	<0.5	<0.5	<0.5	0.9	40%	<0.5	--	97%	97%	<0.5
Benzo(b)&(k)fluoranthene	1	<1	<1	<1	2	67%	<1	--	91%	81%	<1
Benzo(a) pyrene	0.5	<0.5	<0.5	<0.5	1.1	32%	<0.5	--	95%	87%	<0.5
Indeno(1,2,3-c,d)pyrene	0.5	<0.5	<0.5	<0.5	0.6	>18%	<0.5	--	86%	80%	<0.5
Dibenz(a,h)anthracene	0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--	86%	87%	<0.5
Benzo(g,h,i)perylene	0.5	<0.5	<0.5	<0.5	0.6	18%	<0.5	--	88%	84%	<0.5
Sum of reported PAHs	--	--	--	--	10.7	50%	--	--	--	--	--
2-FBP (Surr @ 5mg/kg)	--	*75%*	*76%*	*74%*	*80%*	*11%*	*75%*	*4%*	*76%*	*88%*	*76%*
TP-d14 (Surr @ 5mg/kg)	--	*86%*	*87%*	*80%*	*91%*	*6%*	*91%*	*12%*	*88%*	*99%*	*84%*

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E007.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/MS.

Laboratory Identification		**161184**	**161186**	**161195**	**161198**	**161201**	**161205**	**161195d**	**161195r**	**161201s**	**lcs**
Sample Identification		BH04F	BH05F	BH12F	BH14F	BH16F	D2	QC	QC	QC	QC
Depth (m)		0.5	0.5	0.5	0.5	0.5	0.5	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	16/6/08
Laboratory Analysis Date		17/6/08	17/6/08	17/6/08	18/6/08	18/6/08	18/6/08	18/6/08	--	18/6/08	16/6/08
Method : E008.2											
Phenols by GC/MS	**EQL**										
Phenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	73%	93%
2-chlorophenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	81%	90%
2-methylphenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	53%	97%
3-&4-methylphenol	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	93%	99%
2-nitrophenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	68%	79%
2,4-dimethylphenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	57%	84%
2,4-dichlorophenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	63%	82%
4-chloro-3-methylphenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	52%	78%
2,4,6-trichlorophenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	54%	78%
2,4,5-trichlorophenol	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	71%	62%
Pentachlorophenol	1	<1	<1	<1	<1	<1	<1	<1	--	54%	55%
Sum of reported phenols	--	--	--	--	--	--	--	--	--	--	--
2-FP (Surr @ 5mg/kg)	--	*86%*	*90%*	*89%*	*87%*	*96%*	*86%*	*89%*	*0%*	*88%*	*112%*
Phenol-d5 (Surr @ 5mg/kg)	--	*58%*	*73%*	*73%*	*64%*	*76%*	*61%*	*80%*	*9%*	*71%*	*96%*
2,4,6-TBP (Surr @ 5mg/kg)	--	*55%*	*71%*	*59%*	*64%*	*54%*	*53%*	*61%*	*3%*	*65%*	*96%*

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E008.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/MS.

Laboratory Report No: E038124
Client Name: Aargus Pty. Ltd
Contact Name: Con Kariotoglou
Client Reference: Bexley E2252

Date: 19/06/08
This report supercedes reports issued on: 18/06/08

Final
Certificate
of Analysis

Laboratory Identification		**mb**									
Sample Identification		QC									
Depth (m)		--									
Sampling Date recorded on COC		--									
Laboratory Extraction (Preparation) Date		16/6/08									
Laboratory Analysis Date		16/6/08									
Method : E008.2											
Phenols by GC/MS	**EQL**										
Phenol	0.5	<0.5									
2-chlorophenol	0.5	<0.5									
2-methylphenol	0.5	<0.5									
3-&4-methylphenol	1.0	<1.0									
2-nitrophenol	0.5	<0.5									
2,4-dimethylphenol	0.5	<0.5									
2,4-dichlorophenol	0.5	<0.5									
4-chloro-3-methylphenol	0.5	<0.5									
2,4,6-trichlorophenol	0.5	<0.5									
2,4,5-trichlorophenol	0.5	<0.5									
Pentachlorophenol	1	<1									
Sum of reported phenols	--	--									
2-FP (Surr @ 5mg/kg)	--	*99%*									
Phenol-d5 (Surr @ 5mg/kg)	--	*86%*									
2,4,6-TBP (Surr @ 5mg/kg)	--	*66%*									

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E008.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/MS.

Laboratory Identification		**161182**	**161186**	**161190**	**161193**	**161195**	**161205**	**161195d**	**161195r**	**161193s**	**lcs**
Sample Identification		BH02F	BH05F	BH08F	BH10F	BH12F	D2	QC	QC	QC	QC
Depth (m)		0.5	0.5	0.5	0.5	0.5	0.5	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	16/6/08
Laboratory Analysis Date		18/6/08	19/6/08	19/6/08	19/6/08	19/6/08	19/6/08	19/6/08	--	18/6/08	16/6/08
Method : E013.2											
Organochlorine Pesticides (OC)	**EQL**										
a-BHC	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	120%	104%
Hexachlorobenzene	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	111%	112%
b-BHC	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	129%	105%
g-BHC (Lindane)	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	116%	100%
d-BHC	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	116%	107%
Heptachlor	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	106%	103%
Aldrin	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	115%	110%
Heptachlor epoxide	0.05	<0.05	<0.05	<0.05	0.1	<0.05	0.07	<0.05	--	129%	108%
trans-chlordane	0.05	<0.05	<0.05	<0.05	0.18	<0.05	0.10	<0.05	--	#	106%
Endosulfan I	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	112%	108%
cis-chlordane	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	##	105%
Dieldrin	0.05	<0.05	0.06	<0.05	0.42	0.07	0.12	0.05	33%	##	100%
4,4-DDE	0.05	<0.05	0.32	<0.05	0.18	0.43	0.29	0.43	0%	##	107%
Endrin	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	113%	111%
Endosulfan II	0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	115%	109%
4,4-DDD	0.05	<0.05	0.05	<0.05	0.18	0.05	0.05	0.05	0%	##	108%
Endosulfan sulphate	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	89%	70%
4,4-DDT	0.2	<0.2	0.4	<0.2	<0.2	0.3	0.7	0.3	0%	##	107%
Methoxychlor	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	93%	96%
DBC (Surr @ 0.2mg/kg)	--	*130%*	*127%*	*129%*	*129%*	*71%*	*126%*	*76%*	*7%*	*74%*	*116%*

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample. ## Percent recovery not available due to interference from the sample.

E013.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/dual ECD.

Laboratory Identification		**mb**									
Sample Identification		QC									
Depth (m)		--									
Sampling Date recorded on COC		--									
Laboratory Extraction (Preparation) Date		16/6/08									
Laboratory Analysis Date		16/6/08									
Method : E013.2											
Organochlorine Pesticides (OC)	**EQL**										
a-BHC	0.05	<0.05									
Hexachlorobenzene	0.05	<0.05									
b-BHC	0.05	<0.05									
g-BHC (Lindane)	0.05	<0.05									
d-BHC	0.05	<0.05									
Heptachlor	0.05	<0.05									
Aldrin	0.05	<0.05									
Heptachlor epoxide	0.05	<0.05									
trans-chlordane	0.05	<0.05									
Endosulfan I	0.05	<0.05									
cis-chlordane	0.05	<0.05									
Dieldrin	0.05	<0.05									
4,4-DDE	0.05	<0.05									
Endrin	0.05	<0.05									
Endosulfan II	0.05	<0.05									
4,4-DDD	0.05	<0.05									
Endosulfan sulphate	0.05	<0.05									
4,4-DDT	0.2	<0.2									
Methoxychlor	0.2	<0.2									
DBC (Surr @ 0.2mg/kg)	--	*96%*									

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample. ## Percent recovery not available due to interference from the sample.

E013.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/dual ECD.

Laboratory Identification		**161184**	**161186**	**161195**	**161198**	**161201**	**161205**	**161195d**	**161195r**	**161201s**	**lcs**
Sample Identification		BH04F	BH05F	BH12F	BH14F	BH16F	D2	QC	QC	QC	QC
Depth (m)		0.5	0.5	0.5	0.5	0.5	0.5	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	16/6/08
Laboratory Analysis Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	16/6/08
Method : E013.2											
Polychlorinated Biphenyls (PCB)	**EQL**										
Arochlor 1016	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
Arochlor 1232	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
Arochlor 1242	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
Arochlor 1248	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	84%	81%
Arochlor 1254	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
Arochlor 1260	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--
Sum of reported PCBs	--	--	--	--	--	--	--	--	--	--	--
DBC (Surr @ 0.2mg/kg)	--	*125%*	*125%*	*120%*	*124%*	*125%*	*125%*	*122%*	*2%*	*115%*	*94%*

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E013.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/dual ECD.

Laboratory Identification		**mb**									
Sample Identification		QC									
Depth (m)		--									
Sampling Date recorded on COC		--									
Laboratory Extraction (Preparation) Date		16/6/08									
Laboratory Analysis Date		16/6/08									
Method : E013.2											
Polychlorinated Biphenyls (PCB)	**EQL**										
Arochlor 1016	0.5	<0.5									
Arochlor 1232	0.5	<0.5									
Arochlor 1242	0.5	<0.5									
Arochlor 1248	0.5	<0.5									
Arochlor 1254	0.5	<0.5									
Arochlor 1260	0.5	<0.5									
Sum of reported PCBs	--	--									
DBC (Surr @ 0.2mg/kg)	--	*97%*									

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E013.2: 8-10g soil extracted with 20ml DCM/Acetone/Hexane (10:45:45). Analysis by GC/dual ECD.

Laboratory Identification		**161180**	**161181**	**161182**	**161183**	**161184**	**161185**	**161186**	**161187**	**161188**	**161189**
Sample Identification		BH01F	BH01N	BH02F	BH03F	BH04F	BH04N	BH05F	BH06F	BH07F	BH07N
Depth (m)		0.5	01.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	1.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Method : E022.2											
Acid extractable metals (M7)	**EQL**										
Arsenic	1	11	1	3	6	4	<1	3	1	6	1
Cadmium	0.1	0.3	<0.1	<0.1	0.1	0.3	<0.1	0.3	0.2	0.7	<0.1
Chromium	1	9	7	9	5	10	2	17	8	15	6
Copper	2	14	<2	2	6	8	<2	7	4	10	2
Nickel	1	3	<1	1	1	5	<1	3	2	2	<1
Lead	2	56	5	15	33	57	3	36	6	27	20
Zinc	5	53	<5	10	22	32	<5	29	7	28	<5

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**161190**	**161191**	**161192**	**161193**	**161194**	**161195**	**161196**	**161197**	**161198**	**161199**
Sample Identification		BH08F	BH08N	BH09F	BH10F	BH11F	BH12F	BH13F	BH13N	BH14F	BH15F
Depth (m)		0.5	1.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		16/6/08	16/6/08	16/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08
Method : E022.2											
Acid extractable metals (M7)	**EQL**										
Arsenic	1	6	3	5	2	12	9	4	3	4	7
Cadmium	0.1	0.1	<0.1	0.1	0.2	0.4	1.2	0.5	<0.1	0.9	0.7
Chromium	1	4	8	7	12	10	36	9	11	23	13
Copper	2	5	<2	6	9	10	37	13	<2	13	12
Nickel	1	1	<1	2	4	3	5	8	2	6	8
Lead	2	24	3	27	10	43	206	55	3	38	93
Zinc	5	34	<5	25	17	79	175	44	5	32	61

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**161200**	**161201**	**161202**	**161203**	**161204**	**161205**	**161180d**	**161180r**	**161188d**	**161188r**
Sample Identification		BH15N	BH16F	BH17F	BH17N	D1	D2	QC	QC	QC	QC
Depth (m)		1.5	0.5	0.5	1.5	1.5	0.5	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	--
Laboratory Analysis Date		17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	16/6/08	--	16/6/08	--
Method : E022.2											
Acid extractable metals (M7)	**EQL**										
Arsenic	1	2	3	4	3	3	5	8	32%	7	15%
Cadmium	0.1	<0.1	1.1	0.3	<0.1	<0.1	1.4	0.2	40%	0.6	15%
Chromium	1	5	24	13	12	9	42	9	0%	12	22%
Copper	2	4	13	11	<2	<2	20	14	0%	9	11%
Nickel	1	1	2	5	<1	<1	7	3	0%	3	40%
Lead	2	6	36	51	3	7	72	68	19%	65	83%
Zinc	5	6	29	50	<5	<5	55	43	21%	26	7%

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**161195d**	**161195r**	**161188t**	**161195t**	**161201s**	**161183s**	**crm**	**crm**	**lcs**	**lcs**
Sample Identification		QC	QC	QC	QC	QC	QC	QC	QC	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		--	--	--	--	--	--	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	--	17/6/08	17/6/08	16/6/08	16/6/08	16/6/08	17/6/08	16/6/08	17/6/08
Laboratory Analysis Date		17/6/08	--	18/6/08	18/6/08	17/6/08	16/6/08	16/6/08	17/6/08	16/6/08	17/6/08
Method : E022.2 **Acid extractable metals (M7)**	**EQL**										
Arsenic	1	10	11%	--	14	104%	92%	102%	93%	100%	92%
Cadmium	0.1	0.6	67%	--	0.8	125%	98%	99%	97%	101%	100%
Chromium	1	22	48%	--	36	82%	104%	103%	86%	107%	90%
Copper	2	22	51%	--	23	112%	100%	97%	93%	106%	93%
Nickel	1	3	50%	--	3	119%	99%	105%	80%	107%	93%
Lead	2	58	112%	43	189	#	121%	98%	95%	104%	100%
Zinc	5	74	81%	--	80	#	149%	100%	94%	108%	92%

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**mb**	**mb**								
Sample Identification		QC	QC								
Depth (m)		--	--								
Sampling Date recorded on COC		--	--								
Laboratory Extraction (Preparation) Date		16/6/08	17/6/08								
Laboratory Analysis Date		16/6/08	17/6/08								
Method : E022.2											
Acid extractable metals (M7)	**EQL**										
Arsenic	1	<1	<1								
Cadmium	0.1	<0.1	<0.1								
Chromium	1	<1	<1								
Copper	2	<2	<2								
Nickel	1	<1	<1								
Lead	2	<2	<2								
Zinc	5	<5	<5								

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E022.2: 0.5g digested in nitric/hydrochloric acid. Analysis by ICP-MS.

Laboratory Identification		**161180**	**161181**	**161182**	**161183**	**161184**	**161185**	**161186**	**161187**	**161188**	**161189**
Sample Identification		BH01F	BH01N	BH02F	BH03F	BH04F	BH04N	BH05F	BH06F	BH07F	BH07N
Depth (m)		0.5	01.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	1.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08
Method : E026.2 **Acid extractable mercury**	**EQL**										
Mercury	0.05	0.43	<0.05	0.1	0.17	0.71	<0.05	2.11	4.92	8.43	0.08

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**161190**	**161191**	**161192**	**161193**	**161194**	**161195**	**161196**	**161197**	**161198**	**161199**
Sample Identification		BH08F	BH08N	BH09F	BH10F	BH11F	BH12F	BH13F	BH13N	BH14F	BH15F
Depth (m)		0.5	1.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		17/6/08	17/6/08	17/6/08	17/6/08	18/6/08	17/6/08	17/6/08	17/6/08	18/6/08	18/6/08
Method : E026.2 **Acid extractable mercury**	**EQL**										
Mercury	0.05	0.25	0.06	0.59	1.37	2.92	1.93	0.73	0.07	10.9	1.78

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**161200**	**161201**	**161202**	**161203**	**161204**	**161205**	**161180d**	**161180r**	**161188d**	**161188r**
Sample Identification		BH15N	BH16F	BH17F	BH17N	D1	D2	QC	QC	QC	QC
Depth (m)		1.5	0.5	0.5	1.5	1.5	0.5	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	--
Laboratory Analysis Date		17/6/08	18/6/08	18/6/08	17/6/08	17/6/08	18/6/08	17/6/08	--	17/6/08	--
Method : E026.2											
Acid extractable mercury	**EQL**										
Mercury	0.05	0.98	13.0	1.05	0.07	<0.05	0.38	0.29	39%	6.14	31%

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**161195d**	**161195r**	**161195t**	**161201s**	**161183s**	**crm**	**crm**	**lcs**	**lcs**	**mb**
Sample Identification		QC	QC	QC	QC	QC	QC	QC	QC	QC	QC
Depth (m)		--	--	--	--	--	--	--	--	--	--
Sampling Date recorded on COC		--	--	--	--	--	--	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	--	17/6/08	16/6/08	16/6/08	16/6/08	17/6/08	16/6/08	17/6/08	16/6/08
Laboratory Analysis Date		17/6/08	--	19/6/08	19/6/08	17/6/08	16/6/08	17/6/08	16/6/08	17/6/08	16/6/08
Method : E026.2											
Acid extractable mercury	**EQL**										
Mercury	0.05	1.06	58%	1.09	#	99%	103%	86%	91%	84%	<0.05

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Identification		**mb**										
Sample Identification		QC										
Depth (m)		--										
Sampling Date recorded on COC		--										
Laboratory Extraction (Preparation) Date		17/6/08										
Laboratory Analysis Date		17/6/08										
Method : E026.2 **Acid extractable mercury**	**EQL**											
Mercury	0.05	<0.05										

Results expressed in mg/kg dry weight unless otherwise specified

Comments: # Percent recovery not available due to significant background levels of analyte in sample.

E026.2: 0.5g digested with nitric/hydrochloric acid. Analysis by CV-ICP-MS or FIMS.

Laboratory Report No: E038124
Client Name: Aargus Pty. Ltd
Contact Name: Con Kariotoglou
Client Reference: Bexley E2252

Date: 19/06/08
This report supercedes reports issued on: 18/06/08

Final
Certificate
of Analysis

Laboratory Identification		**161206**	**lcs**	**mb**							
Sample Identification		Rinsate R1	QC	QC							
Depth (m)		--	--	--							
Sampling Date recorded on COC		6/6/08	--	--							
Laboratory Extraction (Preparation) Date		17/6/08	17/6/08	17/6/08							
Laboratory Analysis Date		17/6/08	17/6/08	17/6/08							
Method : E022.1											
Filtered metals (M7)	**EQL**										
Arsenic	1	<1	100%	<1							
Cadmium	0.1	<0.1	88%	<0.1							
Chromium	1	<1	100%	<1							
Copper	1	240	102%	<1							
Nickel	1	<1	103%	<1							
Lead	1	<1	93%	<1							
Zinc	5	14	100%	<5							

Results expressed in ug/l unless otherwise specified

Comments:

E022.1: Filtered HNO3 preserved sample directly analysed by ICP-MS.

Laboratory Identification		**161206**	**lcs**	**mb**							
Sample Identification		Rinsate R1	QC	QC							
Depth (m)		--	--	--							
Sampling Date recorded on COC		6/6/08	--	--							
Laboratory Extraction (Preparation) Date		17/6/08	17/6/08	17/6/08							
Laboratory Analysis Date		18/6/08	18/6/08	18/6/08							
Method : E026.1											
Filtered mercury	**EQL**										
Mercury	0.1	<0.1	95%	<0.1							

Results expressed in ug/l unless otherwise specified

Comments:

E026.1: Analysis by CV-ICP-MS or FIMS following BrCl pre-treatment.

Laboratory Identification		**161184**	**161186**	**161195**	**161198**	**161201**	**161205**	**161195d**	**161195r**	**161201s**	**lcs**
Sample Identification		BH04F	BH05F	BH12F	BH14F	BH16F	D2	QC	QC	QC	QC
Depth (m)		0.5	0.5	0.5	0.5	0.5	0.5	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	16/6/08
Laboratory Analysis Date		17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	17/6/08	--	17/6/08	17/6/08
Method : E040.2/E054.2											
Total Cyanide	**EQL**										
Total Cyanide	1	<1	<1	<1	<1	<1	<1	<1	--	106%	81%

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E040.2/E054.2: Caustic extract followed by strong acid distillion. Analysis by colour.

Laboratory Identification		**mb**									
Sample Identification		QC									
Depth (m)		--									
Sampling Date recorded on COC		--									
Laboratory Extraction (Preparation) Date		16/6/08									
Laboratory Analysis Date		17/6/08									
Method : E040.2/E054.2											
Total Cyanide	**EQL**										
Total Cyanide	1	<1									

Results expressed in mg/kg dry weight unless otherwise specified

Comments:

E040.2/E054.2: Caustic extract followed by strong acid distillion. Analysis by colour.

Laboratory Identification		**161180**	**161181**	**161182**	**161183**	**161184**	**161185**	**161186**	**161187**	**161188**	**161189**
Sample Identification		BH01F	BH01N	BH02F	BH03F	BH04F	BH04N	BH05F	BH06F	BH07F	BH07N
Depth (m)		0.5	01.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	1.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		--	--	--	--	--	--	--	--	--	--
Method : E005.2											
Moisture	**EQL**										
Moisture	--	12	14	12	14	16	10	17	12	14	16

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**161190**	**161191**	**161192**	**161193**	**161194**	**161195**	**161196**	**161197**	**161198**	**161199**
Sample Identification		BH08F	BH08N	BH09F	BH10F	BH11F	BH12F	BH13F	BH13N	BH14F	BH15F
Depth (m)		0.5	1.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08
Laboratory Analysis Date		--	--	--	--	--	--	--	--	--	--
Method : E005.2											
Moisture	**EQL**										
Moisture	--	15	13	14	33	13	19	20	14	17	11

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**161200**	**161201**	**161202**	**161203**	**161204**	**161205**	**161180d**	**161180r**	**161188d**	**161188r**
Sample Identification		BH15N	BH16F	BH17F	BH17N	D1	D2	QC	QC	QC	QC
Depth (m)		1.5	0.5	0.5	1.5	1.5	0.5	--	--	--	--
Sampling Date recorded on COC		6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	6/6/08	--	--	--	--
Laboratory Extraction (Preparation) Date		16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	16/6/08	--	16/6/08	--
Laboratory Analysis Date		--	--	--	--	--	--	--	--	--	--
Method : E005.2											
Moisture	**EQL**										
Moisture	--	13	16	18	12	13	17	12	0%	15	7%

Results expressed in % w/w unless otherwise specified

Comments:

E005.2: Moisture by gravimetric analysis. Results are in % w/w.

Laboratory Identification		**161195d**	**161195r**								
Sample Identification		QC	QC								
Depth (m)		--	--								
Sampling Date recorded on COC		--	--								
Laboratory Extraction (Preparation) Date		16/6/08	--								
Laboratory Analysis Date		--	--								
Method : E005.2											
Moisture	**EQL**										
Moisture	--	18	5%								

Results expressed in % w/w unless otherwise specified

Comments:

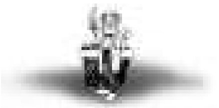
E005.2: Moisture by gravimetric analysis. Results are in % w/w.

LabMark
ENVIRONMENTAL LABORATORIES

Report Date : 12/06/2008
Report Time : 11:21:05AM

Quality, Service, Support

Sample **Receipt** Notice (SRN) for E038124



Client Details

Client Name:	Aargus Pty. Ltd
Client Phone:	02 9568 6159
Client Fax:	1300 136 038
Contact Name:	Con Kariotoglou
Contact Email:	admin@aargus.net
Client Address:	PO Box 398 Drummoyne NSW 1470
Project Name:	Bexley
Project Number:	E2252
CoC Serial Number:	- Not provided -
Purchase Order:	- Not provided -
Surcharge:	No surcharge applied (results by 6:30pm on due date)
Sample Matrix:	SOIL & WATER

Laboratory Reference Information

Please have this information ready when contacting Labmark.

Laboratory Report:	**E038124**
Quotation Number:	- Not provided, standard prices apply
Laboratory Address:	Unit 1, 8 Leighton Pl. Asquith NSW 2077
Phone:	61 2 9476 6533
Fax:	61 2 9476 8219
Sample Receipt Contact:	Ros Schacht
Email:	Ros.Schacht@labmark.com.au
Reporting Contact:	Geoff Weir
Email:	geoff.weir@labmark.com.au

Date Sampled (earliest date):	06/06/2008
Date Samples Received:	10/06/2008
Date Sample Receipt Notice issued:	12/06/2008
Date Preliminary Report Due:	18/06/2008

NATA Accreditation:	13542
TGA GMP License:	185-336 (Sydney)
APVMA License:	6105 (Sydney)
AQIS Approval:	NO356 (Sydney)
AQIS Entry Permit:	200521534 (Sydney)

Reporting Requirements: Electronic Data Download required: No

Invoice Number: 32396

Sample Condition:
COC received with samples. Report number and lab ID's defined on COC.
Samples received in good order .
Samples received with cooling media: Ice bricks .
Samples received chilled.
Security seals not required. Direct Labmark's custody taken .
Sample container & chemical preservation suitable .

Comments:

Holding Times: Date received allows for sufficient time to meet Technical Holding Times.

Preservation: Chemical preservation of samples satisfactory for requested analytes.

Important Notes:
LabMark shall responsibly dispose of spent customer soil and water samples which includes the disintegration of the sample label. A sample disposal fee of $1.00 is applicable on all samples received by the laboratory regardless of whether they have undergone analytical testing. Sample disposal of environmental samples shall be 31 days (water) and 3 months (soil, HN03 preserved samples) after laboratory receipt, unless otherwise requested in writing by the client. Samples requested to be held in non-refrigerated storage shall incur $5.00/ sample/ 3 months. Additional refrigerated storage shall incur $30/ sample/ 3 months. Combination prices apply only if requested. Transfer of report ownership from LabMark to the client shall occur once full and final payment has been settled and verified. All report copies may be retracted where full payment does not occur within the agreed settlement period.

Analysis comments:

Subcontracted Analyses:

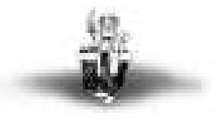
Thank you for choosing Labmark to analyse your project samples.
Additional information on www.labmark.com.au

Report Date : 12/06/2008
Report Time : 11:21:05AM

LabMark
ENVIRONMENTAL LABORATORIES

Quality, Service, Support

Sample **Receipt** Notice (SRN) for **E038124**



The table below represents LabMark's understanding and interpretation of the customer supplied sample COC request (refer to SRN comments section on first page for external subcontracting method details). Please confirm that your COC request has been entered correctly. Due to THT and TAT requirements, testing shall commence immediately as per this table, unless the customer intervenes with a correction prior to testing.

GRID REVIEW TABLE

Requested Analysis

No.	Date	Depth	Client Sample ID	BTEX by P&T	BTEX by P&T	Filtered mercury	Acid extractable mercury	Filtered metals (M7)	Acid extractable metals (M7)	Moisture	Organochlorine Pesticides (OC)	Polyaromatic Hydrocarbons (PAH)	Polychlorinated Biphenyls (PCB)	Phenols by GC/MS	PREP Not Reported	PREP Not Reported	Total Cyanide	Petroleum Hydrocarbons (TPH)	Petroleum Hydrocarbons (TPH)	Volatile TPH by P&T (vTPH)	Volatile TPH by P&T (vTPH)		
161180	06/06	0.5	BH01F	●			●		●	●		●			●			●		●			
161181	06/06	01.5	BH01N				●		●	●					●								
161182	06/06	0.5	BH02F				●		●	●	●				●								
161183	06/06	0.5	BH03F	●			●		●	●		●			●			●		●			
161184	06/06	0.5	BH04F				●		●	●			●	●	●		●						
161185	06/06	1.5	BH04N	●			●		●	●		●			●			●		●			
161186	06/06	0.5	BH05F				●		●	●	●		●	●	●		●						
161187	06/06	0.5	BH06F	●			●		●	●		●			●			●		●			
161188	06/06	0.5	BH07F				●		●	●					●								
161189	06/06	1.5	BH07N				●		●	●					●								
161190	06/06	0.5	BH08F				●		●	●	●				●								
161191	06/06	1.5	BH08N	●			●		●	●		●			●			●		●			
161192	06/06	0.5	BH09F	●			●		●	●		●			●			●		●			
161193	06/06	0.5	BH10F				●		●	●	●				●								
161194	06/06	0.5	BH11F	●			●		●	●		●			●			●		●			
161195	06/06	0.5	BH12F	●			●		●	●	●	●	●	●	●		●	●		●			
161196	06/06	0.5	BH13F				●		●	●					●								
161197	06/06	1.5	BH13N	●			●		●	●		●			●			●		●			
161198	06/06	0.5	BH14F	●			●		●	●		●	●	●	●		●	●		●			
161199	06/06	0.5	BH15F				●		●	●					●								
161200	06/06	1.5	BH15N				●		●	●					●								
161201	06/06	0.5	BH16F	●			●		●	●		●	●	●	●		●	●		●			
161202	06/06	0.5	BH17F	●			●		●	●		●			●			●		●			
161203	06/06	1.5	BH17N				●		●	●					●								
161204	06/06	1.5	D1	●			●		●	●					●			●		●			
161205	06/06	0.5	D2	●			●		●	●	●	●	●	●	●		●	●		●			
161206	06/06		Rinsate R1		●	●		●								●			●		●		
			Totals:	14	1	1	26	1	26	26	6	13	6	6	26	1	6	14	1	14	1		

'PREP Not Reported' refers to an internal laboratory instruction - client confirmation of this parameter is not required.

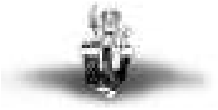
Thank you for choosing Labmark to analyse your project samples.
Additional information on www.labmark.com.au

LabMark
ENVIRONMENTAL LABORATORIES

Quality, Service, Support

Report Date : 12/06/2008
Report Time : 11:21:05AM

Sample **Receipt** Notice (SRN) for **E038124**



				Requested Analysis																			
No.	Date	Depth	Client Sample ID	M8 - M7-F_W	M8 - M7-T_S																		
161180	06/06	0.5	BH01F		●																		
161181	06/06	01.5	BH01N		●																		
161182	06/06	0.5	BH02F		●																		
161183	06/06	0.5	BH03F		●																		
161184	06/06	0.5	BH04F		●																		
161185	06/06	1.5	BH04N		●																		
161186	06/06	0.5	BH05F		●																		
161187	06/06	0.5	BH06F		●																		
161188	06/06	0.5	BH07F		●																		
161189	06/06	1.5	BH07N		●																		
161190	06/06	0.5	BH08F		●																		
161191	06/06	1.5	BH08N		●																		
161192	06/06	0.5	BH09F		●																		
161193	06/06	0.5	BH10F		●																		
161194	06/06	0.5	BH11F		●																		
161195	06/06	0.5	BH12F		●																		
161196	06/06	0.5	BH13F		●																		
161197	06/06	1.5	BH13N		●																		
161198	06/06	0.5	BH14F		●																		
161199	06/06	0.5	BH15F		●																		
161200	06/06	1.5	BH15N		●																		
161201	06/06	0.5	BH16F		●																		
161202	06/06	0.5	BH17F		●																		
161203	06/06	1.5	BH17N		●																		
161204	06/06	1.5	D1		●																		
161205	06/06	0.5	D2		●																		
161206	06/06		Rinsate R1	●																			
			Totals:	1	26																		

Thank you for choosing Labmark to analyse your project samples.
Additional information on www.labmark.com.au

AARGUS PTY LTD

Laboratory Test Request / Chain of Custody Record

446 Parramatta Road
PETERSHAM NSW 2049

P O Box 398
DRUMMOYNE NSW 1470

Tel: 1300 137 038
Fax: 1300 136 038
email: admin@aargus.net

Page 1 of 3

TO: LabMark PTY LTD
UNIT 1
8 LEIGHTON PLACE
ASQUITH NSW 2077

PH: 02 9476 6533 **FAX:** 02 9476 8219
ATTN:

Sampling Date: 06.06.2008 **Job No:** E2252
Sampled By: CK,MB **Project:** Bexley
Project Manager: CK **Location:** Bexley

Results required by: Monday, 16 - 06 - 2008 (by 4pm)

Sampling details		Sample type											
Location	Depth (m)	Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH / BTEX	PAH	OCP	PCB	Phenols	Cyanides			KEEP SAMPLE
161180 BH01F	0.5	DSG		✓	✓	✓							YES
161181 BH01N	1.5	DSG		✓									YES
161182 BH02F	0.5	DSG		✓			✓						YES
161183 BH03F	0.5	DSG		✓	✓	✓							YES
161184 BH04F	0.5	DSG		✓				✓	✓	✓			YES
161185 BH04N	1.5	DSG		✓	✓	✓							YES
161186 BH05F	0.5	DSG		✓			✓	✓	✓	✓			YES
161187 BH06F	0.5	DSG		✓	✓	✓							YES
161188 BH07F	0.5	DSG		✓									YES
161189 BH07N	1.5	DSG		✓			✓						YES
161190 BH08F	0.5	DSG		✓			✓						YES
161191 BH08N	1.5	DSG		✓	✓	✓							YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Mitchell Bowden	MB	11/06/2008			

Legend:
WG Water sample, glass bottle
WP Water sample, plastic bottle
USG Undisturbed soil sample (glass jar)
DSG Disturbed soil sample (glass jar)
DSP Disturbed soil sample (small plastic bag)
✓ Test required
@ mole H^+/tonne

AARGUS PTY LTD

Laboratory Test Request / Chain of Custody Record

446 Parramatta Road
PETERSHAM NSW 2049

P O Box 398
DRUMMOYNE NSW 1470

Tel: 1300 137 038
Fax: 1300 136 038
email: admin@aargus.net

Page 2 **of** 3

TO: LabMark PTY LTD
UNIT 1
8 LEIGHTON PLACE
ASQUITH NSW 2077

PH: 02 9476 6533 **FAX:** 02 9476 8219

ATTN:

Sampling Date: 06.06.2008
Job No: E2252
Sampled By: CK,MB
Project: Bexley
Project Manager: CK
Location: Bexley

Results required by: Monday, 16 - 06 - 2008 (by 4pm)

	Sampling details		Sample type											
	Location	Depth (m)	Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH / BTEX	PAH	OCP	PCB	Phenols	Cyanides			KEEP SAMPLE
161192	BH09F	0.5	DSG		✓	✓	✓							YES
161193	BH10F	0.5	DSG		✓			✓						YES
161194	BH11F	0.5	DSG		✓	✓	✓							YES
161195	BH12F	0.5	DSG		✓	✓	✓	✓	✓	✓	✓			YES
161196	BH13F	0.5	DSG		✓									YES
161197	BH13N	1.5	DSG		✓	✓	✓							YES
161198	BH14F	0.5	DSG		✓	✓	✓		✓	✓	✓			YES
161199	BH15F	0.5	DSG		✓									YES
161200	BH15N	1.5	DSG		✓									YES
161201	BH16F	0.5	DSG		✓	✓	✓	✓	✓	✓	✓			YES
161202	BH17F	0.5	DSG		✓	✓	✓							YES
161203	BH17N	1.5	DSG		✓									YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Mitchell Bowden	MB	11/06/2008			

Legend:

WG	Water sample, glass bottle	USG	Undisturbed soil sample (glass jar)	DSP	Disturbed soil sample (small plastic bag)
WP	Water sample, plastic bottle	DSG	Disturbed soil sample (glass jar)	✓	Test required

@ mole H^+/tonne

AARGUS PTY LTD

Laboratory Test Request / Chain of Custody Record

446 Parramatta Road
PETERSHAM NSW 2049

P O Box 398
DRUMMOYNE NSW 1470

Tel: 1300 137 038
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Page 3 of 3

TO: **LabMark PTY LTD**
UNIT 1
8 LEIGHTON PLACE
ASQUITH NSW 2077

PH: 02 9476 6533 **FAX:** 02 9476 8219

ATTN:

Sampling Date: 06.06.2008 **Job No:** E2252

Sampled By: CK, MB **Project:** Bexley

Project Manager: CK **Location:** Bexley

Results required by: Monday, 16 - 06 - 2008 (by 4pm)

Sampling details		Sample type										
Location	Depth (m)	Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH / BTEX	PAH	OCP	PCB	Phenols	Cyanides		KEEP SAMPLE
161204 D1	1.5	DSG		✓	✓							YES
161205 D2	0.5	DSG		✓	✓	✓	✓	✓	✓	✓		YES
161206 Rinsate (R1)	-		WP,WG	✓	✓							YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Mitchell Bowden	MB	11/06/2008			

Legend:

				DSP	
WG	Water sample, glass bottle	USG	Undisturbed soil sample (glass jar)		@ mole H^+/tonne
WP	Water sample, plastic bottle	DSG	Disturbed soil sample (glass jar)	✓	

APPENDIX D

BOREHOLE LOGS

BOREHOLE LOG

Aargus
AUSTRALIA

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH01**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
					TOPSOIL, organic loam	
0.5	**BH1F**				FILL, sandy loam with some gravel	
						No groundwater present No HC odour
1					NATURAL, CLAYEY SAND, brown, wet, medium grainec	
1.5	**BH1N**					
					Borehole terminated @ 1.5m below ground level in natural clayey san	
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole
▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH02**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
					TOPSOIL, organic loam	
0.5	**BH2F**				FILL, sandy loam	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole
▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH03**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		┅			TOPSOIL, organic loam	
0.5	**BH3F**	▨			FILL, sandy loam	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole
▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH04**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		┄			TOPSOIL, organic loam	
0.5	**BH4F**	▨			FILL, sandy loam with some gravel	
1		░			NATURAL, CLAYEY SAND, brown, wet, medium grainec	No groundwater present No HC odour
1.5	**BH4N**	░				
					Borehole terminated @ 1.5m below ground level in natural clayey san	
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH05**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		╌			TOPSOIL, organic loam	
		░				
		░				
		░				
0.5	**BH5F**	░			FILL, sandy loam with some gravel	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present
						No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
M Moist - Does not run freely but no free water visible on soil surface
W Wet - Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS	Very Soft	- Unconfined compressive strength less than 25kPa
S	Soft	- Unconfined compressive strength 25-50kPa
F	Firm	- Unconfined compressive strength 50-100kPa
St	Stiff	- Unconfined compressive strength 100-200kPa
VSt	Very Stiff	- Unconfined compressive strength 200-400kPa
H	Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH06**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		▭			TOPSOIL, organic loam	
0.5	**BH6F**	▨			FILL, sandy loam with some gravel	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH07**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
					TOPSOIL, organic loam	
0.5	**BH7F**				FILL, sandy loam with some gravel	
1					NATURAL, CLAYEY SAND, brown, wet, medium grainec	No groundwater present No HC odour
1.5	**BH7N**					
					Borehole terminated @ 1.5m below ground level in natural clayey san	
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH08**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		▤			TOPSOIL, organic loam	
0.5	**BH8F**	▨			FILL, sandy loam	
		░				No groundwater present No HC odour
1		░			NATURAL, CLAYEY SAND, brown, wet, medium grainec	
1.5	**BH8N**	░				
					Borehole terminated @ 1.5m below ground level in natural clayey san	
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼	Standing groundwater level in borehole
▶	Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS	Very Soft	- Unconfined compressive strength less than 25kPa
S	Soft	- Unconfined compressive strength 25-50kPa
F	Firm	- Unconfined compressive strength 50-100kPa
St	Stiff	- Unconfined compressive strength 100-200kPa
VSt	Very Stiff	- Unconfined compressive strength 200-400kPa
H	Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH09**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		┄			TOPSOIL, organic loam	
0.5	**BH9F**	⁙			FILL, sandy loam	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH10**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		▤			TOPSOIL, organic loam	
0.5	**BH10F**	▨			FILL, sandy loam with some gravel	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH11**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		- - -			TOPSOIL, organic loam	
0.5	**BH11F**	▨			FILL, sandy loam with some gravel	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH12**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		- - -			TOPSOIL, organic loam	
0.5	**BH12F**	▨			FILL, sandy loam	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS	Very Soft	- Unconfined compressive strength less than 25kPa
S	Soft	- Unconfined compressive strength 25-50kPa
F	Firm	- Unconfined compressive strength 50-100kPa
St	Stiff	- Unconfined compressive strength 100-200kPa
VSt	Very Stiff	- Unconfined compressive strength 200-400kPa
H	Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

Aargus
AUSTRALIA

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH13**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
					TOPSOIL, organic loam	
0.5	**BH13F**				FILL, sandy loam with some gravel	
						No groundwater present No HC odour
1					NATURAL, CLAYEY SAND, brown, wet, medium grained	
1.5	**BH13N**					
					Borehole terminated @ 1.5m below ground level in natural clayey san	
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH14**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
					TOPSOIL, organic loam	
0.5	**BH14F**				FILL, sandy loam with some gravel	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH15**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
					TOPSOIL, organic loam	
0.5	**BH15F**				FILL, sandy loam	
						No groundwater present No HC odour
1					NATURAL, CLAYEY SAND, brown, wet, medium grainec	
1.5	**BH15N**					
					Borehole terminated @ 1.5m below ground level in natural clayey san	
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH16**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
					TOPSOIL, organic loam	
0.5	**BH16F**				FILL, sandy loam with some gravel	
					Borehole terminated @ 0.5m below ground level in fil	No groundwater present No HC odour
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Tenetur Pty Ltd	**BOREHOLE NO.**	**BH17**
PROJECT	Environmental Site Assessment	**DATE.**	**06.06.08**
LOCATION	St George Bowling Club - Harrow Road, Bexley NSW	**JOB NO.**	**E2252**
METHOD	Hand Auger	**SURFACE ELEV.**	**see below**
LOGGED BY	CK	**CHECKED BY**	**NK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	
		┄			TOPSOIL, organic loam	
0.5	**BH17F**	▨			FILL, sandy loam with some gravel	
1		⁙			NATURAL, CLAYEY SAND, brown, wet, medium graine	No groundwater presen No HC odour
1.5	**BH17N**	⁙				
					Borehole terminated @ 1.5m below ground level in natural clayey san	
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

▼ Standing groundwater level in borehole
▶ Water seepage in borehole (wet)

Samples

BH1.0.5	- Soil sample taken at indicated depth
S	- Surface water sample
GW/W	- Groundwater sample/water sample

Moisture Condition

D Dry	- Runs freely through fingers
M Moist	- Does not run freely but no free water visible on soil surface
W Wet	- Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

APPENDIX E

REGULATORY CRITERIA

Table 5-A - Soil Investigation Levels (mg/kg)

Substances	Health Investigation Levels (HILs)						Ecological Investigation Levels (EILs)		Background
	A[1]	B[2]	C[3]	D	E	F	REIL[4]	Interim Urban[5]	Ranges[6]
METALS/METALLOIDS									
Arsenic (total)	100			400	200	500	Limited Australian data developed at this time		
Barium								20	1 - 50
Beryllium	20			80	40	100		300	100 - 3000
Cadmium	20			80	40	100			
Chromium (III)	12%			48%	24%	60%		3	1
Chromium (VI)	100			400	200	500		400	
Chromium (Total)*[7]								1	
Cobalt	100			400	200	500			5 - 1000
Copper	1000			4000	2000	5000			1 - 40
Lead	300			1200	600	1500		100	2 - 100
Manganese	1500			6000	3000	7500		600	2 · 200
Methyl mercury	10			40	20	50		500	850
Mercury (inorganic)	15			60	30	75			
Nickel	600			2400	600	3000		1	0.03
Vanadium								60	5 - 500
Zinc	7000			28000	14000	35000		50	20 - 500
ORGANICS								200	10 - 300
Aldrin + Dieldrin	10			40	20	50			
Chlordane	50			200	100	250			
DDT + DDD + DDE	200			800	400	1000			
Heptachlor	10			40	20	50			
Polycyclic aromatic hydrocarbons (PAHs)	20			80	40	100			
Benzo(a)pyrene	1			4	2	5			
Phenol	8500			34000	17000	42500			
PCBs (Total)	10			40	20	50			
Petroleum Hydrocarbon Components (constituents): • >C16 - C35 Aromatics[8]	90			360	180	450			
• >C16 - C35 Aliphatics	5600			22400	11200	28000			
• >C35 Aliphatics	56000			224000	112000	280000			
OTHER									
Boron	3000			12000	6000	15000			
Cyanides (Complexed)	500			2000	1000	2500			
Cyanides (free)	250			1000	500	1250			
Phosphorus									
Sulfur								2000	
Sulfate[9]								600	
								2000	

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[1] Human exposure settings based on land use have been established for HILs (see Taylor and Langley 1998). These are:

A. 'Standard' residential with garden/accessible soil (home-grown produce contributing less than 10% of vegetable and fruit intake; no poultry): this category includes children's day-care centres, kindergartens, preschools and primary schools.
B. Residential with substantial vegetable garden (contributing 10% or more of vegetable and fruit intake) and/or poultry providing any egg or poultry meat dietary intake.
C. Residential with substantial vegetable garden (contributing 10% or more of vegetable and fruit intake); poultry excluded.
D. Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise apartments and flats.
E. Parks, recreational open space and playing fields: includes secondary schools.
F. Commercial/Industrial: includes premises such as shops and offices as well as factories and industrial sites.

(For details on derivation of HILs for human exposure settings based on land use see Schedule B(7A).

[2] Site and contaminant specific: on site sampling is the preferred approach for estimating poultry and plant uptake. Exposure estimates may then be compared to the relevant ADIs, PTWIs and GDs.

[3] Site and contaminant specific: on site sampling is the preferred approach for estimating plant uptake. Exposure estimates may then be compared to the relevant ADIs, PTWIs and GDs.

[4] These will be developed for regional areas by jurisdictions as required.

[5] Interim EILs for the urban setting are based on considerations of phytotoxicity, ANZECC B levels, and soil survey data from urban residential properties in four Australian capital cities.

[6] Background ranges, where HILs or EILs are set, are taken from the Field Geologist's Manual, compiled by D A Berkman, Third Edition 1989. Publisher - The Australasian Institute of Mining & Metallurgy. This publication contains information on a more extensive list of soil elements than is included in this Table. Another source of information is Contaminated Sites Monograph No. 4: Trace Element Concentrations in Soils from Rural & Urban Areas of Australia, 1995. South Australian Health Commission.

[7] Valence state not distinguished - expected as Cr (III).

[8] The carbon number is an 'equivalent carbon number' based on a method that standardises according to boiling point. It is a method used by some analytical laboratories to report carbon numbers for chemicals evaluated on a boiling point GC column.

[9] For protection of built structures.

Table 3 Threshold concentrations for sensitive land use — soils

Analytes	Threshold concentrations[a] (mg/kg dry wt)	Sources
TPH [b, c]: C6–C9	65	see note [d]
TPH[c]: C10–C40 (C10–C14, C15–C28, C29–C40)	1,000	see note [e]
Benzene	1 [f]	ANZECC /NHMRC 1992
Toluene	1.4 [g] / 130 [h]	Netherlands 1994
Ethyl benzene	3.1 [i] / 50 [j]	Netherlands 1994
Total Xylenes	14 [k] / 25 [j]	Netherlands 1994
Phenol	— [l]	— [l]
Total Lead	300	ANZECC /NHMRC 1992
Benzo(a)pyrene	1	ANZECC /NHMRC 1992
Total PAHs [m]	20	ANZECC /NHMRC 1992

NB. Scientifically justified alternative threshold concentrations may be acceptable. Thresholds may be reviewed as new scientific information becomes available.

Explanatory notes for Table 3

a Refer to relevant source documents for details.

Definitions of terms used in discussion of Netherlands criteria (Denneman 1993) are:

- The **maximum permissible concentration** (MPC) is the 'concentration of a toxic substance that fully protects 95% of the species in an ecosystem'.
- The **intervention level** represents 'a level where action is needed because impermissible risks may occur. It depends on other than chemical characteristics if action should take place immediately or not'. In the case of ecological risk, the intervention level 'fully protects 50% of the species in an ecosystem'.

Further information regarding MPCs and intervention levels may be found in Denneman & van den Berg 1993.

The Netherlands sourced values in Table 2 refer to soil with 10% natural organic matter content. These threshold concentrations must be adjusted for the particular natural organic matter content of the specific site. The natural organic matter content in soil may be determined using the Walkley and Black Method, AS 1289.D1.1–1977, *Determination of the Organic Matter Content of a Soil (Standard Method)*.

The threshold concentrations for ethyl benzene and xylenes to protect terrestrial organisms have been derived from aquatic toxicological data using equilibrium partitioning. Investigations have shown (Van Gestal & Ma 1993) that in the case of earthworms, toxicity is related to the pore water contaminant concentration. The LC_{50} pore water concentrations for several compounds have been favourably compared with LC_{50} aquatic toxicological data for fish.

Explanatory notes for Table 3 (cont.)

The derivations of criteria adopted as threshold concentrations have not explicitly taken account of chemical mixtures. The potential impact of mixtures of chemicals should be assessed on a site-specific basis.

The potential for the generation of odours may mean that lower thresholds than those listed in Table 2 are required for volatile compounds.

b Total petroleum hydrocarbons

c Approximate range of petroleum hydrocarbon fractions: petrol C6–C9, kerosene C10–C18, diesel C12–C18 and lubricating oils above C18.

d The TPH C6–C9 threshold concentration, i.e. 65 mg/kg, applies to soil containing 10% natural organic matter. This concentration has been calculated assuming the following:

- that there has been a fresh spill of petrol
- that the aromatic content of the petrol is 30%
- that the resultant BTEX soils concentrations are at their lower thresholds.

TPH C6–C9 concentrations above the relevant threshold may indicate that BTEX concentrations are above their thresholds. This threshold concentration should be interpreted as only an approximate potential indicator of contamination.

e The TPH C10–C40 threshold concentration is based on a consideration both of the Netherlands Intervention Level for the TPH C10–C40 range and on commonly reported analytical detection limits. The Netherlands intervention value is 5,000 mg/kg dry weight.

f A lower benzene threshold concentration may be needed to protect groundwater.

g The toluene threshold concentration is the Netherlands MPC to protect terrestrial organisms in soil. This value was obtained by applying a US EPA assessment factor to terrestrial chronic No Observed Effect Concentration (NOEC) data. The MPC is an 'indicative' value (Van de Plassche *et al.* 1993; Van de Plassche & Bockting 1993).

h Human health and ecologically based protection level for toluene. The threshold concentration presented here is the Netherlands intervention value for the protection of terrestrial organisms. Other considerations such as odours and the protection of groundwater may require a lower remediation criterion.

i The ethyl benzene threshold concentration is the Netherlands MPC for the protection of terrestrial organisms in soil. No terrestrial ecotoxicological data could be found for use in the Netherlands criteria derivation. Therefore, equilibrium partitioning has been applied to the MPC for water to obtain estimates of the MPC for soil. The MPC for water has been derived from aquatic ecotoxicological data (Van de Plassche *et al.* 1993; Van de Plassche & Bockting 1993).

j Human health based protection level for ethyl benzene or total xylenes as shown. The threshold concentration presented here is the Netherlands intervention value. Other considerations such as odours and the protection of groundwater may require a lower remediation criterion

k The xylene threshold concentration is the Netherlands MPC for the protection of terrestrial organisms in soil. No terrestrial ecotoxicological data could be found for use in the Netherlands criteria derivation. Therefore, equilibrium partitioning has been applied to the MPC for water to obtain an estimate of the MPC for soil. The MPC for water has been derived from aquatic ecotoxicological data. The concentration shown applies to total xylenes and is based on the arithmetic average of the individual xylene MPCs (Van de Plassche *et al.* 1993; Van de Plassche & Bockting 1993).

l Phenol contamination is not expected to be significant at service station sites. Phenol has been included in the analyte list because it is a potential constituent of waste oil. The potential impact of phenol should be evaluated on a site-specific basis. Phenol may have a significant impact on waters.

m Polycyclic aromatic hydrocarbons

Contaminated aquifers and contaminated aquicludes should, as far as practicable, be remediated to the condition they were in before they became contaminated.

If groundwater is to be used for drinking water, analyte concentrations should not exceed the relevant drinking water guidelines: *Guidelines for Drinking Water Quality in Australia* (NHMRC/AWRC 1987), and *Draft Australian Drinking Water Guidelines* (NHMRC/ARMCANZ 1994). The draft NHMRC/ARMCANZ (1994) guidelines have been released for public comment, so some proposed guideline values may change upon review.

Groundwater that enters aquatic ecosystems (freshwater or marine) should not cause concentrations in the receiving ecosystem to exceed the relevant water quality guideline recommendations. See *Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC 1992).

If the analyte concentrations in groundwater exceed the relevant thresholds, the groundwater should be remediated to or below the threshold concentrations. **If the threshold concentrations provided are not applicable, then the EPA should be consulted to determine the remediation goals.** The site assessor should keep a record of the reasons for selecting particular threshold concentrations. If other groundwater uses (e.g. industrial or agricultural) are affected, then other guideline recommendations should be considered (see ANZECC 1992).

The threshold concentrations may not apply in the following circumstances:

- when an appropriate human health risk assessment or ecological risk assessment demonstrates that lower or higher concentrations may be applicable
- when an appropriate risk-benefit analysis demonstrates that lower or higher concentrations may be acceptable.

2.5.2 How threshold concentrations have been selected

Threshold concentrations have, wherever possible, been selected from Australian sources, including ANZECC, NHMRC and ARMCANZ. In cases where the information was not available locally, Netherlands sources have been used (see Bibliography).

Threshold concentrations for soils are presented in Table 3. The concentrations have been taken from ANZECC/NHMRC (1992), and the Netherlands Ministry of Housing, Environment etc. (1994).

Threshold concentrations for waters are presented in Table 4. The

Table 4 Threshold concentrations—waters

Analytes	Threshold concentrations (μg/L)[a]				
	Protection of drinking water		Protection of aquatic ecosystems[b]		
	Health-based	Sources	Fresh	Marine	Source
TPH: C6–C9	—[c]	—[c]	—[e]	—[e]	—[e]
TPH: C10–C36	—[d]	—[d]	—[e]	—[e]	—[e]
Benzene	10[f]	NHMRC/AWRC	300	300	ANZECC
Toluene	800[g]	NHMRC/ARMCANZ	300	—[c]	ANZECC
Ethyl benzene	300[g]	NHMRC/ARMCANZ	140	—[c]	ANZECC
Xylene	600[g]	NHMRC/ARMCANZ	380[h]	380[h]	Netherlands 1994
Phenols	2	ANZECC	50	50	ANZECC
Benzo(a)pyrene	0.01	NHMRC/AWRC	—[c]	—[c]	—[c]
PAHs	—[c]	—[c]	3	3	ANZECC
Lead	10	NHMRC/ARMCANZ	1–5[i]	5	ANZECC

NB. Scientifically justified alternative threshold concentrations may be acceptable. Thresholds may be reviewed as new scientific information becomes available.

Explanatory notes for Table 4

[a] Refer to the relevant source documents for details. The unit μg/L = micrograms per litre.

[b] Groundwater entering aquatic ecosystems should not cause concentrations to exceed the relevant threshold concentrations.

[c] Information needed to select threshold concentrations is incomplete.

[d] Information needed to select threshold concentrations is incomplete. Alkanes in this range have low solubility and are unlikely to be of concern in water. All separate phase products must be removed.

[e] Information needed to select threshold concentrations is incomplete. The NSW Clean Waters Act 1970 and Clean Waters Regulations 1972 prohibit the pollution of waters by unlicensed contaminated discharges and require licensed discharges to be visually free of oil and grease. Experience has demonstrated that the latter criterion is equivalent to an oil and grease concentration of approximately 10 mg/L.

[f] NHMRC/ARMCANZ 1994 proposed 1 μg/L as the new benzene guideline concentration. This has not yet been adopted.

[g] NHMRC/ARMCANZ 1994 proposed concentrations are similar to WHO 1993 drinking-water quality guideline concentrations.

[h] Netherlands 1994 Maximum Permissible Concentration for total xylenes.

[i] Dependent on water hardness.

APPENDIX F

AARGUS FIELDWORK ENVIROMENTAL PROTOCOLS

Aargus

Fieldwork Protocols

February 2008

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1.0 OBJECTIVE AND SCOPE

The objective of Aargus Pty Ltd (Aargus) Protocols is to ensure that the methodology followed during environmental works 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 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 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. Any deviations from these protocols should be explained within the Environmental Report to which they are attached.

2.0 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
- 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

A hand auger 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.

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 environmental scientists / engineers. 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, 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.

2.4 Labelling of soil samples

Samples are labelled with the following information:

- Job number;
- Date of sample collection;
- Name of the environmental scientist / engineer 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 1.0m 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 2.0m is the sample taken from testpit 1 at a depth of 2.0 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.

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:

- 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.

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 reference to existing ground 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 if the level of precision required can be obtained by the use of Aargus field equipment. Aargus 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.

3.0 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 of 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 2.0 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 environmental scientist/engineer monitors and records drilling activities, procedures adopted, materials used, progress of the stages of well construction (including (i.e. 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 0ff-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 environmental scientist/engineer 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 environmental scientist/engineer 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, any where 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 equilibria.

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 a stainless steel 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 ad 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 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 Field measurements

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

- Ensure that formation water is being sampled
- Provide on-site measurements for 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.

3.8 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.

3.9 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.

3.10 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.

4.0 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.

5.0 PHOTO IONISATION DETECTOR (PID)

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.

6.0 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).

7.0 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 equioment 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.

8.0 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.

9.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

9.1 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.

9.2 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.

9.3 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 cleanup 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.

10.0 DATA QUALITY OBJECTIVES

10.1 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 environmental 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.

10.2 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.

10.3 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.

10.4 Laboratory Data Quality Objectives (DQO)

General

Labmark is the Aargus-preferred laboratory for the 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 SGS.

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 Labmark laboratory analyses DQOs.

Table 2: Labmark 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 QA/QC Testing	**Laboratory QA/QC Acceptance Criteria**
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%.
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.

11.0 USE AND CALCULATION OF THE 95% UCL FOR SITE VALIDATION PURPOSE

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:

$$\mathbf{95\%\ UCL = mean + t_{\propto,n-1}\frac{\mathit{STDEV}}{\sqrt{n}}}$$

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)

∝	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

12.0 COPYRIGHT

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13.0 ABBREVIATIONS

ANZECC	Australian and New Zealand Environment and Conservation Council
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

14.0 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*

APPENDIX G

SITE PHOTOGRAPHS

SITE PHOTOGRAPHS

Client	Tenetur Pty Ltd
Project	Environmental Site Assessment
Location	St George Bowling Club, Harrow Road, Bexley NSW
Job No.	E2252
Checked By	MK

Photograph N^{o} 1

Harrow Road frontage
Looking north east

Photograph N^{o} 2

Harrow Road frontage
Looking north, showing car park

Photograph N^{o} 3

Bowler Avenue frontage
Looking south

Photograph N^{o} 4

St George Bowling Club House
Looking north east

Photograph N^{o} 5

Club House view
Looking south west

Photograph N^{o} 6

Driveway frontage
Looking west

APPENDIX H

LAND TITLE INFORMATION

Department of Lands

TITLE SEARCH

Computer Folio Certificate issued under Section 96D of the Real Property Act 1900

BEXLEY

No. 56

Search certified to:
18/7/2007 10:55 AM

COMPUTER FOLIO REFERENCE	
174/715467	
EDITION No. & DATE OF CURRENT CERTIFICATE OF TITLE	
6	13/7/2006

Page 1

LAND

LOT 174 IN DEPOSITED PLAN 715467
AT ROCKDALE
LOCAL GOVERNMENT AREA ROCKDALE
PARISH OF ST GEORGE COUNTY OF CUMBERLAND
TITLE DIAGRAM DP715467

FIRST SCHEDULE

TENETUR PTY LIMITED (T AC406471)

SECOND SCHEDULE (6 NOTIFICATIONS)
----
1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 DP715467 RIGHT OF CARRIAGEWAY APPURTENANT TO THE LAND ABOVE DESCRIBED
3 DP715467 EASEMENT FOR OVERHANG APPURTENANT TO THE LAND ABOVE DESCRIBED
4 DP715467 EASEMENT FOR SEWERAGE PURPOSES OVER EXISTING LINE OF PIPES AFFECTING THE PART OF THE LAND ABOVE DESCRIBED SHOWN SO BURDENED IN THE TITLE DIAGRAM
5 DP715467 RESTRICTION(S) ON THE USE OF LAND
6 AC406472 MORTGAGE TO WESTPAC BANKING CORPORATION

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Registrar General

Department of Lands

HISTORICAL TITLE SEARCH

Certificate issued under Section 96G
of the Real Property Act 1900

No. 57
Search certified to: 18/7/2007 10:56AM
Computer Folio Reference: 174/715467

First Title(s): OLD SYSTEM
Prior Title(s): VOL 692 FOL 89 VOL 692 FOL 225
VOL 864 FOL 60

Recorded	Number	Type of Instrument	C.T. Issue
23/8/1985	DP715467	DEPOSITED PLAN	FOLIO CREATED EDITION 1
13/6/2002	8678358	CAVEAT	
6/2/2003	9353007	WITHDRAWAL OF CAVEAT	
6/2/2003	9353008	MORTGAGE	EDITION 2
7/10/2003	AA42776	MORTGAGE	EDITION 3
19/2/2004	AA432553	CAVEAT	
18/6/2004	AA724078	WITHDRAWAL OF CAVEAT	
18/6/2004	AA724079	DISCHARGE OF MORTGAGE	
18/6/2004	AA724080	DISCHARGE OF MORTGAGE	
18/6/2004	AA724081	MORTGAGE	EDITION 4
17/8/2004	AA884445	TRANSFER OF MORTGAGE	EDITION 5
13/7/2006	AC406470	DISCHARGE OF MORTGAGE	
13/7/2006	AC406471	TRANSFER	
13/7/2006	AC406472	MORTGAGE	EDITION 6

*** END OF SEARCH ***

The Registrar General certifies that at the date and time specified above the information set out in this search constitutes the historical record of all dealings recorded in or action taken in respect of the mentioned title which is required to be kept by the Registrar General under section 32(7) of the Real Property Act 1900.

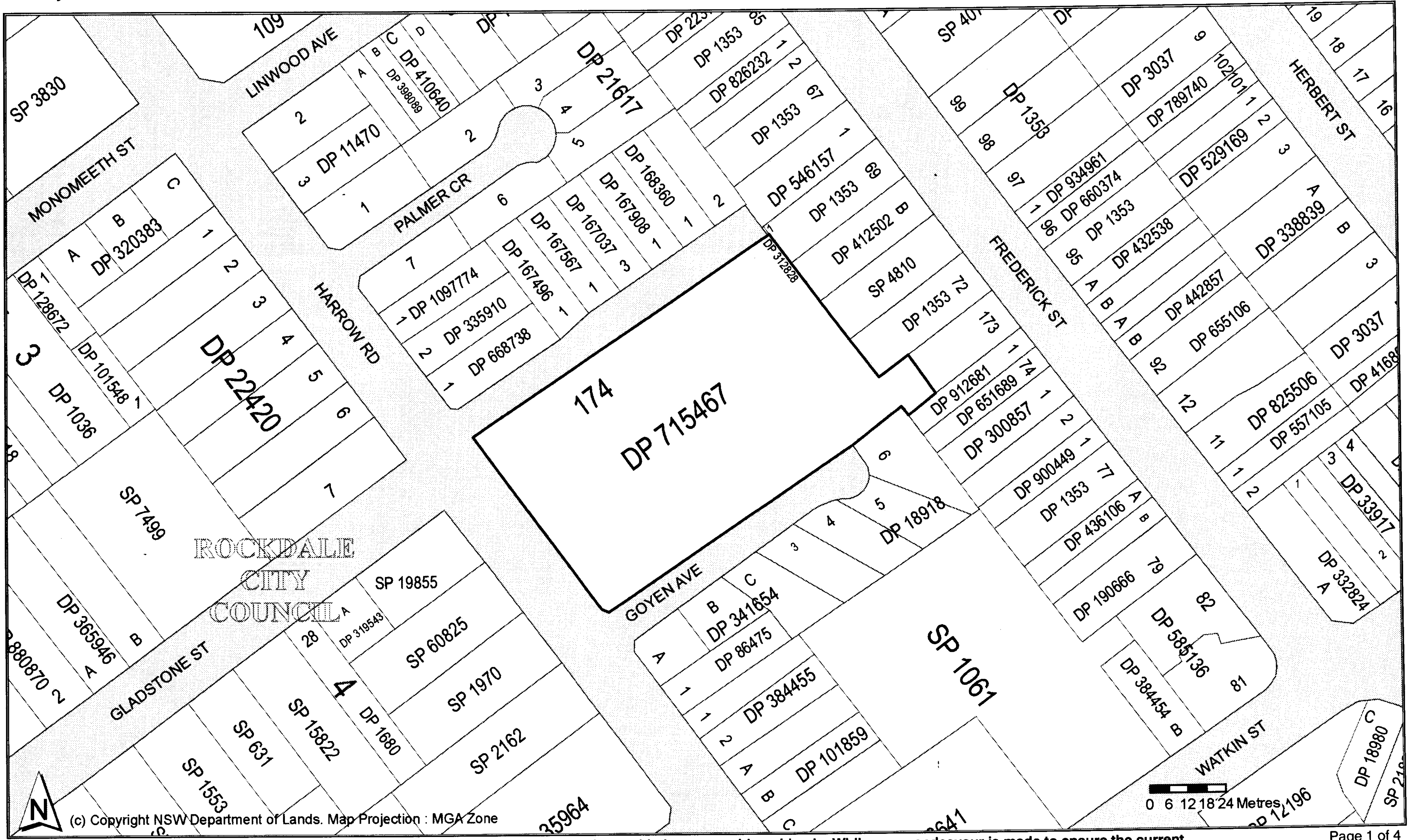
Registrar General

Department of Lands
Reliable from the ground up

Cadastral Records Enquiry Report

Requested Parcel : Lot 174 DP 715467
Identified Parcel : Lot 174 DP 715467

Locality : BEXLEY
LGA : ROCKDALE
Parish : ST GEORGE
County : CUMBERLAND



(c) Copyright NSW Department of Lands. Map Projection : MGA Zone

Report Generated 10:32:45 AM, 13 May, 2008

This information is provided as a searching aid only. While every endeavour is made to ensure the current cadastral pattern is accurately reflected, the Registrar General cannot guarantee the information provided. For all ACTIVITY PRIOR to SEPT 2002 you must refer to the RGs Charting and Reference Maps.

APPENDIX I

EPA NOTICE SUMMARY

NSW EPA

Print Close page

Site and notice details

Your search for: LGA: Rockdale City Council 2 notices on 2 sites were matched.

Area No: 3174

The information below was correct at the time the notices were issued.

Site: Cook Park
Address: General Holmes Drive, Brighton-le-sands, 2216
LGA: Rockdale City Council

Occupier: Rockdale Council
Owner: Crown Land

Notices relating to this site (2 current and 0 former)

(Map) where available, maps show the part of the site affected by the notice

* notice matched search criteria

Notice recipient	Notice type & number	Status	Date
Shell Company of Australia Limited	Note of Existence of Voluntary Remediation Proposal* 26078	Current	Issued 17 Aug 2005
Not Applicable	Declaration of Remediation Site* 21051	Current	Issued 19 Mar 2004

19 June 2008

APPENDIX J

RESUME OF CLIENT TEAM

MARK KELLY

DATE OF BIRTH	25th October 1975
EDUCATIONAL QUALIFICATIONS	BAppSc (Geology) (Hons) University of New South Wales, Sydney, Australia Majoring in Soil and Groundwater Resources and Remediation
ADDITIONAL COURSES	Groundwater Hydrology Hydrogeochemistry Analysis and Interpretation of Hydrogeochemical Data Physical Aspects of Contaminated Groundwater Interpretation of Aeromagnetics Structural Interpretation and Analysis
PROFESSIONAL MEMBERSHIP	Geological Society of Australia (GSA)
PROFESSIONAL LICENCES	Senior First Aid Certificate (2006) X-ray Fluorescence (XRF) Metal Detector Operation License (EPA License No 24430) Energy Australia Passport (Service No. 7728)
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FIELDS OF SPECIAL COMPETENCY	**Contaminated Land Assessment and Site Remediation –** management, technical advice, planning, data evaluation, coordinating and supervision of environmental/contaminated site assessments including preliminary and detailed assessments, contaminated site remediation and validation with particular reference to soil, water and groundwater. Acid sulphate soils, salinity and hazardous materials assessments.

EXPERIENCE:

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2006 - 2007	Senior Environmental Geologist – Geotechnique Pty Ltd
1999 – 2006	Environmental Geologist – Geotechnique Pty Ltd

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- Project management, scheduling laboratory chemical analysis, data evaluation and reporting on environmental/contaminated site investigations including preliminary, detailed assessments, remediation and validation
- Preparation of waste classification, including biosolids from sewage treatment plants
- Salinity Assessments
- Preparation of proposals
- Occupational Health & Safety Issues
- Environmental Management Plans
- Coordinating and corresponding with Principal/Senior Environmental Engineers, Environmental Engineers, field staff, management, clients and contractors
- Liaising and negotiating with relevant government departments, statutory authorities
- Basic Turbocad skills

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- Site inspections
- Soil and water sampling
- Installation of groundwater monitoring wells
- Assessing the contamination status of land/water
- Site remediation and validation
- Site management including remediation, asbestos removal
- PID calibration and use
- Hazardous material assessment
- Salinity indicators
- Service station works including underground storage tank removal
- Gas monitoring

SITES

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- Childcare Facilities
- Energy Australia facilities including active sites and decommissioning of sites.
- Sewage Treatment Plants including the assessment of biosolids, installation works and initialization of site management plans and inspections.

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Salinity Assessments – Duties included historical searches, analysing aerial photographs, liaising with authorities, identification of potential contaminants, sampling and analysis design, soil sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

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Targeted Environmental Site Assessments – Duties included historical searches, analysing aerial photographs, liaising with authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

Underground Storage Tank Removal – Removal of underground storage tanks in order to satisfy regulatory requirements for the redevelopment of sites. Duties included historical searches, liaising with contractors and regulatory authorities, sampling and analysis design, soil and groundwater sampling, decontamination, QA/QC, data analysis and report generation.

MAJOR PROJECTS

- Auburn Hospital - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- Australian Defence Industries site, St Marys – Former defence force lands. An extensive sampling program was managed and the results of soil analysis were reviewed with respect to human heath risk and potential ecological impact. Reports endorsed by accredited site auditor.

- Auburn Catholic Club - Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- Barter & Sons - Former poultry farm, scheduled for industrial / commercial development. Responsible for cost estimating, project management and co-ordination of site investigation works. Included a review of available site history, and contamination assessment of soils, targeting heavy metals, pesticides and asbestos. Remediation recommended landfill disposal (industrial and solid waste category).

- Brown Consulting (NSW) Group - Newbury Estate, Stanhope Gardens - Former market garden and grazing site developed for low density residential purposes. Responsible for cost estimating, project management and co-ordination of site investigation works, remediation and validation. Included review of site history information, contamination assessment of soils waters and sediment. Remediation recommendations included Landfill disposal and land farming. Reported on site investigations, remediation options (Remediation Action Plan), and validation. Reports endorsed by accredited site auditor.

- Columban Mission Institute, North Turramurra - Duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

- Cronulla Sewage Treatment Plant – Classification of biosolids for disposal off site to other land uses or to landfills.

- Deicorp Pty Ltd – Coulson Street, Erskineville – Former clothing factory and workshops with a UST to be redeveloped into a number of multi-storey residential apartment blocks. The collection of data to assess the efficacy of remediation works in decontaminating the site. Duties included liaising with clients, contractors and regulatory authorities, field sampling, QA/QC, data analysis and report generation. Reports endorsed by accredited site auditor.

- Department of Commerce – Assessment of a number of Department of Housing sites for potential hazardous materials within active housing commission units.

- Department of Housing – Lilyfield - Development of a residential area. Duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

- Department of Lands – Redfern - Development of a major residential area. Duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

- Duffy Kennedy Constructions – Cronulla – A former service station site. Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- EG Property Group / Funds Management –Port Adelaide, SA, Summer Hill and Five Dock, NSW –Active transport company, wheat production plant and silos, former bowling greens, former railway lines, land filling activities, land reclamation. Reports for due diligence and full environmental site assessments, duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

- Energy Australia Substations - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- Event Project Management - Bundaleer Street, Belrose – An active nursery to be redeveloped as part of extension works to the Covenant Christian School. A Phase 1 and Phase 2 contaminated land investigation with recommendations for remediation techniques and costs.

- Exceland Property Group (NSW) Pty Ltd – The Castellorizian Club at Kingsford. Duties included historical searches, analysing aerial photographs, liaising with authorities (WorkCover, Council's, EPA etc), identification of potential contaminants and report generation.

- Glasson Family Group – Wolli Creek – A large development site comprising a number of industrial properties including factories, warehouses, car yards etc. Conducting sampling and reporting on ASS/PASS and potential management techniques during future development.

- Glenbrook Sewer Installation - Environmental Representative for sewer installation contracts in Glenbrook. Responsible for the preparation of Environmental Management Plans (EMP) and work method statements. Monitored the works undertaken by the contractor, ensuring adequate environmental safeguards are in place and maintained. Prepared inspection reports and EMP status reports for Sydney Water.

- Granville Boys High School – assessment of soils and supervision of remedial works within an existing playing field. Remedial works included removal of soils contaminated with asbestos to an EPA licensed landfill.

- Group Development Services – Carrying out full assessments, from Stage 1 to Stage 4, on numerous rural residential sites in north western Sydney.

- International Speedway, Granville – Assessment of an existing spectator mound for asbestos and other soils analytes and recommendations for capping on-site.

- IWD Pty Ltd - Lyons Road, Drummoyne – A former service station with numerous UST's. The assessment included tank and line tests, gross pollution review, soil sampling, groundwater sampling, historical review and final data interpretation. Remediation of contaminated soils after the tanks were removed, soil classification and final validating of site surfaces. Reports endorsed by accredited site auditor.

- JK Williams Contracting Pty Ltd - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- John Morony Correctional Complex, Berkshire Park – assessment of soils and preparation of remedial costs prior to extension works to the existing prison.

- Landcom - Archbold Road, Eastern Creek and McIver Avenue, Middleton Grange – Former farming lands purchased by Landcom for residential subdivision, school developments, parklands and town centre (shopping facilities etc). Responsible for cost estimating, project management and co-ordination of site investigation works. Preparation of a preliminary RAP and recommendations in remediation techniques and costs.

- Liverpool City Council – Former park lands. Duties included historical searches, analysing aerial photographs, liaising with authorities (WorkCover, Council's, EPA etc), identification of potential contaminants and report generation.

- Mann Group - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- Manson Group – Kogarah – Former glass factory with an UST. Preparation of a Remedial Action Plan (RAP), followed by remediation and validation of the site including project management, liaising with contractors and clients, sampling, soil classification and assessment, and final report generation.

- Narwee Boys High School – Preparation of a hazardous materials (HAZMAT) assessment. Analysis involved identifying asbestos materials from lagging, roofing guttering, floor tiles, electricity backing boards, mercury switches, mercury/cadmium lamps, synthetic mineral fibres, lead paint etc.

- Parramatta City Council - Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- Paynter Dixon Constructions Pty Ltd – Homebush – Teachers Credit Union site. Duties included historical searches, analysing aerial photographs, liaising with authorities (WorkCover, Council's, EPA etc), identification of potential contaminants and report generation.

- Penrith City Council - Claremont Meadows Stage 2 – South Western Precinct – Masterplan. Full environmental and salinity assessments were carried out to address the Claremont Meadows Stage 2 DCP - Performance Standards for which is currently under consideration by the Council for the Stage 1 Subdivision Plan of the properties provides for creation of residential allotments, dedication of a Public

Reserve, construction and dedication of new roads and creation of residue lots for future development.

- Proust & Gardner Consulting - Carrying out full assessments, from Stage 1 to Stage 4, on numerous rural residential and residential sites in both the local Sydney and Central Coast regions. Sites included vacant lands, farming lands, market gardens, poultry farms, residential properties and schools.

- Reefway Waste Services – Alexandria and Auburn – Active waste receivers and recyclers. Management of soil quality by analysing soils for reuse. Discussion with DECC on providing a 'gateway' mechanism for removing bona fide resource recovery from the waste regulatory framework.

- Richard Crookes Constructions Pty Ltd – Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- Robert Moore & Asscoiates - Carrying out full assessments, from Stage 1 to Stage 4, on numerous rural residential and residential sites across Sydney. Sites included vacant lands, farming lands, market gardens and residential properties.

- Royal Botanical Gardens, Sydney – Former works depot. Managing removal of UST's and associated pipelines, sampling and soil classification of soils to an EPA inert and solid waste licensed landfill.

- Sam the Paving Man - Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- Stocklands Mall, Merrylands - Former carpark area. Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- SPAD Pty Ltd – Former chemical factory. Report for full environmental site assessment, duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil sampling, preparation of borehole logs, decontamination, QA/QC and report generation. Preparation of a RAP, managing remedial works and issuing final validation report.

- Sydney Airport Corporation – Soil classification and leachate management for an EPA solid licensed landfill.

- Telstra Depot, Rooty Hill - Report for full environmental site assessment, duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil sampling, preparation of borehole logs, decontamination, QA/QC and report generation. Preparation of a RAP, managing remedial works and issuing final validation report.

- THG Resource – Kingston, QLD –Active scraps metal and car recycler. Duties included detailing management practices, outlining procedures for all identified environmental issues and providing a plan during operation to safeguard the way in which waste is managed.

- University of Sydney - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

APPENDIX G

PROJECT TEAM CVs

Aargus

CON KARIOTOGLOU

DATE OF BIRTH	10th December 1962
EDUCATIONAL	Bachelor of Science Sydney University, Sydney Australia
	Diploma of Occupational Health & Safety TAFE (ongoing)
	Advanced Certificate, Graphic Design Billy Blue School of Graphic Arts
ADDITIONAL COURSES	Certificate, Building Business Management Certificate, Desktop Publishing
MEMBERSHIPS	Australian Institute of Occupational Hygienists Environment Institute of Australia and New Zealand
FIELDS OF SPECIAL COMPETENCY	Occupational Health & Safety and Health Monitoring Asbestos and Hazardous Materials Assessments, Asbestos Risk Assessments and Management Plans, Soil Classifications, Preliminary Site Assessments, Detailed Site Assessments, Remedial Action Plans, Remediation and Validations.

EXPERIENCE:

2011-present	**WHS Consultant & Project Manager**, *Aargus Pty Ltd*
2007-2011	**Project Manager**, *Aargus Pty Ltd*
2002-2007	**Creative Director**, *Howling Media*
1990-2002	**OH&S Officer & Project Manager**, *EnviroSciences*
1988-1990	**Technical Officer**, *Sydney Diagnostic Services*
1986-1988	**Technical Officer**, *Douglas Laboratories*

PROJECT EXPERTISE

Air Quality Monitoring – Levels of volatile gases were monitored to determine Occupational Health and Safety (OH&S) compliance within an enclosed work environment.

Acid Sulphate Soil Assessment – Development areas within potential Acid Sulphate Soil regions were assessed to determine the presence, absence or extent of Acid Sulphate Soils. Duties included site surveys, soil sampling, chemical testing of soils, preparation of borehole logs, liaising with clients and regulatory authorities and report generation.

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Sampling and Testing Plans – Preparation of sampling location, sampling density and testing program for ESA's and RemVal's that are sent to the Site Auditor for approval.

Site Audit Responses – replying to comments made by NSW Site Auditors on selected jobs to meet final requirements for a full clearance of a site after remedial works have taken place.

Site Based Management Plans – includes detailed management practices, and procedures for all identified environmental issues for every environmentally relevant activity (ERA) within the site. The plans provide the environmental procedures to be followed during operation and are to safeguard the way in which waste is managed.

Soil Vapour Survey – Soil vapours originating from beneath an apartment block development containing known contamination were monitored to assess the affects on human health. Duties included operation of technical equipment, sampling of soil vapours, QA/QC, analysis of data and report generation.

Targeted Environmental Site Assessments – Duties included historical searches, analysing aerial photographs, liaising with authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

Underground Storage Tank Removal – Removal of underground storage tanks in order to satisfy regulatory requirements for the redevelopment of sites. Duties included historical searches, liaising with contractors and regulatory authorities, sampling and analysis design, soil and groundwater sampling, decontamination, QA/QC, data analysis and report generation.

MAJOR PROJECTS

- Auburn Hospital - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- Australian Defence Industries site, St Marys – Former defence force lands. An extensive sampling program was managed and the results of soil analysis were reviewed with respect to human heath risk and potential ecological impact. Reports endorsed by accredited site auditor.

- Auburn Catholic Club - Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- Barter & Sons - Former poultry farm, scheduled for industrial / commercial development. Responsible for cost estimating, project management and co-ordination of site investigation works. Included a review of available site history, and contamination assessment of soils, targeting heavy metals, pesticides and asbestos. Remediation recommended landfill disposal (industrial and solid waste category).

- Brown Consulting (NSW) Group - Newbury Estate, Stanhope Gardens - Former market garden and grazing site developed for low density residential purposes. Responsible for cost estimating, project management and co-ordination of site investigation works, remediation and validation. Included review of site history information, contamination assessment of soils waters and sediment. Remediation recommendations included Landfill disposal and land farming. Reported on site investigations, remediation options (Remediation Action Plan), and validation. Reports endorsed by accredited site auditor.

- Columban Mission Institute, North Turramurra - Duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

- Cronulla Sewage Treatment Plant – Classification of biosolids for disposal off site to other land uses or to landfills.

- Deicorp Pty Ltd – Coulson Street, Erskineville – Former clothing factory and workshops with a UST to be redeveloped into a number of multi-storey residential apartment blocks. The collection of data to assess the efficacy of remediation works in decontaminating the site. Duties included liaising with clients, contractors and regulatory authorities, field sampling, QA/QC, data analysis and report generation. Reports endorsed by accredited site auditor.

- Department of Commerce – Assessment of a number of Department of Housing sites for potential hazardous materials within active housing commission units.

- Department of Housing – Lilyfield - Development of a residential area. Duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

- Department of Lands – Redfern - Development of a major residential area. Duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

- Duffy Kennedy Constructions – Cronulla – A former service station site. Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- EG Property Group / Funds Management –Port Adelaide, SA, Summer Hill and Five Dock, NSW –Active transport company, wheat production plant and silos, former bowling greens, former railway lines, land filling activities, land reclamation. Reports for due diligence and full environmental site assessments, duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil and groundwater sampling, preparation of borehole logs, decontamination, QA/QC and report generation.

- Energy Australia Substations - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- Event Project Management - Bundaleer Street, Belrose – An active nursery to be redeveloped as part of extension works to the Covenant Christian School. A Phase 1 and Phase 2 contaminated land investigation with recommendations for remediation techniques and costs.

- Exceland Property Group (NSW) Pty Ltd – The Castellorizian Club at Kingsford. Duties included historical searches, analysing aerial photographs, liaising with authorities (WorkCover, Council’s, EPA etc), identification of potential contaminants and report generation.

- Glasson Family Group – Wolli Creek – A large development site comprising a number of industrial properties including factories, warehouses, car yards etc. Conducting sampling and reporting on ASS/PASS and potential management techniques during future development.

- Glenbrook Sewer Installation - Environmental Representative for sewer installation contracts in Glenbrook. Responsible for the preparation of Environmental Management Plans (EMP) and work method statements. Monitored the works undertaken by the contractor, ensuring adequate environmental safeguards are in place and maintained. Prepared inspection reports and EMP status reports for Sydney Water.

- Granville Boys High School – assessment of soils and supervision of remedial works within an existing playing field. Remedial works included removal of soils contaminated with asbestos to an EPA licensed landfill.

- Group Development Services – Carrying out full assessments, from Stage 1 to Stage 4, on numerous rural residential sites in north western Sydney.

- International Speedway, Granville – Assessment of an existing spectator mound for asbestos and other soils analytes and recommendations for capping on-site.

- IWD Pty Ltd - Lyons Road, Drummoyne – A former service station with numerous UST's. The assessment included tank and line tests, gross pollution review, soil sampling, groundwater sampling, historical review and final data interpretation. Remediation of contaminated soils after the tanks were removed, soil classification and final validating of site surfaces. Reports endorsed by accredited site auditor.

- JK Williams Contracting Pty Ltd - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- John Morony Correctional Complex, Berkshire Park – assessment of soils and preparation of remedial costs prior to extension works to the existing prison.

- Landcom - Archbold Road, Eastern Creek and McIver Avenue, Middleton Grange – Former farming lands purchased by Landcom for residential subdivision, school developments, parklands and town centre (shopping facilities etc). Responsible for cost estimating, project management and co-ordination of site investigation works. Preparation of a preliminary RAP and recommendations in remediation techniques and costs.

- Liverpool City Council – Former park lands. Duties included historical searches, analysing aerial photographs, liaising with authorities (WorkCover, Council's, EPA etc), identification of potential contaminants and report generation.

- Mann Group - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- Manson Group – Kogarah – Former glass factory with an UST. Preparation of a Remedial Action Plan (RAP), followed by remediation and validation of the site including project management, liaising with contractors and clients, sampling, soil classification and assessment, and final report generation.

- Narwee Boys High School – Preparation of a hazardous materials (HAZMAT) assessment. Analysis involved identifying asbestos materials from lagging, roofing guttering, floor tiles, electricity backing boards, mercury switches, mercury/cadmium lamps, synthetic mineral fibres, lead paint etc.

- Parramatta City Council - Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- Paynter Dixon Constructions Pty Ltd – Homebush – Teachers Credit Union site. Duties included historical searches, analysing aerial photographs, liaising with authorities (WorkCover, Council's, EPA etc), identification of potential contaminants and report generation.

- Penrith City Council - Claremont Meadows Stage 2 – South Western Precinct – Masterplan. Full environmental and salinity assessments were carried out to address the Claremont Meadows Stage 2 DCP - Performance Standards for which is currently under consideration by the Council for the Stage 1 Subdivision Plan of the properties provides for creation of residential allotments, dedication of a Public Reserve, construction and dedication of new roads and creation of residue lots for future development.

- Proust & Gardner Consulting - Carrying out full assessments, from Stage 1 to Stage 4, on numerous rural residential and residential sites in both the local Sydney and Central Coast regions. Sites included vacant lands, farming lands, market gardens, poultry farms, residential properties and schools.

- Reefway Waste Services – Alexandria and Auburn – Active waste receivers and recyclers. Management of soil quality by analysing soils for reuse. Discussion with DECC on providing a ‘gateway’ mechanism for removing bona fide resource recovery from the waste regulatory framework.

- Richard Crookes Constructions Pty Ltd – Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

- Robert Moore & Asscoiates - Carrying out full assessments, from Stage 1 to Stage 4, on numerous rural residential and residential sites across Sydney. Sites included vacant lands, farming lands, market gardens and residential properties.

- Royal Botanical Gardens, Sydney – Former works depot. Managing removal of UST’s and associated pipelines, sampling and soil classification of soils to an EPA inert and solid waste licensed landfill.

- Sam the Paving Man - Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- Stocklands Mall, Merrylands - Former carpark area. Sampling and soil classification of soils, followed by onsite management of the disposal of the soils to licensed landfills.

- SPAD Pty Ltd – Former chemical factory. Report for full environmental site assessment, duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil sampling, preparation of borehole logs, decontamination, QA/QC and report generation. Preparation of a RAP, managing remedial works and issuing final validation report.

- Sydney Airport Corporation – Soil classification and leachate management for an EPA solid licensed landfill.

- Telstra Depot, Rooty Hill - Report for full environmental site assessment, duties included desktop study, liaising with clients, contractors and regulatory authorities, identification of potential contaminants, sampling and analysis design, soil sampling, preparation of borehole logs, decontamination, QA/QC and report generation. Preparation of a RAP, managing remedial works and issuing final validation report.

- THG Resource – Kingston, QLD –Active scraps metal and car recycler. Duties included detailing management practices, outlining procedures for all identified environmental issues and providing a plan during operation to safeguard the way in which waste is managed.

- University of Sydney - Various soil classifications and leachate management for an EPA inert and solid licensed landfill.

APPENDIX H

SITE ASSESSMENT CRITERIA

Table H1 – Assessment Criteria

Contaminant	Assessment Criteria (mg/kg)			Source
	HIL 'A'	HIL 'E'	NSW EPA	
Inorganics				
Arsenic	100	200	-	NEPM, 1999
Cadmium	20	40	-	NEPM, 1999
Chromium (III)	120,000	240,000	-	NEPM, 1999
Copper	1,000	2,000	-	NEPM, 1999
Lead	300	600	-	NEPM, 1999
Zinc	7,000	14,000	-	NEPM, 1999
Nickel	600	600	-	NEPM, 1999
Mercury	15	30	-	NEPM, 1999
Organics				
TPH/BTEX				
C_6 to C_9 Fraction	-	-	65	NSW EPA, 1994
C_{10} to C_{36}	-	-	1,000	NSW EPA, 1994
Benzene	-	-	1	NSW EPA, 1994
Toluene	-	-	1.4	NSW EPA, 1994
Ethylbenzene	-	-	3.1	NSW EPA, 1994
Total Xylenes	-	-	14	NSW EPA, 1994
PAH				
Benzo(a)pyrene	1	2	-	NEPM, 1999
Total PAH	20	40	-	NEPM, 1999
OCP				
Aldrin + Dieldrin	10	20	-	NEPM, 1999
Chlordane	50	100	-	NEPM, 1999
DDT+DDD+DD	200	400	-	NEPM, 1999
Heptachlor	10	20	-	NEPM, 1999
PCB (Total)	10	20	-	NEPM, 1999

Table 1: Contaminant threshold values (CT1 & CT2) for classifying waste by chemical assessment without the leaching (TCLP) test

For disposal requirements for organic and inorganic chemical contaminants not listed below, contact DECC. 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		
Contaminant	**General solid waste[1]** **CT1 (mg/kg)**	**Restricted solid waste** **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	2000	8000	108-90-7
Chloroform	120	480	67-66-3
Chlorpyrifos	4	16	2921-88-2
Chromium (VI)[3]	100	400	
m-Cresol	4000	16000	108-39-4
o-Cresol	4000	16000	95-48-7
p-Cresol	4000	16000	106-44-5
Cresol (total)	4000	16000	1319-77-3
Cyanide (amenable)[4]	70	280	
Cyanide (total)	320	1280	
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	2400	100-41-4
Fluoride	3000	12000	
Fluroxypyr	40	160	69377-81-7

	Maximum values of *specific contaminant concentration* (SCC) for classification without TCLP		
Contaminant	**General solid waste[1]**	**Restricted solid waste**	**CAS Registry Number**
	CT1 (mg/kg)	**CT2 (mg/kg)**	
Lead	100	400	
Mercury	4	16	
Methyl ethyl ketone	4000	16000	78-93-3
Moderately harmful pesticides[6] (total)	N/A[7]	N/A[7]	See below[6]
Molybdenum	100	400	
Nickel	40	160	
Nitrobenzene	40	160	98-95-3
C6-C9 petroleum hydrocarbons	N/A[7]	N/A[7]	
C10-C36 petroleum hydrocarbons	N/A[7]	N/A[7]	
Phenol (non-halogenated)	288	1152	108-95-2
Picloram	60	240	1918-02-1
Plasticiser compounds[8]	20	80	See below[8]
Polychlorinated biphenyls	N/A[7]	N/A[7]	1336-36-3
Polycyclic aromatic hydrocarbons (total)	N/A[7]	N/A[7]	
Scheduled chemicals	N/A[7]	N/A[7]	
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	1152	108-88-3
1,1,1-Trichloroethane	600	2400	71-55-6
1,1,2-Trichloroethane	24	96	79-00-5
Trichloroethylene	10	40	79-01-6
2,4,5-Trichlorophenol	8000	32000	95-95-4
2,4,6-Trichlorophenol	40	160	88-06-2

	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**
Triclopyr	40	160	55335-06-3
Vinyl chloride	4	16	75-01-4
Xylenes (total)	1000	4000	1330-20-7

Notes

1. Values are the same for both 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. DECC 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 (CAS Registry Number) are to be included in the total values specified:

   Atrazine (1912-24-9), Azoxystrobin (131860-33-8), Bifenthrin (82657-04-3), Brodifacoum (56073-10-0), Carboxin (5234-68-4), Copper naphthenate (1338-02-9), Cyfluthrin (68359-37-5), Cyhalothrin (68085-85-8), Cypermethrin (52315-07-08), Deltamethrin (52918-63-5), Dichlofluanid (1085-98-9), Dichlorvos (62-73-7), Difenoconazole (119446-68-3), Dimethoate (60-51-5), Diquat dibromide (85-00-7), Emamectin benzoate (137515-75-4 & 155569-91-8), Ethion (563-12-2), Fenthion (55-38-9), Fenitrothion (122-14-5), Fipronil (120068-37-3), Fluazifop-P-butyl (79241-46-6), Fludioxonil (131341-86-1), Glyphosate (1071-83-6), Imidacloprid (138261-41-3), Indoxacarb (173584-44-6), Malathion (Maldison) (121-75-5), Metalaxyl (57837-19-1), Metalaxyl-M (70630-17-0), Methidathion (950-37-8), 3-Methyl-4-chlorophenol (59-50-7), Methyl chlorpyrifos (5598-13-0), N-Methyl pyrrolidone (872-50-4), 2-octylthiazol-3-one (26530-20-1), Oxyfluorfen (42874-03-3), Paraquat dichloride (1910-42-5), Parathion methyl (298-00-0), Permethrin (52645-53-1), Profenofos (41198-08-7), Prometryn (7287-19-6), Propargite (2312-35-8), Pentachloronitrobenzene (Quintozene) (82-68-8), Simazine (122-34-9), Thiabendazole (148-79-8),Thiamethoxam (153719-23-4), Thiodicarb (59669-26-0) and Thiram (137-26-8).

7. N/A means not applicable, because these contaminants are only assessed using SCC - see Table 2 for SCC criteria.

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.

Table 2: Leachable concentration (TCLP) and specific contaminant concentration (SCC) values for classifying waste by chemical assessment

For disposal requirements for organic and inorganic chemical contaminants not listed below, contact DECC. 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**		
Contaminant	**Leachable concentration**	**Specific contaminant concentration**	**Leachable concentration**	**Specific contaminant concentration**	**CAS Registry Number**
	TCLP1 (mg/L)	**SCC1 (mg/kg)**	**TCLP2 (mg/L)**	**SCC2 (mg/kg)**	
Arsenic	5.0[2]	500	20	2000	
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]	3600	400	14400	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]	1900	20	7600	
m-Cresol	200[2]	7200	800	28800	108-39-4
o-Cresol	200[2]	7200	800	28800	95-48-7
p-Cresol	200[2]	7200	800	28800	106-44-5
Cresol (total)	200[2]	7200	800	28800	1319-77-3
Cyanide (amenable)[7, 8]	3.5[7]	300	14	1200	
Cyanide (total)[7]	16[7]	5900	64	23600	
2,4-D	10[2]	360	40	1440	94-75-7
1,2-Dichlorobenzene	4.3[2]	155	17.2	620	95-50-1
1,4-Dichlorobenzene	7.5[2]	270	30	1080	106-46-7
1,2-Dichloroethane	0.5[2]	18	2	72	107-06-2
1,1-Dichloro-ethylene	0.7[2]	25	2.8	100	75-35-4
Dichloromethane	8.6[2]	310	34.4	1240	75-09-2

	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**
2,4-Dinitrotoluene	0.13[2]	4.68	0.52	18.7	121-14-2
Endosulfan[9]	3	108	12	432	See below[9]
Ethylbenzene	30[10]	1080	120	4320	100-41-4
Fluoride	150[10]	10000	600	40000	
Fluroxypyr	2	75	8	300	69377-81-7
Lead	5[2]	1500	20	6000	
Mercury	0.2[2]	50	0.8	200	
Methyl ethyl ketone	200[2]	7200	800	28800	78-93-3
Moderately harmful pesticides[11](total)	N/A[12]	250	N/A[12]	1000	See below[11]
Molybdenum	5[10]	1000	20	4000	
Nickel	2[10]	1050	8	4200	
Nitrobenzene	2[2]	72	8	288	98-95-3
C6-C9 petroleum hydrocarbons[13]	N/A[12]	650	N/A[12]	2600	
C10-C36 petroleum hydrocarbons[13]	N/A[12]	10000	N/A[12]	40000	
Phenol (non-halogenated)	14.4[14]	518	57.6	2073	108-95-2
Picloram	3	110	12	440	1918-02-1
Plasticiser compounds[15]	1	600	4	2400	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	

	Maximum values for *leachable concentration* and *specific contaminant concentration* when used together				
	General solid waste[1]		**Restricted solid waste**		
Contaminant	**Leachable concentration TCLP1 (mg/L)**	**Specific contaminant concentration SCC1 (mg/kg)**	**Leachable concentration TCLP2 (mg/L)**	**Specific contaminant concentration SCC2 (mg/kg)**	**CAS Registry Number**
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
1,1,1,2-Tetrachloroethane	10[2]	360	40	1440	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	2073	108-88-3
1,1,1-Trichloroethane	30[2]	1080	120	4320	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]	14400	1600	57600	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]	1800	200	7200	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 1990) 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 – Proposed Rule* (USEPA 1995)

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. DECC 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 1994)

11. The following moderately harmful pesticides (CAS Registry Number) are to be included in the total values specified:

    Atrazine (1912-24-9), Azoxystrobin (131860-33-8), Bifenthrin (82657-04-3), Brodifacoum (56073-10-0), Carboxin (5234-68-4), Copper naphthenate (1338-02-9), Cyfluthrin (68359-37-5), Cyhalothrin (68085-85-8), Cypermethrin (52315-07-08), Deltamethrin (52918-63-5), Dichlofluanid (1085-98-9), Dichlorvos (62-73-7), Difenoconazole (119446-68-3), Dimethoate (60-51-5), Diquat dibromide (85-00-7), Emamectin benzoate (137515-75-4 & 155569-91-8), Ethion (563-12-2), Fenthion (55-38-9), Fenitrothion (122-14-5), Fipronil (120068-37-3), Fluazifop-P-butyl (79241-46-6), Fludioxonil (131341-86-1), Glyphosate (1071-83-6), Imidacloprid (138261-41-3), Indoxacarb (173584-44-6), Malathion (Maldison) (121-75-5), Metalaxyl (57837-19-1), Metalaxyl-M (70630-17-0), Methidathion (950-37-8), 3-Methyl-4-chlorophenol (59-50-7), Methyl chlorpyrifos (5598-13-0), N-Methyl pyrrolidone (872-50-4), 2-octylthiazol-3-one (26530-20-1), Oxyfluorfen (42874-03-3), Paraquat dichloride (1910-42-5), Parathion methyl (298-00-0), Permethrin (52645-53-1), Profenofos (41198-08-7), Prometryn (7287-19-6), Propargite (2312-35-8), Pentachloronitrobenzene (Quintozene) (82-68-8), Simazine (122-34-9), Thiabendazole (148-79-8),Thiamethoxam (153719-23-4), Thiodicarb (59669-26-0) and 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.

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, cleanup 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 1999).

14. Proposed level for phenol and toluene in *Hazardous Waste Management System: Identification and Listing of Hazardous Waste – Toxicity Characteristics Revisions, Final Rule* (USEPA 1990)

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 (CAS number) 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. The following Scheduled Chemicals (CAS Registry Number) are to be included in the total values specified:

    Aldrin (309-00-2), Alpha-BHC (319-84-6), Beta-BHC (319-85-7), Gamma-BHC (Lindane) (58-89-9), Delta-BHC (319-86-8), Chlordane (57-74-9), DDD (72-54-8), DDE (72-55-9), DDT (50-29-3), Dieldrin (60-57-1), Endrin (72-20-8), Endrin aldehyde (7421-93-4), Heptachlor (76-44-8), Heptachlor epoxide (1024-57-3), Hexachlorobenzene (118-74-1), Hexachlorophene (70-30-4), Isodrin (465-73-6), Pentachlorobenzene (608-93-5), Pentachloronitrobenzene (82-68-8), Pentachlorophenol (87-86-5), 1,2,4,5-Tetrachlorobenzene (95-94-3), 2,3,4,6 Tetrachlorophenol (58-90-2), 1,2,4-Trichlorobenzene (120-82-1), 2,4,5-Trichlorophenoxyacetic acid, salts and esters (93-76-5).

18. Calculated from *Guidelines for Drinking Water Quality* (WHO 1993)

Table 3: Summary of criteria for chemical assessment to determine waste classification

Waste classification[1]	Criteria[2] 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 and DECC approves immobilisation[3]	Without DECC approval of immobilisation, classify as restricted solid or hazardous (as applicable)
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 and DECC approves immobilisation[3]	Without DECC approval of immobilisation, classify as hazardous
Hazardous waste	1. TCLP test values > TCLP 2	
	2. TCLP test values ≤ TCLP2 and SCC test values > SCC2 and no DECC approval for immobilisation	

Notes:

1. See also the general waste classification principles on page 2 for other criteria that must be satisfied before the waste can be classified.
2. These criteria apply to each toxic and ecotoxic contaminant present in the waste (see Tables 1 and 2).
3. In certain cases DECC 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).

APPENDIX I

AARGUS FIELDWORK PROTOCOLS

Aargus

Environmental - Remediation - Engineering - Laboratories - Drilling

Sampling Quality & Fieldwork Assurance Protocols

January 2013

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ATTACHMENTS

Groundwater Well & Wellhead Construction Details

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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$_7$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:

$$\mathbf{95\%\ UCL = mean + t_{\propto,n-1}\,\frac{\mathit{STDEV}}{\sqrt{n}}}$$

where

mean	arithmetic average of all sample measurements
$t_{\propto,n-1}$	A test statistic (Student’s t at an ∝ level of significance and n-1 degrees of freedom)
∝	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

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14 ABBREVIATIONS

ANZECC	Australian and New Zealand Environment and Conservation Council
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

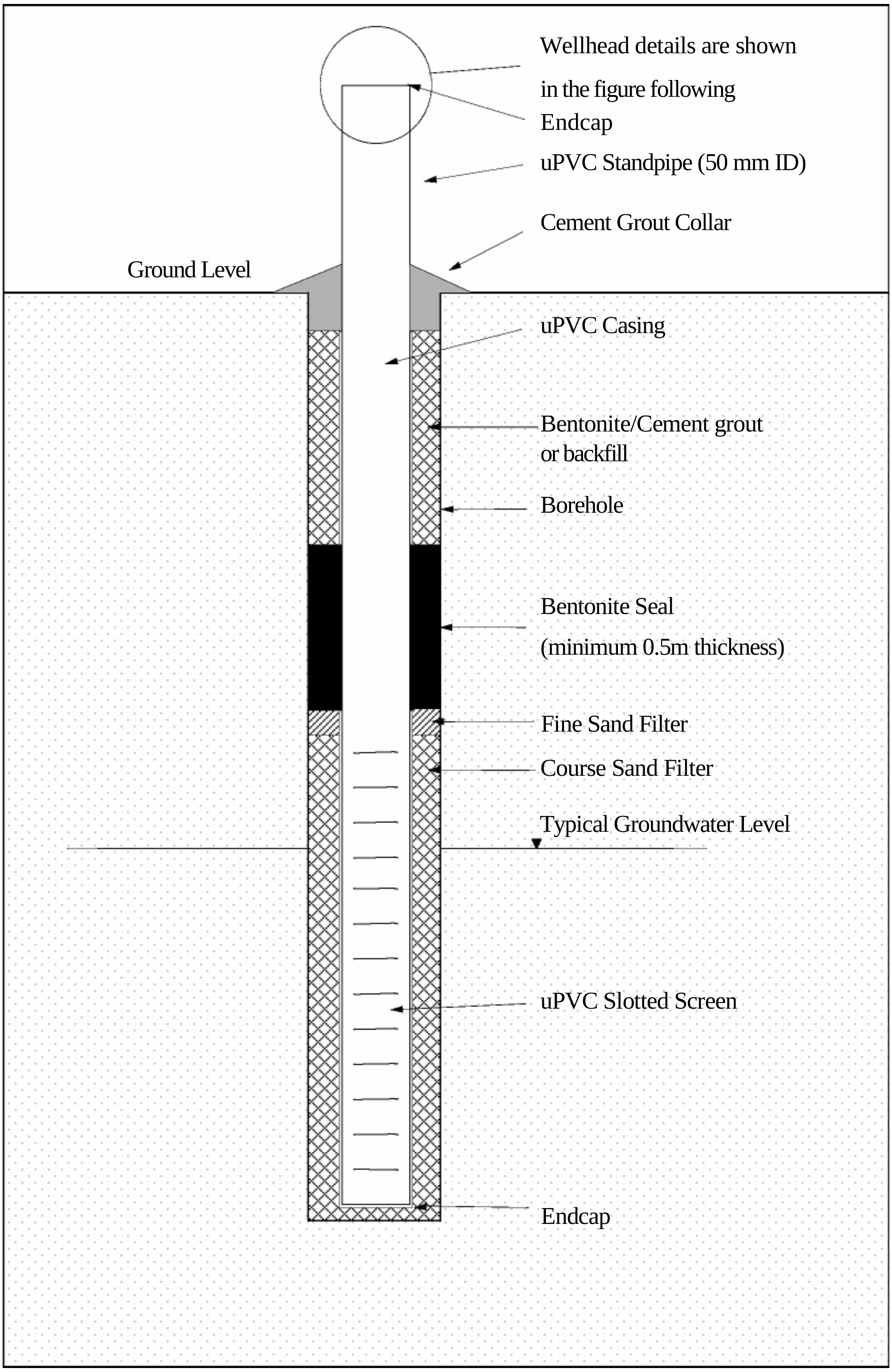
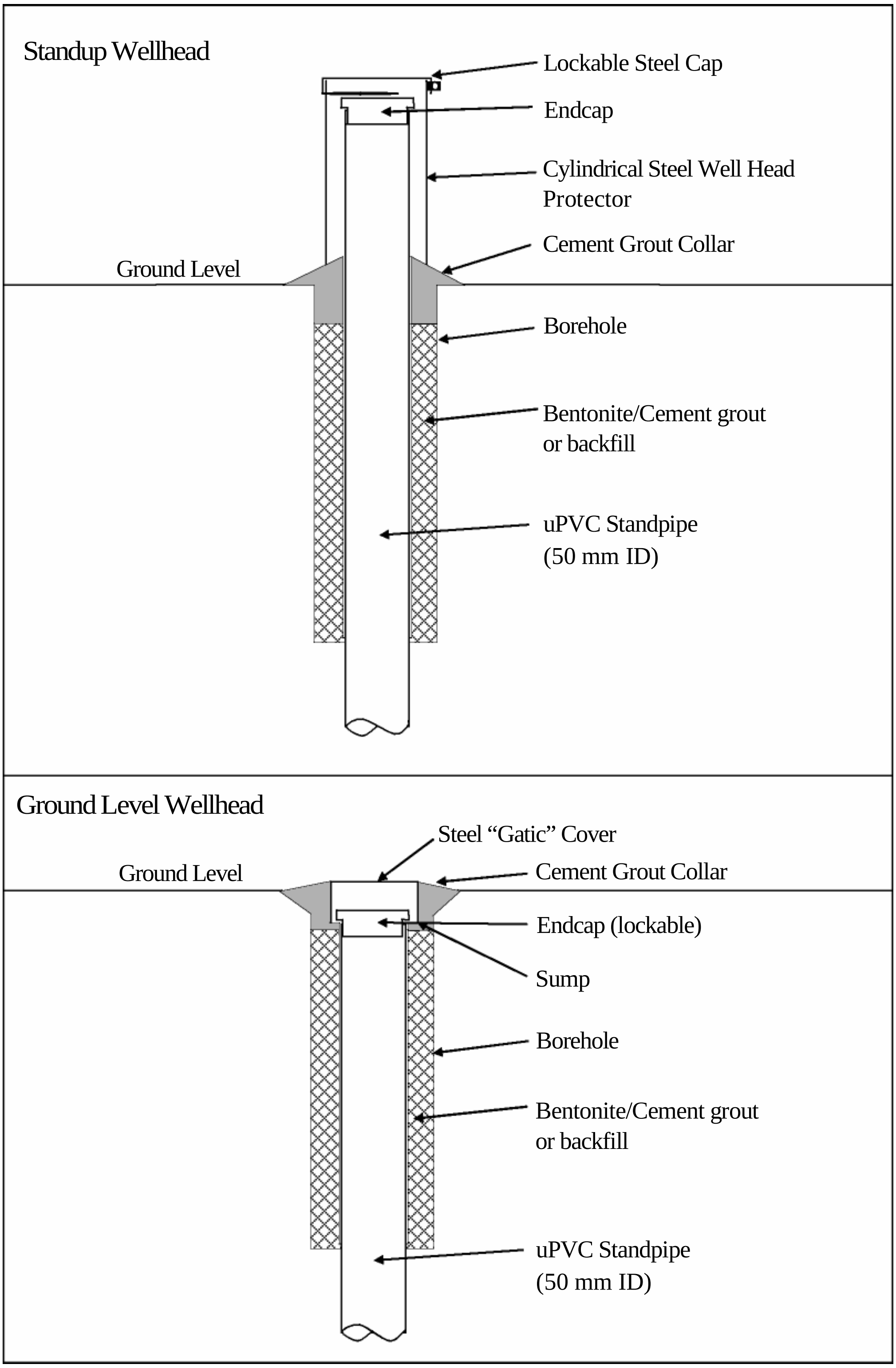


Figure 2 Groundwater Wellhead Construction Details



Aargus

Environmental - Remediation - Engineering - Laboratories - Drilling

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 = <u>Risk Score</u>

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.*

APPENDIX J

SAMPLE PRESERVATION AND LABORATORY METHODS

Analyte	Method	APHA/USEPA Method
C_6-C_9 – 1999 NEPM Fractions **TRH (Volatile)/BTEX** **C_6-C_{10} – 2010 DRAFT NEPM Fractions**	10g soil extracted with 20mL methanol, tumbled for 1 hour, and analysed with solvent and instrument check surrogates. Clay samples must be completely disintegrated before an aliquot is taken for analysis. Water direct injection of supplied sample (unopened) and analysis with solvent and instrument check surrogates. Analysis by capillary column Purge and Trap GCMS (mgt LabMark in-house method numbers Method: E029/E016 BTEX, Method: E004 Petroleum Hydrocarbons (TPH), Method: LM-LTM-ORG2010, Method: E005 Moisture Content). Owing to the differential responses of mass spectrometric detectors towards aliphatic and aromatic compounds, it is essential that the standard contain representatives of both groups. This standard should therefore consist of about 40% aromatic and 60% aliphatic target analytes, to be representative of a typical Australian fuel. The aromatic compounds shall comprise the components of BTEX. The aliphatics shall comprise equal proportions of all n-alkanes in the C6 to C10 range.	USEPA Method 8260B
Total Recoverable Hydrocarbons C_{10}-C_{36} – 1999 NEPM Fractions **>C_{10}-C_{40} – 2010 DRAFT NEPM Fractions**	Soil - 10g soil and anhydrous sodium sulfate extracted with 20mL dichloromethane/acetone (1:1), and tumbled for a minimum of 1 hour. Clay samples must be completely disintegrated before an aliquot is taken for analysis. Water - One 250ml of water sequentially extracted in a separatory funnel three times with 20mL dichloromethane. Analysis by capillary column GC/FID (mgt LabMark in-house method numbers Method: E004 Petroleum Hydrocarbons (TPH), Method: LM-LTM-ORG2010, Method: E005 Moisture Content)	USEPA Method 8015C
TPH (Silica Gel)	Exchange an aliquot of sample extract into a suitable solvent for clean-up. For example, a 1:1 dichloromethane/acetone extract should be exchanged into a suitable non-polar solvent to allow for removal of polar substances. To the solvent-exchanged extract add an appropriate weight of silica gel. Mix the extract and silica gel thoroughly (e.g. with vortex mixer) and allow the sorbent to settle before removing a portion of the extract for analysis. (mgt LabMark in-house method numbers Method: LM-LTM-ORG2010, Method: E005 Moisture Content)	USEPA Method 3630C
Phenols/PAH	Soil - 10g soil, surrogates, mixed with anhydrous sodium sulfate and extracted with 20mL dichloromethane/acetone (1:1), and tumbled for a minimum of 1 hour. Clay samples must be completely disintegrated before an aliquot is	USEPA Method 8270D

Analyte	Method	APHA/USEPA Method
	taken for analysis. Water - 250ml water sample plus surrogates triple extracted with dichloromethane (base and neutrals). Analysis by capillary column GC/MS (mgt LabMark in-house Methods E008.1, E008.2, E015.1, E015.2, E017.1 and E017.2, E016.1, E016.2, E017.1 and E017.2, E007.1, E007.2, E015.1, E015.2, E017.1 and E017.2 Method: E005 Moisture Content).	
Total Metals (As, Cd, Cr, Cu, Ni, Pb, Zn)	A 0.5gm portion of soil undergoes acidic microwave digestion. Analysis by ICP/MS.(mgt Labmark in-house method E022.2).	USEPA Method 6020A
Total Mercury (Hg)	0.5g soil acidic microwave digestion. Analysis by FIMS. (mgt Labmark in-house method E026.2).	USEPA Method 7471B
Filtered Metals (As, Cd, Cr, Cu, Ni, Pb ,Zn)	Filtered (0.45mm) and acidified in the field prior to analysis. Analysis by ICP/MS. (mgt LabMark in-house method E022.1).	USEPA Method 6020A
Filtered Metals (Al, As, Be, Cd, Cr, Co, Cu, Fe, Pb, Mo, Ni)	Filtered (0.45mm) and acidified in the field prior to analysis. Analysis by ICP/MS. (mgt LabMark in-house method E022.1).	USEPA Method 6020A
Total Metals (Al, As, Be, Cd, Cr, Co, Cu, Fe, Pb, Mo, Ni)	Acidified in the field prior to analysis and digested in the laboratory using aqua regia. Analysis by ICP/MS. (mgt LabMark in-house method E022.1).	USEPA Method 6020A
Filtered Mercury (Hg)	Filtered, oxidation and final reduction. Analysis by FIMS. (mgt LabMark in-house method E022.1).	USEPA Method 7471B
Conductivity	Direct measurement using a calibrated meter and electrode. (mgt LabMark in-house method E032 Electrical conductivity (EC)).	APHA Method 2520 B
pH	Direct measurement using a calibrated meter and electrode. (mgt LabMark in-house method E018 pH).	APHA Method 4500-H^+
Suspended Solids (SS)	Gravimetric measurement of the residue filtered through a GFC filter. (mgt LabMark in-house method 4100 Total Suspended Solids dried at 103-105°C).	APHA Method 2540 D
Ammonia (as N)	Alkaline phenol and hypochlorite react with ammonia to form indophenol blue that is proportional to the ammonia concentration that is determined colorimetrically. (mgt LabMark in-house method E036/E050 Ammonia as N).	APHA Method 4500-N
Phosphorus (as P)	Acid digestion of phosphorus species to form a molybdophosphoric acid complex that is reduced to molybdenum blue which is proportional to the phosphorus concentration that is determined colorimetrically. (mgt LabMark in-house method E038 /E052 Total Phosphorus (as P)).	APHA Method 4500-P

SAMPLE PRESERVATION AND SAMPLING GUIDE

Soils, Sediments & Solid Matrices

mgt-LabMark Recommended Preservation and Container Guide

Parameter	Container	Lab Analysis Portion (g) (1)	mgt-LabMark Preferred Preservation	Recommended Holding Times
Acid Sulphate Soil (SPOCAS/CrS)	P or G	50	6°C / freezing may limit loss of integrity	24 hours #
Alcohols	G	20	6°C, Zero Headspace	14 days*
Asbestos	P	50	None, separate sample required	indefinite
BTEX / TPH (C6-C9)	G	20	6°C, Zero Headspace	14 days*
Carbamates	G	20	6°C	14 days*
Cyanides	G	20	6°C	14 days
Dioxins and Furans	G	250	6°C, dark	28 days
Explosives	G	50	6°C	14 days*
Formaldehyde	G	50	6°C	14 days
HRAF (aliphatic / aromatic speciation of TPH)	G	20	6°C, Zero Headspace	14 days*
Inorganics - general anion, cations and CEC	G or P	20	6°C	28 days
Metals (except Hg & Cr VI)	G or P	20	NR	6 months
Mercury or Chromium VI	G or P	20	6°C	28 days
Micro (E. Coli, FC, TC etc.)	P (sterile)	125	6°C	24 hours
Moisture	G or P	20	6°C	14 days
pH or EC	G or P	20	6°C	7 days**
Phenols (Totals or Speciated)	G	20	6°C	14 days*
Phenoxy Acid Herbicides	G	20	6°C	14 days*
Sulphur/Sulphides	G	20	6°C	7 days
Any SVOCs including - OCs, OPs, PCBs, PAHs, Phthalates, SVCCs plus TPH (C10-C36), Glyphosates, TBTs	G	20	6°C	14 days*
SVOC's (USEPA 8270 list)	G	20	6°C	14 days*
TCLP or AS4439.2/.3 ##	G	250	6°C	7 days ###
TCLP (Zero Headspace) ##	G	250	6°C, Zero Headspace	7 days
Total Organic Carbon (or TOM)	G	20	6°C, Zero Headspace	28 days
TPH (C6-C9) plus BTEX	G	20	6°C, Zero Headspace	14 days*
TPH/TRH (C10-C36)	G	20	6°C	14 days*
VOCs / VHCs / VACs / THMs	G	20	6°C, Zero Headspace	14 days*
Common Suites of analytes				
TPH, BTEX, Metals, Moisture	G	60	6°C, Zero Headspace	See above
TPH, BTEX, Metals, PAH, SVOCs, VOCs, pH, Moisture	G	80	6°C, Zero Headspace	See above
TPH, BTEX, Metals, PAH, OCPs, PCBs, TCLP, Moisture	G	250	6°C, Zero Headspace	See above
Trip Spikes for VOCs (prepared in the Lab)	G	full jar	**<-10°C**, Zero Headspace	14 days***
Typical sample weights contained in standard jars (zero headspace)			**250 mL jar** = 350-420 g	
Dust Gauges - contact Lab				

REFERENCES: USEPA SW846, NEPM, EPA VIC, ISO5667, Queensland Acid Sulfate Soils Management Advisory Committee (QASSMAC), Environmental Analysis Laboratory (EAL)
Please note Maximum THT's may vary upon the guideline document referenced.

NOTES:	(1)	We recommend that you provide additional sample on the 1st, 11th, 21st. 31st etc sample for performance of Duplicates / Matrix Spikes. Note however that Matrix Spike determinations are not appropriate for all tests.
	*	Extract within 14 days and analyse within 40 days (mgt-LabMark's preference is to extract within 7 days for volatiles where sufficient time available).
	**	mgt-LabMark's preference is to analyse as soon as possible
	***	Shelf life in matrix (sand) is low if not frozen, therefore freeze if storing or return to lab with samples immediately
	#	where acidity (hence liming rates) is captured in actual and potential acidity, analysis within one week should be satisfactory
	##	Time from sampling date to tumbling (water THTs for leachate apply)
	###	except Metals/OCPs/PCBs 28 days
CONTAINERS:	P	= Plastic (HDPE or equivalent, teflon lined lid), batch tested
	G	= Glass (teflon lined lid), batch tested

Soil Samples are discarded 3 months from the date received

mgt-LabMark Environmental - Contact Details

LOCATION	DELIVERY ADDRESS	TELEPHONE	FACSIMILE
Sydney	Units F3-F6, Lane Cove Business Park, 16 Mars Rd. Lane Cove NSW	(02) 8215 6222	(02) 9476 8219
Melbourne	2-5 Kingston Town Close, Oakleigh VIC 3166	(03) 9564 7055	(03) 92564 7190
Brisbane	Unit 1/21 Smallwood Place, Murarrie QLD 4172	(07) 3902 4600	(07) 3902 4646
Adelaide	140 Richmond Road, Marleston SA 5033	(08) 8443 4430	Mobile - 0438 424 511
Perth	Unit 5, 91 Leach Hwy, Kewdale WA	(08) 9353 6535	Mobile - 0418 856 576
Darwin	Unit 3, 83 Coonawarra Rd, Winellie NT 0800	(08) 8947 1557	Mobile - 0428 489 614
Newcastle	Unit 5, 166 Hannell Street, Wickham NSW	(02) 4902 4830	Mobile - 0410 220 750

SAMPLE PRESERVATION AND SAMPLING GUIDE
Liquid Matrices

mgt LabMark
ENVIRONMENTAL LABORATORIES

Recommended Preservation and Container Guide

Parameter	Container	Lab Analysis Portion mL$^{(2)}$	mgt-LabMark Preferred Preservation	Recommended Holding Times
Acidity/Alkalinity	P or G	200	6^{o}C	14 days**
Alcohols	PT	2 x vials	pH<2 (HCl), 6^{o}C, Zero headspace	14 days $^{(3)}$
Ammonia-N	P or G	200	pH<2 (H_2SO_4), 6^{o}C$^{(1)}$ /site filter and freeze	28 days
BOD$_5$	P or G	2 x 500	6^{o}C, Zero headspace	48 Hours$^{\#}$
Bromate	P	50	6^{o}C	28 days
Bromide	P	50	6^{o}C	28 days
BTEX plus TPH (C6-C9)	PT	2 x vials	pH<2 (HCl or H_2SO_4), 6^{o}C, Zero headspace	14 days $^{(3)}$
Carbamates/Dioxins/Furans	G	500	6^{o}C	1 month
Carbon, Total Organic (TOC)	G	100	pH<2 ($H_2SO_{4\ \text{or HCl}}$), 6^{o}C	28 days
Carbon, Dissolved Organic (DOC)	G	100	Field filter at 0.45um then pH<2 ($H_2SO_{4\ \text{or HCl}}$), 6^{o}C	28 days
Cations	P	50	6^{o}C, pH<2 (HNO_3)	6 months^{APHA}
Chlorate	P	50	6^{o}C	7 days
Chloride	P	50	6^{o}C	28 days
Chlorite	P	50	6^{o}C	24 hours$^{(5)}$
Chlorine (residual)	-	--	Field test	Note (5)
Chlorophyll-a (Vol' PQL dependant)	Dark P	500-2000	Unfiltered Dark, 6^{o}C or Filtered residue	24 Hours$^{\#\#}$
Chromium VI (hexavalent Cr)	P	100	filtered, unpreserved / pH 8-9 (NaOH), 6^{o}C$^{(1)}$	1 day / 28 days $^{(1)APHA}$
COD	G	100	pH<2 (H_2SO_4), 6^{o}C$^{(1)}$	28 days
Colour	P	100	6^{o}C	2 days^{AS}
Conductivity (EC) or Salinity	P	50	6^{o}C, Zero headspace, 6oC	28 days
Cyanide (Total/Amenable)	P	100	pH >12 (NaOH), 6^{o}C Dark	14 days $^{(6)}$
Cyanide (Free / WAD)	P	100	Free neutral, WAD pH >12 (NaOH), 6oC Dark	14 days $^{(6)\#\#}$
Dissolved Oxygen	-	--	Field test	Note (5)
Explosives	G	500	6^{o}C	7 days*
Ferrous/Ferric Iron $^{(4)}$	P	100	filtered pH <2 (HCl), 6^{o}C, Dark, Zero Headspace	7 days^{ISO}
Fluoride	P	50	6^{o}C	28 days
Formaldehyde	G	100	6^{o}C	7 days
Hardness	P	50	6^{o}C, pH<2 (HNO_3)	6 months
Iodate	P	50	6^{o}C	1 month
Iodide	P	50	6^{o}C	1 month
Ion Balance	P	500-1000	See Individual Analytes in price book	--
Metals – Total (Recoverable)	P	100	pH<2 (HNO_3)	6 months
Metals – Dissolved	P	100	Field Filter at 0.45 um **then** pH<2 (HNO_3)	6 months
Mercury – (Total Recoverable)	P	100	pH<2 (HNO_3)	28 days
Mercury – Dissolved	P	100	Field Filter at 0.45 um **then** pH<2 (HNO_3)	28 days
Methane (Ethane/Ethene)	PT	2 x vials	**Half fill** the vials, store upside down at 6^{o}C	14 days
Nitrogen: TKN	P or G	100	pH<2 (H_2SO_4), 6^{o}C$^{(1)}$	28 days
Nitrate / NOx	P or G	50	unpreserve 6^{o}C / pH<2 (HCl), 6^{o}C	2 days$^{\#\#}$ / 7 days
Nitrite	P or G	50	unpreserve 6^{o}C	2 days
Nitrogen: Total N	-	--	TKN and NOx sample bottles are required	--
Oil & Grease	G	2 x 500	pH<2 (H_2SO_4 or HCl), 6^{o}C	28 days
OC/OP Pesticides – see SVOCs	G	see SVOC	6^{o}C	7 days*
PAHs – see SVOCs below	G	see SVOC	6^{o}C	7 days*
pH / free CO2 / total CO_2	P or G	100	Field Test, 6^{o}C	Note (5)
Phenolics (total)	P or G	100	pH<2 (H_2SO_4),6^{o}C	28 days^{APHA}
Phenols – speciated	G	see SVOC	6^{o}C	7 days*
Phenoxy Acid Herbicides	G	500	6^{o}C, pH 1-2 HCl	14 days
Phosphate (ortho)	P or G	50	6^{o}C	2 days$^{\#\#}$ 1 month filtered^{ISO}
Phosphorus (Total filtered or unfiltered)	P	100	pH<2 (HNO_3)	1 month
Solids (suspended, dissolved etc)	P	500-1000	6^{o}C	7 days
Sulphate	P	50	6^{o}C	28 days
Sulphide (Total)	P	200	6^{o}C (Zinc Acetate/NaOH pH>9) zero headspace	7 Days
Sulphide (Dissolved)	P	100	6^{o}C	24 hours
Surfactants – anionic (MBAS)	G	250	6^{o}C/preserved with formalin	2 days/4 days preserved with formalin to 1%
SVOCs including – OCs, OPs, PCBs, PAHs, Phthalates (**normal level**) plus TPH (C10-C36)	G	2 x 500	6^{o}C	7 days*
Low or Trace level Organics		4 x 500		
SVOC's (USEPA 8270 list)	G	see SVOC	6^{o}C	7 days*
TPH (C6-C9)	PT	As for BTEX no additional vials needed	pH<2 (HCl), 6^{o}C, Zero headspace	14 days $^{(3)}$
TPH (C10-C36)	G	As for SVOC 'normal' no additional needed	6^{o}C	7 days*
Turbidity	P or G	100	Analyse Immediately, dark, 6^{o}C	48 Hours
VOCs / VHCs / VACs / THMs / MTBEs	PT	2xvials	pH<2 (HCl or H_2SO_4), 6^{o}C, Zero headspace$^{(7)}$	14 days $^{(3)}$
Microbiological	P/S	120	6^{o}C	24 hours
Micro' – (in Chlorinated Water) Coliforms - Ecoli	P/S	500 (4*120)	6^{o}C - 0.008% $Na_2S_2O_3$.	24 hours
Micro' – (in Chlorinated Water)	P/S	120	6^{o}C - 0.008% $Na_2S_2O_3$.	24 hours

REFERENCES: APHA 21st Edition, USEPA SW846, ISO 5667.3, EPA VIC and AS/NZS 5667.1 1998
Please note Maximum HT's may vary upon the guideline document referenced.

NOTES:

(1)	This test may not require preservation if received and analysed within 24 hours of sampling; this must be pre-arranged with the laboratory.
(2)	We recommend that you provide additional sample on the 1st, 11th, 21st, 31st etc sample for performance of Duplicates / Matrix Spikes. (Note however that Matrix spike determinations are not appropriate for all tests).
(3)	USEPA recommends 14 days, Australian Standard recommends 7 days.
(4)	If **Dissolved Metals** are requested, the Ferrous Iron sample must be field filtered before being preserved
(5)	This analyte should be determined in the field, these tests will not be measured for compliance to holding time but are analysed on receipt
(6)	Holding Time is reduced to 24hrs with the presence of sulphides. Contact the laboratory if the presence of sulphides is suspected
(7)	Sodium Bisulfate is an alternative preservation for VOC analysis upon request
*	This holding time requires the samples to be extracted within 7 days and analysed within 40 days.
**	The mgt-LabMark aim is to perform these analyses within 2 days (where sufficient time available).
#	The holding times may be extended to one month if the sample is frozen
##	The holding times may be extended to 28 days if the sample is filtered then frozen.

CONTAINERS:

P	= Plastic (HDPE or equivalent, all teflon lined), batch tested
PT	= Purge & Trap VOA Vial (with teflon liner), batch tested
G	= Glass (all teflon lined), batch tested
P/S	= Plastic Sterile, batch tested

Liquid samples are discarded 4 weeks from the date received

SOLIDS

Analyte	LOR (mg/kg)	Method
Compositing (per discrete sample)	-	In-house
Solids pulverise only	-	In-house
Solids crush/pulverise	-	In-house
Concrete core cutting (per section)	-	In-house
Samples received for holding	-	-
Extended storage per month	-	-
Trip spike (soil) supply per jar	-	-
Trip blank (soil) supply per jar	-	-
Rinsate water supply per L	-	-
Moisture#	0.1%	In-house
Soil/water leach (1:5)	-	In-house
TCLP extraction	-	USEPA 1311
ASLP – metals & SVOC	-	AS 4439.3
TCLP/ASLP – VOC	-	AS 4439.3 (ZHE)
Paint film (dried) digest ^	-	In-house
Field Tests		
pHF ^	0.1 pH unit	23AF
pHFox ^	0.1 pH unit	23BF
pHF and pHFox ^	0.1 pH unit	23AF/BF
SPOCAS Test Suite		
TPA – Titratable Potential Acidity	5 mol H+/tonne	23G
TAA - Titratable Actual Acidity	5 mol H+/tonne	23F
pHox/pHKCl	0.1 pH unit	23A - 23B
SP/SKCl/SPOS	0.005%	23C - 23E
Ca & Mg extractables	0.005%	23S - 23X
Additional ANCE (If pHOX >6.5)	5 mol H+/tonne	23Q
Additional SHCl (If pHKCl <4.5 to calc SNAS)	0.01%	20B
Chromium Test Suite		
pHKCl	0.1 pH unit	23A
TAA	5 mol H+/tonne	23F
SCR	0.005%	22A
Additional SHCl / SKCl (If pHKCl <4.5 to calc SNAS)	0.005%	20B & 23C
Additional ANCBT ^(If pHOX >6.5)	5 mol H+/tonne	23Q
Acid Mine Drainage		
Net Acid Generation		
pHox	0.1 pH unit	
Net Acid Producing Potential ^		Calculation
Aged pH (1:2) ^	0.1 pH unit	In-house
Aged EC (1:2) ^	0.1 pH unit	In-house
Sulphate (SHCl) ^	0.005%	
Total Sulphur ^	0.005%	
TOS (Tot S - SO4)^	0.005%	Calculation
ANC ^	0.06% CaCO3	23Q
Anions (F, Cl, NO2, Br, NO3, PO4, SO4)	Refer to the individual analytes	
Bromide (water soluble)	1	APHA 4110

No charge if analysis requested that requries results to be reported on a dry weight basis

^ Not covered by the terms of our NATA accreditation

SOLIDS continued

Analyte	LOR (mg/kg)	Method
Bulk Density	g/mL	In-house
Carbon (total)	0.05%	Leco
Chloride (water soluble)	5	APHA 4110
Cyanide (total)	0.5	APHA 4500-CN
Cyanide (weak acid dissociable)	0.5	APHA 4500-CN
Cyanide (free)	0.5	APHA 4500-CN
Cyanide (amenable to chlorination)	0.5	APHA 4500-CN
Electrical conductivity	5 µS/cm	APHA 2510B mod
Fluoride (total)	50	In-house
Fluoride (water soluble)	0.5	APHA 4400 F-C
Modified Emerson Class	-	External
Oil and Grease	50	APHA 5520B
Organic Matter (Calculated from TOC)	0.05%	Discrete Analyser
pH	0.1 pH unit	APHA 4500-H mod
pH (CaCl2)	0.1 pH unit	APHA 4500-H mod
pH/Electrical Conductivity	Refer to individual analytes	Refer to individual analytes
Phenolics (total)	0.1	APHA 5530
Redox potential (Eh or ORP)	1 mv	In-house
Resistivity	2000 ohm.m	APHA 2510B mod
Salinity (calculated from EC)	10	APHA 2520 mod
Sieve fraction	Various	In-house
Sieve analysis	Various	In-house
Sieve sedimentation (hydrometer)	Various	In-house
Soil texture ^	-	In-House
Sulphate (water soluble)	5	APHA 4110 mod
Sulphate (acid extractable)	0.005%	APHA 3120 mod
Sulphur (total) ^	0.005%	In-house
Total organic carbon (TOC)	0.05%	Discrete Analyser
Total organic carbon (TOC)	0.01%	Leco
Whole Rock Analysis	-	In-house
Ammonia (water soluble) ^	0.5	APHA 4500-NH3 mod
Nitrate (water soluble)	0.5	APHA 4110/4500-NH3
Nitrite (water soluble)	0.5	APHA 4110
Nitrogen - oxidised	0.5	APHA 4110
Total kjeldahl nitrogen (TKN)	5	APHA 4500-Norg B mod
Phosphate (water soluble)	1	APHA 4110/4500-P
Phosphorus sorption ^	1	In-house
Phosphorous retention index (PRI) ^	1%/5mg/kg	In-house
Available phosphorous (Colwell)	1	Rayment & Higginson
Phosphorous absorption isotherm ^	0.02	In-house
Phosphorus (total)	5	APHA 4500-P B/E mod

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SOLIDS continued

Analyte	LOR (mg/kg)	Method
Aluminium (Al)	Detections vary between testing facilites. Limits are in line with current regulations and requirements.	USEPA 6010B / USEPA 6020A
Antimony (Sb)		
Arsenic (As)		
Barium (Ba)		
Beryllium (Be)		
Bismuth (Bi)		
Boron (B)		
Cadmium (Cd)		
Calcium (Ca)		
Chromium (Cr)		
Cobalt (Co)		
Copper (Cu)		
Iron (Fe)		
Lead (Pb)		
Lithium (Li)		
Magnesium (Mg)		
Manganese (Mn)		
Molybdenum (Mo)		
Nickel (Ni)		
Potassium (K)		
Phosphorus (P)		
Selenium (Se)		
Silver (Ag)		
Sodium (Na)		
Strontium (Sr)		
Sulphur (S) ^		
Thallium (Tl)		
Tin (Sn)		
Titanium (Ti)		
Vanadium (V)		
Zinc (Zn)		
Full ICP-OES Scan	Various	USEPA 6010B / USEPA 6020A
Hexavalent chromium (Cr6+)	1	APHA 3500-Cr
Mercury (Hg)	0.5	USEPA 7471A
Benzene, toluene, ethyl benzene, xylenes (BTEX)	Refer to Data Sheet 1	USEPA 8260

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SOLIDS continued

Analyte	LOR (mg/kg)	Method
BTEX (low level)	Refer to Data Sheet 1	USEPA 8260
Total Recoverable Hydrocarbons (C6-C9)	Refer to Data Sheet 1	USEPA 8260 mod
Total Recoverable Hydrocarbons (C10-C36)	Refer to Data Sheet 1	USEPA 8015
Total Recoverable Hydrocarbons (C6-C36)	Refer to Data Sheet 1	USEPA 8015
BTEX + TRH (C6-C9)	Refer to individual analytes	
TRH + BTEX	Refer to individual analytes	
TPH (includes silica gel clean-up)	Refer to Data Sheet 1	NEPM USEPA 8015
Product ID by GC-FID	Not applicable	GC/FID
TRH aliphatic/aromatic speciation (NEPM requirements)	Refer to Data Sheet 1	MA DEP 1994 GC/FID
Trihalomethanes (THM)	Refer to Data Sheet 7	USEPA 8260B
Monocyclic aromatic hydrocarbons (14 MAHs)	Refer to Data Sheet 7	USEPA 8260B
Volatile halogenated hydrocarbons (41 VHCs)	Refer to Data Sheet 7	USEPA 8260B
VOC screen (60 analytes)	Refer to Data Sheet 7	USEPA 8260B
VOC scan for ID of unknowns (10 VOCs max) plus VOC target screen ^	-	USEPA 8260B
Herbicides - phenoxy acid	Refer to Data Sheet 3	USEPA 8151A
Herbicides - phenoxy acid (low level)	Refer to Data Sheet 3	USEPA 8151A
Organochlorine pesticides (OCP)	Refer to Data Sheet 5A	USEPA 8080/8081/ 8270
Organochlorine pesticides (low level)	Refer to Data Sheet 5A	USEPA 8080/8081/ 8270
For general organics packages refer to the Soil Package Calculator	Refer to Data Sheet 5A	USEPA 8080/8081/ 8270
Organophosphate pesticides (OPP)	Refer to Data Sheet 5B	USEPA 8080/8081/ 8270
Organophosphate pesticides (low level)	Refer to Data Sheet 5B	USEPA 8080/8081/ 8270
OPP (extended list)	Refer to Data Sheet 5B	USEPA 8080/8081/ 8270
Polychlorinated biphenyls (PCB, Arochlors)	Refer to Data Sheet 6	USEPA 8080/8081/ 8270
PCB congeners (low level)	Refer to Data Sheet 6	USEPA 8080/8081/ 8270
OC/OP pesticides	Refer to Data Sheet 5A/B	USEPA 8080/8081/ 8270
OC/OP pesticides/PCB congeners	Refer to Data Sheets 5/6	USEPA 8080/8081/ 8270
OC/OP/PCB congeners (all low level)	Refer to Data Sheets 5/6	USEPA 8080/8081/ 8270
PAHs	Refer to Data Sheet 2	USEPA 8270D
PAHs (low level analytes)	Refer to Data Sheet 2	USEPA 8270D
Phenols - speciated (standard list)	Refer to Data Sheet 4	USEPA 8041
Phenols - speciated plus acid herbicides	Refer to Data Sheets 3/4	USEAP 8041/8151
Phenols - speciated (low level)	Refer to Data Sheet 4	USEPA 8041
Phenols - speciated (extended list)	Refer to Data Sheet 4	USEPA 8041
SVOC 8270 Scan	Refer to Data Sheet 13	USEPA 8270D
SVOCs (PAH, OC, OP, PCB package)	Refer to Data Sheet 9	USEPA 8270D
SVOC SGS Extended Organics Scan (162 Analytes)	Refer to Data Sheet 9	USEPA 8270D
SVOC scan for ID of unknowns (10 SVOCs max) plus SVOC target screen ^	1	USEPA 8270D
Herbicides - triazines	Refer to Data Sheet 3	USEPA 8270D mod
Chlorinated benzenes & naphthalenes	Refer to Data Sheet 9	USEPA 8270D
Carbamates	Refer to Data Sheet 9	USEPA 8270D
Phthalates	Refer to Data Sheet 9	USEPA 8270D
Synthetic pyrethroids	Refer to Data Sheet 9	USEPA 8270D mod
Dioxins/Furans		
Dioxins	Refer to Data Sheet 13	HR-GC-MS
Dioxins (Fast)		

^ Not covered by the terms of our NATA accreditation

AQUEOUS

Analyte	LOR (mg/L)	Method Reference
Filtration of samples (per filter)	-	APHA 3000
Absorbance at 254nm	0 abs units	Christian 1986
Acidity	5 mg CaCO3/L	APHA 2310B
Adsorbable organic halides (AOX)	2 µg/L	External
Alkalinity - total	5 mg CaCO3/L	APHA 2320B
Alkalinity - hydroxide	5 mg CaCO3/L	APHA 2320B
Alkalinity - carbonate	5 mg CaCO3/L	APHA 2320B
Alkalinity - bicarbonate	5 mg CaCO3/L	APHA 2320B
Biological oxygen demand (BOD)	2	APHA 5210B
Carbohydrate as sugar	5	In-house
Chemical oxygen demand (COD)	5	APHA
Chlorine demand	-	-
Chlorine - total	0.1	APHA 4500-Cl2
Chlorine - free	0.1	APHA 4500-Cl2
Chlorophyll a,b,c / pheophytin	0.5 µg/L	APHA 10200H
Colour - true	5 PCU	APHA 2120 A/B
Electrical Conductivity	1 µS/cm	APHA 2510B
Cyanide - total	0.005	APHA 4500-CN C/E
Cyanide - amenable to chlorination	0.005	APHA 4500-CN G
Cyanide - weak acid dissociable	0.005	APHA 4500-CN C/I
Cyanide - free	0.5	APHA 4500-CN B/E
Cyanate	0.5	APHA 4500-CN L
Dissolved oxygen	0.1	APHA4 500-O G
Ferrous iron	0.1	APHA 3500-Fe B
Formaldehyde	0.2	In-house
Free CO2 ^	5	APHA 4500-CO2
Hardness - total	5 mg CaCO3/L	APHA 2340B
Chromium - hexavalent (Cr6+)	0.05	APHA 3500-Cr B
Hydrogen sulphide - free	0.05	APHA 4500-S2- C/F
MBAS (refer to Surfactants - MBAS)	-	-
Microtox	Various	External
Odour	-	In-house
Oil and grease	1	APHA 5520B
Oil and grease - hydrocarbons	1	APHA 5520F
pH	0.1 pH units	APHA 4500H
pH/Electrical Conductivity	Refer to the individual analytes	
Phenolics - total	0.05	APHA 5530
Solids - total	10	APHA 2540B
Solids - total suspended (TSS, 103°C)	5	APHA 2540D
Solids - total dissolved (TDS, 180°C)	10	APHA 2540C
Solids - volatile (550°C)	10	APHA 2540E
Solids - settleable ^	10	APHA 2540F
Sulphide	0.05	APHA 4500-S2- C/F
Sulphite	2	APHA 4500-SO32- B
Sulphur - total	0.5	APHA 3500
Surfactants - anionic (MBAS)	0.1	APHA 5540C
Thiocyanate	1	APHA 4500-CN M
Thiocyanate (low level) ^	0.05	APHA 4500-CN M
Thiosulfate	1	APHA 4110
Total organic carbon (TOC)	1	APHA 5310B

^ Not covered by the terms of our NATA accreditation

AQUEOUS continued

Analyte	LOR (mg/L)	Method Reference
Dissolved organic carbon (DOC/FOC)	1	APHA 5310B
Total inorganic carbon (TIC)	1	APHA 5310B
Total carbon	1	APHA 5310B
Turbidity	0.5 NTU	APHA 2130B
Redox potential (Eh)	1 mV	APHA 2580B
Silica - reactive	0.05	APHA 4500-Si F
Sodium absorption ratio (SAR)	0.1	APHA 3500C-Ca,Mg,Na
Anions by IC (F, Cl, NO2, Br, NO3, PO4, SO4)	Refer to the individual analytes	
Bromide	0.2	APHA 4110
Chloride	1	APHA 4110
Fluoride by IC	0.1	APHA 4110
Fluoride by ISE	0.1	APHA 4500-F C
Iodide	0.01	APHA 4110 mod
Nitrate by IC	0.2	APHA 4110
Nitrite by IC	0.1	APHA 4110
Sulphate	1	APHA 4110
Ammonia	0.05	APHA 4500-NH3 B/C
Ammonia (low level)	0.005	APHA 4500-NH3 G
Nitrite	0.05	APHA 4110/4500-NO2 B
Nitrite (low level)	0.005	APHA 4500-NO2 B
Nitrogen - organic (TKN - NH3-N)	0.05	APHA 4500-Norg/NH3
Nitrogen - total Kjeldahl (TKN)	0.05	APHA 4500-Norg
Nitrogen - total oxidised (TON)	0.05	APHA 4500-NO3/NO2
Nitrogen - total oxidised (TON, low level)	0.005	APHA 4500-NO3/NO2
Nitrogen - total (TKN + TON)	0.05	APHA 4500-N
Nitrogen - total persulphate (TPN)	0.05	APHA 4500-N
Phosphorus - filterable reactive	0.05	APHA 4500-P
Phosphorus - filterable reactive (low level)	0.005	APHA 4500-P F
Phosphorus - total	0.05	APHA 4500-P B/ F
Forms of Nitrogen		
Ammonia	Refer to the individual analytes	
Total Kjeldahl nitrogen		
Nitrate		
Nitrite		
Total nitrogen		
Forms of Phosphorus		
Orthophosphate (FRP)	Refer to the individual analytes	
Total phosphorus		
Total persulphate nitrogen	0.05	APHA 4500-Norg B/4500-P F

^ Not covered by the terms of our NATA accreditation

AQUEOUS continued

Analyte	LOR (µg/L)	LOR (mg/L)		Method Reference
	ICP-MS	ICP-OES	AAS/GF-AAS	
Aluminium (Al)	Detections vary between testing facilites. Limits are in line with current regulations and requirements.			USEPA 6010B / USEPA 6020A/ APHA
Antimony (Sb)				
Arsenic (As)				
Barium (Ba)				
Beryllium (Be)				
Bismuth (Bi)				
Boron (B)				
Cadmium (Cd)				
Calcium (Ca)				
Chromium (Cr)				
Cobalt (Co)				
Copper (Cu)				
Iron (Fe)				
Lanthanum (La)				
Lead (Pb)				
Lithium (Li)				
Magnesium (Mg)				
Manganese (Mn)				
Molybdenum (Mo)				
Nickel (Ni)				
Potassium (K)				
Phosphorus (P)				
Selenium (Se)				
Silicon (Si)				
Silver (Ag)				
Sodium (Na)				
Strontium (Sr)				
Sulphur (S)				
Tellurium (Te)				
Thallium (Tl)				
Thorium (Th)				
Tin (Sn)				
Titanium (Ti)				
Uranium (U)				
Vanadium (V)				
Ytterbium (Y)				
Zinc (Zn)				
ICP-MS scan				

^ Not covered by the terms of our NATA accreditation

APPENDIX K

CHAIN OF CUSTODY DOCUMENTATION & LAB CERTIFICATES

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Aargus P/L
446 Parramatta Road
Petersham
NSW 2049

Attention: **Mark Kelly**

Report **382348-S**
Client Reference HARROW ROAD BEXLEY DESA ES5504
Received Date Jun 13, 2013

Client Sample ID			**COMPOSITE A**	**A1 0-0.1**	**A2 0-0.1**	**A3 0-0.1**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Jn08192**	**S13-Jn08193**	**S13-Jn08194**	**S13-Jn08195**
Date Sampled			**Jun 11, 2013**	**Jun 11, 2013**	**Jun 11, 2013**	**Jun 11, 2013**
Test/Reference	LOR	Unit				
Organochlorine Pesticides (OC)						
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	-
4.4'-DDE	0.05	mg/kg	0.10	-	-	-
4.4'-DDT	0.2	mg/kg	< 0.2	-	-	-
a-BHC	0.05	mg/kg	< 0.05	-	-	-
a-Chlordane	0.05	mg/kg	0.43	-	-	-
Aldrin	0.05	mg/kg	< 0.05	-	-	-
b-BHC	0.05	mg/kg	< 0.05	-	-	-
d-BHC	0.05	mg/kg	< 0.05	-	-	-
Dieldrin	0.05	mg/kg	< 0.05	-	-	-
Endosulfan I	0.05	mg/kg	< 0.05	-	-	-
Endosulfan II	0.05	mg/kg	< 0.05	-	-	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	-
Endrin	0.05	mg/kg	< 0.05	-	-	-
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	-
Endrin ketone	0.05	mg/kg	< 0.05	-	-	-
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	-	-
g-Chlordane	0.05	mg/kg	0.10	-	-	-
Heptachlor	0.05	mg/kg	< 0.05	-	-	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	-
Methoxychlor	0.2	mg/kg	< 0.2	-	-	-
Dibutylchlorendate (surr.)	1	%	71	-	-	-
Tetrachloro-m-xylene (surr.)	1	%	75	-	-	-
Heavy Metals						
Arsenic	2	mg/kg	-	2.6	2.3	2.1
Cadmium	0.4	mg/kg	-	< 0.4	< 0.4	0.4
Chromium	5	mg/kg	-	9.0	< 5	10
Copper	5	mg/kg	-	13	6.8	12
Lead	5	mg/kg	-	13	7.9	9.6
Mercury	0.05	mg/kg	-	1.0	0.76	1.1
Nickel	5	mg/kg	-	5.1	< 5	< 5
Zinc	5	mg/kg	-	38	23	24
% Moisture	0.1	%	12	13	13	13

Client Sample ID			**COMPOSITE B**	**A4 0-0.1**	**A5 0-0.1**	**A6 0-0.1**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Jn08196**	**S13-Jn08197**	**S13-Jn08198**	**S13-Jn08199**
Date Sampled			**Jun 11, 2013**	**Jun 11, 2013**	**Jun 11, 2013**	**Jun 11, 2013**
Test/Reference	LOR	Unit				
Organochlorine Pesticides (OC)						
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	-
4.4'-DDE	0.05	mg/kg	0.08	-	-	-
4.4'-DDT	0.2	mg/kg	< 0.2	-	-	-
a-BHC	0.05	mg/kg	< 0.05	-	-	-
a-Chlordane	0.05	mg/kg	0.14	-	-	-
Aldrin	0.05	mg/kg	< 0.05	-	-	-
b-BHC	0.05	mg/kg	0.12	-	-	-
d-BHC	0.05	mg/kg	< 0.05	-	-	-
Dieldrin	0.05	mg/kg	0.09	-	-	-
Endosulfan I	0.05	mg/kg	< 0.05	-	-	-
Endosulfan II	0.05	mg/kg	< 0.05	-	-	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	-
Endrin	0.05	mg/kg	< 0.05	-	-	-
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	-
Endrin ketone	0.05	mg/kg	< 0.05	-	-	-
g-BHC (Lindane)	0.05	mg/kg	0.09	-	-	-
g-Chlordane	0.05	mg/kg	0.07	-	-	-
Heptachlor	0.05	mg/kg	< 0.05	-	-	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	-
Methoxychlor	0.2	mg/kg	< 0.2	-	-	-
Dibutylchlorendate (surr.)	1	%	74	-	-	-
Tetrachloro-m-xylene (surr.)	1	%	75	-	-	-
Heavy Metals						
Arsenic	2	mg/kg	-	5.2	< 2	3.0
Cadmium	0.4	mg/kg	-	1.0	0.5	0.5
Chromium	5	mg/kg	-	18	8.8	9.0
Copper	5	mg/kg	-	14	13	27
Lead	5	mg/kg	-	13	9.2	11
Mercury	0.05	mg/kg	-	3.1	0.98	0.72
Nickel	5	mg/kg	-	5.8	< 5	< 5
Zinc	5	mg/kg	-	34	26	35
% Moisture	0.1	%	12	13	11	12

Client Sample ID			**COMPOSITE C**	**A7 0-0.1**	**A8 0-0.1**	**A9 0-0.1**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Jn08200**	**S13-Jn08201**	**S13-Jn08202**	**S13-Jn08203**
Date Sampled			**Jun 11, 2013**	**Jun 11, 2013**	**Jun 11, 2013**	**Jun 11, 2013**
Test/Reference	LOR	Unit				
Organochlorine Pesticides (OC)						
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	-
4.4'-DDE	0.05	mg/kg	0.36	-	-	-
4.4'-DDT	0.2	mg/kg	0.2	-	-	-

Client Sample ID **Sample Matrix** **Eurofins | mgt Sample No.** **Date Sampled** Test/Reference	LOR	Unit	**COMPOSITE C** **Soil** **S13-Jn08200** **Jun 11, 2013**	**A7 0-0.1** **Soil** **S13-Jn08201** **Jun 11, 2013**	**A8 0-0.1** **Soil** **S13-Jn08202** **Jun 11, 2013**	**A9 0-0.1** **Soil** **S13-Jn08203** **Jun 11, 2013**
Organochlorine Pesticides (OC)						
a-BHC	0.05	mg/kg	< 0.05	-	-	-
a-Chlordane	0.05	mg/kg	0.12	-	-	-
Aldrin	0.05	mg/kg	< 0.05	-	-	-
b-BHC	0.05	mg/kg	< 0.05	-	-	-
d-BHC	0.05	mg/kg	< 0.05	-	-	-
Dieldrin	0.05	mg/kg	0.12	-	-	-
Endosulfan I	0.05	mg/kg	< 0.05	-	-	-
Endosulfan II	0.05	mg/kg	< 0.05	-	-	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	-
Endrin	0.05	mg/kg	< 0.05	-	-	-
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	-
Endrin ketone	0.05	mg/kg	< 0.05	-	-	-
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	-	-
g-Chlordane	0.05	mg/kg	0.06	-	-	-
Heptachlor	0.05	mg/kg	< 0.05	-	-	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	-
Methoxychlor	0.2	mg/kg	< 0.2	-	-	-
Dibutylchlorendate (surr.)	1	%	73	-	-	-
Tetrachloro-m-xylene (surr.)	1	%	73	-	-	-
Heavy Metals						
Arsenic	2	mg/kg	-	29	10	7.6
Cadmium	0.4	mg/kg	-	0.7	0.5	0.7
Chromium	5	mg/kg	-	17	25	37
Copper	5	mg/kg	-	17	12	18
Lead	5	mg/kg	-	18	17	25
Mercury	0.05	mg/kg	-	2.7	6.5	2.6
Nickel	5	mg/kg	-	5.4	< 5	< 5
Zinc	5	mg/kg	-	52	27	31
% Moisture	0.1	%	12	14	13	11

Client Sample ID **Sample Matrix** **Eurofins | mgt Sample No.** **Date Sampled** Test/Reference	LOR	Unit	**DUPLICATE AD1** **Soil** **S13-Jn08204** **Jun 11, 2013**	**X1** **Soil** **S13-Jn08205** **Jun 11, 2013**	**X2** **Soil** **S13-Jn08206** **Jun 11, 2013**	**X3** **Soil** **S13-Jn08207** **Jun 11, 2013**
Organochlorine Pesticides (OC)						
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	-
4.4'-DDE	0.05	mg/kg	0.09	-	-	-
4.4'-DDT	0.2	mg/kg	< 0.2	-	-	-
a-BHC	0.05	mg/kg	< 0.05	-	-	-
a-Chlordane	0.05	mg/kg	< 0.05	-	-	-
Aldrin	0.05	mg/kg	< 0.05	-	-	-
b-BHC	0.05	mg/kg	< 0.05	-	-	-

Client Sample ID			**DUPLICATE AD1**	**X1**	**X2**	**X3**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Jn08204**	**S13-Jn08205**	**S13-Jn08206**	**S13-Jn08207**
Date Sampled			**Jun 11, 2013**	**Jun 11, 2013**	**Jun 11, 2013**	**Jun 11, 2013**
Test/Reference	LOR	Unit				
Organochlorine Pesticides (OC)						
d-BHC	0.05	mg/kg	< 0.05	-	-	-
Dieldrin	0.05	mg/kg	< 0.05	-	-	-
Endosulfan I	0.05	mg/kg	< 0.05	-	-	-
Endosulfan II	0.05	mg/kg	< 0.05	-	-	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	-
Endrin	0.05	mg/kg	< 0.05	-	-	-
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	-
Endrin ketone	0.05	mg/kg	< 0.05	-	-	-
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	-	-
g-Chlordane	0.05	mg/kg	< 0.05	-	-	-
Heptachlor	0.05	mg/kg	< 0.05	-	-	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	-
Methoxychlor	0.2	mg/kg	< 0.2	-	-	-
Dibutylchlorendate (surr.)	1	%	71	-	-	-
Tetrachloro-m-xylene (surr.)	1	%	73	-	-	-
Heavy Metals						
Arsenic	2	mg/kg	-	< 2	< 2	< 2
Cadmium	0.4	mg/kg	-	0.6	0.5	0.5
Chromium	5	mg/kg	-	11	11	11
Copper	5	mg/kg	-	13	11	12
Lead	5	mg/kg	-	9.6	10	12
Mercury	0.05	mg/kg	-	0.91	2.2	0.94
Nickel	5	mg/kg	-	5.6	< 5	6.0
Zinc	5	mg/kg	-	31	26	33
% Moisture	0.1	%	12	12	13	12

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

Description	Testing Site	Extracted	Holding Time
Organochlorine Pesticides (OC)	Sydney	Jun 14, 2013	14 Day
- Method: E013 Organochlorine Pesticides (OC)			
Metals M8	Sydney	Jun 13, 2013	28 Day
- Method: E022 Acid Extractable metals in Soils & E026 Mercury			
% Moisture	Sydney	Jun 13, 2013	28 Day
- Method: E005 Moisture Content			

Company Name: Aargus P/L
Address: 446 Parramatta Road
Petersham
NSW 2049

Client Job No.: HARROW ROAD BEXLEY DESA ES5504

Order No.:
Report #: 382348
Phone: 1300 137 038
Fax: 1300 136 038

Received: Jun 13, 2013 12:30 AM
Due: Jun 20, 2013
Priority: 5 Day
Contact Name: Mark Kelly

Eurofins | mgt Client Manager: Ruth Callander

Sample Detail					% Moisture	Metals M8	Metals M8 filtered	Organochlorine Pesticides (OC)
Laboratory where analysis is conducted								
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217					X	X	X	X
Brisbane Laboratory - NATA Site # 20794								
External Laboratory								
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
COMPOSITE A	Jun 11, 2013		Soil	S13-Jn08192	X			X
A1 0-0.1	Jun 11, 2013		Soil	S13-Jn08193	X	X		
A2 0-0.1	Jun 11, 2013		Soil	S13-Jn08194	X	X		
A3 0-0.1	Jun 11, 2013		Soil	S13-Jn08195	X	X		
COMPOSITE B	Jun 11, 2013		Soil	S13-Jn08196	X			X
A4 0-0.1	Jun 11, 2013		Soil	S13-Jn08197	X	X		
A5 0-0.1	Jun 11, 2013		Soil	S13-Jn08198	X	X		
A6 0-0.1	Jun 11, 2013		Soil	S13-Jn08199	X	X		
COMPOSITE C	Jun 11, 2013		Soil	S13-Jn08200	X			X

Company Name:	Aargus P/L	**Order No.:**		**Received:**	Jun 13, 2013 12:30 AM
Address:	446 Parramatta Road Petersham NSW 2049	**Report #:**	382348	**Due:**	Jun 20, 2013
		Phone:	1300 137 038	**Priority:**	5 Day
		Fax:	1300 136 038	**Contact Name:**	Mark Kelly
Client Job No.:	HARROW ROAD BEXLEY DESA ES5504				

Eurofins | mgt Client Manager: Ruth Callander

Sample Detail					% Moisture	Metals M8	Metals M8 filtered	Organochlorine Pesticides (OC)
Laboratory where analysis is conducted								
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217					X	X	X	X
Brisbane Laboratory - NATA Site # 20794								
External Laboratory								
A7 0-0.1	Jun 11, 2013		Soil	S13-Jn08201	X	X		
A8 0-0.1	Jun 11, 2013		Soil	S13-Jn08202	X	X		
A9 0-0.1	Jun 11, 2013		Soil	S13-Jn08203	X	X		
DUPLICATE AD1	Jun 11, 2013		Soil	S13-Jn08204	X			X
X1	Jun 11, 2013		Soil	S13-Jn08205	X	X		
X2	Jun 11, 2013		Soil	S13-Jn08206	X	X		
X3	Jun 11, 2013		Soil	S13-Jn08207	X	X		
RINSATE AR1	Jun 11, 2013		Water	S13-Jn08208			X	

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgment.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram
ug/l: micrograms per litre
ppb: Parts per billion
org/100ml: Organisms per 100 millilitres
MPN/100mL: Most Probable Number of organisms per 100 millilitres
mg/l: milligrams per litre
ppm: Parts per million
%: Percentage
NTU: Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Organochlorine Pesticides (OC) E013 Organochlorine Pesticides (OC)							
4.4'-DDD	mg/kg	< 0.05			0.05	Pass	
4.4'-DDE	mg/kg	< 0.05			0.05	Pass	
4.4'-DDT	mg/kg	< 0.2			0.2	Pass	
a-BHC	mg/kg	< 0.05			0.05	Pass	
a-Chlordane	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-BHC	mg/kg	< 0.05			0.05	Pass	
d-BHC	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-BHC (Lindane)	mg/kg	< 0.05			0.05	Pass	
g-Chlordane	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.2			0.2	Pass	
Method Blank							
Metals M8 E022 Acid Extractable metals in Soils & E026 Mercury							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.05			0.05	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Organochlorine Pesticides (OC) E013 Organochlorine Pesticides (OC)							
4.4'-DDD	%	80			70-130	Pass	
4.4'-DDE	%	80			70-130	Pass	
4.4'-DDT	%	83			70-130	Pass	
a-BHC	%	90			70-130	Pass	
a-Chlordane	%	75			70-130	Pass	
Aldrin	%	79			70-130	Pass	
b-BHC	%	97			70-130	Pass	
d-BHC	%	77			70-130	Pass	
Dieldrin	%	79			70-130	Pass	
Endosulfan I	%	77			70-130	Pass	
Endosulfan II	%	74			70-130	Pass	
Endosulfan sulphate	%	79			70-130	Pass	
Endrin	%	79			70-130	Pass	
Endrin aldehyde	%	67			70-130	Fail	Q13
Endrin ketone	%	77			70-130	Pass	
g-BHC (Lindane)	%	90			70-130	Pass	
g-Chlordane	%	78			70-130	Pass	
Heptachlor	%	100			70-130	Pass	
Heptachlor epoxide	%	80			70-130	Pass	

Test			**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Hexachlorobenzene			%	106			70-130	Pass	
Methoxychlor			%	78			70-130	Pass	
LCS - % Recovery									
Metals M8 E022 Acid Extractable metals in Soils & E026 Mercury									
Arsenic			%	108			70-130	Pass	
Cadmium			%	95			70-130	Pass	
Chromium			%	99			70-130	Pass	
Copper			%	97			70-130	Pass	
Lead			%	110			70-130	Pass	
Mercury			%	107			70-130	Pass	
Nickel			%	102			70-130	Pass	
Zinc			%	117			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Metals M8				Result 1					
Arsenic	S13-Jn08206	CP	%	88			70-130	Pass	
Cadmium	S13-Jn08206	CP	%	94			70-130	Pass	
Chromium	S13-Jn08206	CP	%	81			70-130	Pass	
Copper	S13-Jn08206	CP	%	102			70-130	Pass	
Lead	S13-Jn08206	CP	%	91			70-130	Pass	
Mercury	S13-Jn08206	CP	%	81			70-130	Pass	
Nickel	S13-Jn08206	CP	%	94			70-130	Pass	
Zinc	S13-Jn08206	CP	%	88			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Organochlorine Pesticides (OC)				Result 1	Result 2	RPD			
4.4'-DDD	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	S13-Jn08192	CP	mg/kg	0.10	0.10	1.0	30%	Pass	
4.4'-DDT	S13-Jn08192	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
a-BHC	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-Chlordane	S13-Jn08192	CP	mg/kg	0.43	0.33	27	30%	Pass	
Aldrin	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-BHC	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-BHC	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-BHC (Lindane)	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-Chlordane	S13-Jn08192	CP	mg/kg	0.10	0.08	25	30%	Pass	
Heptachlor	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	S13-Jn08192	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	S13-Jn08192	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Duplicate									
Metals M8				Result 1	Result 2	RPD			
Arsenic	S13-Jn08206	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Cadmium	S13-Jn08206	CP	mg/kg	0.5	0.5	3.0	30%	Pass	
Chromium	S13-Jn08206	CP	mg/kg	11	11	7.0	30%	Pass	
Copper	S13-Jn08206	CP	mg/kg	11	11	6.0	30%	Pass	

Duplicate									
Metals M8				Result 1	Result 2	RPD			
Lead	S13-Jn08206	CP	mg/kg	10	10.0	1.0	30%	Pass	
Mercury	S13-Jn08206	CP	mg/kg	2.2	2.8	24	30%	Pass	
Nickel	S13-Jn08206	CP	mg/kg	< 5	5.0	8.0	30%	Pass	
Zinc	S13-Jn08206	CP	mg/kg	26	28	5.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q13	Some elements for this test have failed in the QC sample. However when at least 80% have passed the QC can be released. All other QC has passed in this test batch

Authorised By

Ruth Callander	Client Services
James Norford	Senior Analyst-Metal (NSW)
Ryan Hamilton	Senior Analyst-Organic (NSW)

Dr. Bob Symons

Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Aargus P/L
446 Parramatta Road
Petersham
NSW 2049

Attention: **Mark Kelly**

Report **382348-W**
Client Reference HARROW ROAD BEXLEY DESA ES5504
Received Date Jun 13, 2013

Client Sample ID			**RINSATE AR1**
Sample Matrix			**Water**
Eurofins | mgt Sample No.			**S13-Jn08208**
Date Sampled			**Jun 11, 2013**
Test/Reference	LOR	Unit	
Heavy Metals			
Arsenic (filtered)	0.001	mg/L	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001
Zinc (filtered)	0.005	mg/L	< 0.005

Description	Testing Site	Extracted	Holding Time
Metals M8 filtered	Sydney	Jun 13, 2013	28 Day

- Method: E020/E030 Filtered Metals in Water & E026 Mercury

Company Name: Aargus P/L
Address: 446 Parramatta Road
Petersham
NSW 2049

Client Job No.: HARROW ROAD BEXLEY DESA ES5504

Order No.:
Report #: 382348
Phone: 1300 137 038
Fax: 1300 136 038

Received: Jun 13, 2013 12:30 AM
Due: Jun 20, 2013
Priority: 5 Day
Contact Name: Mark Kelly

Eurofins | mgt Client Manager: Ruth Callander

Sample Detail					% Moisture	Metals M8	Metals M8 filtered	Organochlorine Pesticides (OC)
Laboratory where analysis is conducted								
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217					X	X	X	X
Brisbane Laboratory - NATA Site # 20794								
External Laboratory								
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
COMPOSITE A	Jun 11, 2013		Soil	S13-Jn08192	X			X
A1 0-0.1	Jun 11, 2013		Soil	S13-Jn08193	X	X		
A2 0-0.1	Jun 11, 2013		Soil	S13-Jn08194	X	X		
A3 0-0.1	Jun 11, 2013		Soil	S13-Jn08195	X	X		
COMPOSITE B	Jun 11, 2013		Soil	S13-Jn08196	X			X
A4 0-0.1	Jun 11, 2013		Soil	S13-Jn08197	X	X		
A5 0-0.1	Jun 11, 2013		Soil	S13-Jn08198	X	X		
A6 0-0.1	Jun 11, 2013		Soil	S13-Jn08199	X	X		
COMPOSITE C	Jun 11, 2013		Soil	S13-Jn08200	X			X

Company Name: Aargus P/L
Address: 446 Parramatta Road
Petersham
NSW 2049

Client Job No.: HARROW ROAD BEXLEY DESA ES5504

Order No.:
Report #: 382348
Phone: 1300 137 038
Fax: 1300 136 038

Received: Jun 13, 2013 12:30 AM
Due: Jun 20, 2013
Priority: 5 Day
Contact Name: Mark Kelly

Eurofins | mgt Client Manager: Ruth Callander

Sample Detail					% Moisture	Metals M8	Metals M8 filtered	Organochlorine Pesticides (OC)
Laboratory where analysis is conducted								
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217					X	X	X	X
Brisbane Laboratory - NATA Site # 20794								
External Laboratory								
A7 0-0.1	Jun 11, 2013		Soil	S13-Jn08201	X	X		
A8 0-0.1	Jun 11, 2013		Soil	S13-Jn08202	X	X		
A9 0-0.1	Jun 11, 2013		Soil	S13-Jn08203	X	X		
DUPLICATE AD1	Jun 11, 2013		Soil	S13-Jn08204	X			X
X1	Jun 11, 2013		Soil	S13-Jn08205	X	X		
X2	Jun 11, 2013		Soil	S13-Jn08206	X	X		
X3	Jun 11, 2013		Soil	S13-Jn08207	X	X		
RINSATE AR1	Jun 11, 2013		Water	S13-Jn08208			X	

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgment.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Metals M8 filtered E020/E030 Filtered Metals in Water & E026 Mercury									
Arsenic (filtered)			mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)			mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)			mg/L	< 0.001			0.001	Pass	
Copper (filtered)			mg/L	< 0.001			0.001	Pass	
Lead (filtered)			mg/L	< 0.001			0.001	Pass	
Mercury (filtered)			mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)			mg/L	< 0.001			0.001	Pass	
Zinc (filtered)			mg/L	< 0.005			0.005	Pass	
LCS - % Recovery									
Metals M8 filtered E020/E030 Filtered Metals in Water & E026 Mercury									
Arsenic (filtered)			%	98			70-130	Pass	
Cadmium (filtered)			%	98			70-130	Pass	
Chromium (filtered)			%	97			70-130	Pass	
Copper (filtered)			%	97			70-130	Pass	
Lead (filtered)			%	100			70-130	Pass	
Mercury (filtered)			%	91			70-130	Pass	
Nickel (filtered)			%	96			70-130	Pass	
Zinc (filtered)			%	99			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Metals M8 filtered				Result 1					
Arsenic (filtered)	S13-Jn08208	CP	%	102			70-130	Pass	
Cadmium (filtered)	S13-Jn08208	CP	%	103			70-130	Pass	
Chromium (filtered)	S13-Jn08208	CP	%	100			70-130	Pass	
Copper (filtered)	S13-Jn08208	CP	%	100			70-130	Pass	
Lead (filtered)	S13-Jn08208	CP	%	102			70-130	Pass	
Mercury (filtered)	S13-Jn08208	CP	%	83			70-130	Pass	
Nickel (filtered)	S13-Jn08208	CP	%	98			70-130	Pass	
Zinc (filtered)	S13-Jn08208	CP	%	103			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Metals M8 filtered				Result 1	Result 2	RPD			
Arsenic (filtered)	S13-Jn09451	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	S13-Jn09451	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Chromium (filtered)	S13-Jn09451	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	S13-Jn09451	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Lead (filtered)	S13-Jn09451	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	S13-Jn09742	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	S13-Jn09451	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc (filtered)	S13-Jn09451	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Ruth Callander	Client Services
James Norford	Senior Analyst-Metal (NSW)

Dr. Bob Symons

Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

eurofins | mgt

ABN – 50 005 085 521 e.mail : enviro@mgtlabmark.com.au web : www.mgtlabmark.com.au

Melbourne
3-5 Kingston Town Close
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Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F6, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Sample Receipt Advice

Company name: **Aargus P/L**

Contact name: Mark Kelly
Client job number: HARROW ROAD BEXLEY DESA ES5504
COC number: Not provided
Turn around time: 5 Day
Date/Time received: Jun 13, 2013 12:30 AM
Eurofins | mgt reference: **382348**

Sample information

☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Organic samples had Teflon liners.

☑ Sample containers for volatile analysis received with zero headspace.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Ruth Callander on Phone : (+61) (3) 8564 5000 or by e.mail: RuthCallander@eurofins.com.au

Results will be delivered electronically via e.mail to Mark Kelly - mark.kelly@aargus.net.

Note: A copy of these results will also be delivered to the general Aargus P/L email address.

Eurofins | mgt Sample Receipt

RECEIV
13 JUN 2013
BY: Jasmine 12:30 pm

AARGUS PTY LTD

Laboratory Test Request / Chain of Custody Record

446 Parramatta Road
PETERSHAM NSW 2049

P O Box 398
DRUMMOYNE NSW 1470

Tel: 1300 137 038
Fax: 1300 136 038
email: admin@aargus.net, mark.kelly@aargus.net

Page 1 **of** 2

TO: **Eurofins MGT**
UNIT F3, BUILDING F
16 MARS ROAD
LANE COVE WEST NSW 2066

PH: **028215 6222** **FAX:** **02 9420 2977**
ATTN:

Sampling Date: 11.06.2013 **Job No:** ES5504
Sampled By: SG **Project:** DESA # 382348
Project Manager: MK **Location:** HARROW ROAD, BEXLEY

Results required by: THURSDAY, 20 - 06 - 2013

Sampling details		Sample type											
Location	Depth (m)	Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH and BTEX	PAH	OCP	PCB	Asbestos				KEEP SAMPLE
A1	0-0.1	DSG		✓									YES
A2	0-0.1	DSG		✓									YES
A3	0-0.1	DSG		✓									YES
A4	0-0.1	DSG		✓									YES
A5	0-0.1	DSG		✓									YES
A6	0-0.1	DSG		✓									YES
A7	0-0.1	DSG		✓									YES
A8	0-0.1	DSG		✓									YES
A9	0-0.1	DSG		✓									YES
X1	-	DSG		✓									YES
X2	-	DSG		✓									YES
X3	-	DSG		✓									YES
RINSATE AR1	-		WP	✓									YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Mark Kelly	MK	12.06.2013			

Legend:

WG	Water sample, glass bottle	USG	Undisturbed soil sample (glass jar)	DSP	Disturbed soil sample (small plastic bag)
WP	Water sample, plastic bottle	DSG	Disturbed soil sample (glass jar)	✓	Test required

@ mole H^+/tonne

ANALYTICAL REPORT

WORLD RECOGNISED
ACCREDITATION

CLIENT DETAILS

Contact	Mark Kelly
Client	AARGUS AUSTRALIA PTY LTD
Address	(PO BOX 398, DRUMMOYNE, NSW 1470) 446 Parramatta Road PETERSHAM NSW 2049
Telephone	61 1300 137 038
Facsimile	61 1300 136 038
Email	mark.kelly@aargus.net
Project	**ES5504 - DESA Harrow Road Bexley**
Order Number	(Not specified)
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE118310 R0**
Report Number	0000059367
Date Reported	20 Jun 2013
Date Received	13 Jun 2013

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

SIGNATORIES

Andy Sutton
Organics Chemist

Dong Liang
Inorganics Metals Team Leader

Kamrul Ahsan
Metals Chemist

		Sample Number	SE118310.001	SE118310.002	SE118310.003	SE118310.004
		Sample Matrix	Soil	Soil	Soil	Soil
		Sample Date	11 Jun 2013	11 Jun 2013	11 Jun 2013	11 Jun 2013
		Sample Name	Y1	Y2	Y3	Split ASS1
Parameter	Units	LOR				

OC Pesticides in Soil Method: AN400/AN420

Hexachlorobenzene (HCB)	mg/kg	0.1	-	-	-	<0.1
Alpha BHC	mg/kg	0.1	-	-	-	<0.1
Lindane	mg/kg	0.1	-	-	-	<0.1
Heptachlor	mg/kg	0.1	-	-	-	<0.1
Aldrin	mg/kg	0.1	-	-	-	<0.1
Beta BHC	mg/kg	0.1	-	-	-	<0.1
Delta BHC	mg/kg	0.1	-	-	-	<0.1
Heptachlor epoxide	mg/kg	0.1	-	-	-	<0.1
o,p'-DDE	mg/kg	0.1	-	-	-	<0.1
Alpha Endosulfan	mg/kg	0.2	-	-	-	<0.2
Gamma Chlordane	mg/kg	0.1	-	-	-	<0.1
Alpha Chlordane	mg/kg	0.1	-	-	-	**0.2**
trans-Nonachlor	mg/kg	0.1	-	-	-	**0.4**
p,p'-DDE	mg/kg	0.1	-	-	-	<0.1
Dieldrin	mg/kg	0.2	-	-	-	<0.2
Endrin	mg/kg	0.2	-	-	-	<0.2
o,p'-DDD	mg/kg	0.1	-	-	-	<0.1
o,p'-DDT	mg/kg	0.1	-	-	-	<0.1
Beta Endosulfan	mg/kg	0.2	-	-	-	<0.2
p,p'-DDD	mg/kg	0.1	-	-	-	<0.1
p,p'-DDT	mg/kg	0.1	-	-	-	<0.1
Endosulfan sulphate	mg/kg	0.1	-	-	-	<0.1
Endrin Aldehyde	mg/kg	0.1	-	-	-	<0.1
Methoxychlor	mg/kg	0.1	-	-	-	<0.1
Endrin Ketone	mg/kg	0.1	-	-	-	<0.1
Isodrin	mg/kg	0.1	-	-	-	<0.1
Mirex	mg/kg	0.1	-	-	-	<0.1

Surrogates

Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	-	-	-	**95**

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest Method: AN040/AN320

Arsenic, As	mg/kg	3	<3	<3	<3	-
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	-
Chromium, Cr	mg/kg	0.3	**14**	**9.0**	**9.4**	-
Copper, Cu	mg/kg	0.5	**8.8**	**8.0**	**8.8**	-
Lead, Pb	mg/kg	1	**11**	**8**	**10**	-
Nickel, Ni	mg/kg	0.5	**3.8**	**3.7**	**4.3**	-
Zinc, Zn	mg/kg	0.5	**19**	**20**	**22**	-

Mercury in Soil Method: AN312

Mercury	mg/kg	0.05	**1.4**	**0.77**	**1.4**	-

Moisture Content Method: AN002

% Moisture	%	0.5	**11**	**11**	**11**	**14**

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Mercury in Soil **Method: ME-(AU)-[ENV]AN312**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB040213	mg/kg	0.05	<0.05	1 - 6%	102%	115%

OC Pesticides in Soil **Method: ME-(AU)-[ENV]AN400/AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Hexachlorobenzene (HCB)	LB040084	mg/kg	0.1	<0.1	0%	NA
Alpha BHC	LB040084	mg/kg	0.1	<0.1	0%	NA
Lindane	LB040084	mg/kg	0.1	<0.1	0%	NA
Heptachlor	LB040084	mg/kg	0.1	<0.1	0%	95%
Aldrin	LB040084	mg/kg	0.1	<0.1	0%	90%
Beta BHC	LB040084	mg/kg	0.1	<0.1	0%	NA
Delta BHC	LB040084	mg/kg	0.1	<0.1	0%	85%
Heptachlor epoxide	LB040084	mg/kg	0.1	<0.1	0%	NA
o,p'-DDE	LB040084	mg/kg	0.1	<0.1	0%	NA
Alpha Endosulfan	LB040084	mg/kg	0.2	<0.2	0%	NA
Gamma Chlordane	LB040084	mg/kg	0.1	<0.1	0%	NA
Alpha Chlordane	LB040084	mg/kg	0.1	<0.1	6%	NA
trans-Nonachlor	LB040084	mg/kg	0.1	<0.1	3%	NA
p,p'-DDE	LB040084	mg/kg	0.1	<0.1	0%	NA
Dieldrin	LB040084	mg/kg	0.2	<0.2	0%	85%
Endrin	LB040084	mg/kg	0.2	<0.2	0%	90%
o,p'-DDD	LB040084	mg/kg	0.1	<0.1	0%	NA
o,p'-DDT	LB040084	mg/kg	0.1	<0.1	0%	NA
Beta Endosulfan	LB040084	mg/kg	0.2	<0.2	0%	NA
p,p'-DDD	LB040084	mg/kg	0.1	<0.1	0%	NA
p,p'-DDT	LB040084	mg/kg	0.1	<0.1	0%	80%
Endosulfan sulphate	LB040084	mg/kg	0.1	<0.1	0%	NA
Endrin Aldehyde	LB040084	mg/kg	0.1	<0.1	0%	NA
Methoxychlor	LB040084	mg/kg	0.1	<0.1	0%	NA
Endrin Ketone	LB040084	mg/kg	0.1	<0.1	0%	NA
Isodrin	LB040084	mg/kg	0.1	<0.1	0%	NA
Mirex	LB040084	mg/kg	0.1	<0.1	0%	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Tetrachloro-m-xylene (TCMX) (Surrogate)	LB040084	%	-	99%	17%	93%

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

Total Recoverable Metals in Soil by ICPOES from EPA 200.8 Digest **Method: ME-(AU)-[ENV]AN040/AN320**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Arsenic, As	LB040210	mg/kg	3	<3	6%	96%	91%
Cadmium, Cd	LB040210	mg/kg	0.3	<0.3	3 - 10%	96%	86%
Chromium, Cr	LB040210	mg/kg	0.3	<0.3	1 - 11%	98%	89%
Copper, Cu	LB040210	mg/kg	0.5	<0.5	2 - 7%	98%	93%
Lead, Pb	LB040210	mg/kg	1	<1	3 - 4%	96%	98%
Nickel, Ni	LB040210	mg/kg	0.5	<0.5	0 - 4%	97%	88%
Zinc, Zn	LB040210	mg/kg	0.5	<0.5	2 - 3%	97%	97%

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN040	A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analsysis by ASS or ICP as per USEPA Method 200.8.
AN088	Orbital rolling for Organic pollutants are extracted from soil/sediment by transferring an appropriate mass of sample to a clear soil jar and extracting with 1:1 Dichloromethane/Acetone. Orbital Rolling method is intended for the extraction of semi-volatile organic compounds from soil/sediment samples, and is based somewhat on USEPA method 3570 (Micro Organic extraction and sample preparation). Method 3700.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN400	OC and OP Pesticides by GC-ECD: The determination of organochlorine (OC) and organophosphorus (OP) pesticides and polychlorinated biphenyls (PCBs) in soils, sludges and groundwater. (Based on USEPA methods 3510, 3550, 8140 and 8080.)
AN420	SVOC Compounds: Semi-Volatile Organic Compounds (SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	This analysis is not covered by the scope of accreditation.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
^	Performed by outside laboratory.	NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here:
http://www.sgs.com.au.pv.sgsv3/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

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APPENDIX L

QA/QC EVALUATION

Aargus

1 FIELD DATA QUALITY ASSESSMENT

1.1 Field Data Completeness

Field Sample Category - Soils	Number (Target)	Non-conformances	Number (Useable)	Overall Completeness %
Primary Samples	9	0	9	100%
Intra-Lab Duplicates	1	0	1	100%
Inter-Lab Duplicates	1	0	1	100%
Rinsate Blanks	1	0	1	100%

Note: (*) – Overall Completeness is calculated as a percentage of the number of useable samples over the target number of samples required.

Field Consideration	Yes / No	Comments / Non-Conformances
Were all critical locations sampled?	Y	All critical locations were sampled as per scope.
Were all samples collected from critical densities and depths?	Y	All sampled were recovered as per scope.
Were the Standard Operating Procedures (SOPs) appropriate and complied with?	Y	The Aargus Fieldwork Protocols were appropriate and complied with.
Were the samplers adequately experienced?	Y	Sampling was conducted by Aargus Environmental Scientist, Samer Ghanem. Please refer to the CVs appended to the report.
Was field documentation complete and correct?	Y	Field records can be found within their respective appendices of the report.
Were an adequate number of intra-laboratory duplicate samples collected?	Y	100% of intra-laboratory duplicate samples required were collected as the table above.
Were an adequate number of inter-laboratory duplicate samples collected?	Y	100% of inter-laboratory duplicate samples required were collected as per the table above.
Were an adequate number of rinsate samples collected?	Y	100% of rinsate samples required were collected as per the table above.

1.2 Field Data Comparability

Field Consideration	Yes / No	Comments / Non-Conformances
Were the same SOPs used on each occasion?	Y	Aargus Fieldwork Protocols were utilised throughout each sampling event.
Was all sampling undertaken by the same person?	Y	Sampling was undertaken by the same scientist.
Could climatic conditions (such as temperature, rainfall, etc.) influence data comparability?	N	All sampling was undertaken on days without rain.
Were the same types of samples collected (filtered, size, fractions, etc.) for each media?	Y	Samples were collected in the same types of containers provided by the laboratory.
Was each field parameter measured using the same equipment?	NA	Not required.
Was the same method and equipment used for extraction of samples?	Y	Soil samples were recovered by the same trowel.

1.3 Field Data Representativeness

Laboratory Batch	Laboratory	Sample Medium	Container Breakages	Sample Preservation	Headspace / Temperature
382348-S	Eurofins (Syd)	Soil	Compliant	Compliant	Compliant
382348-W	Eurofins (Syd)	Water	Compliant	Compliant	Compliant
SE118310	SGS	Soil	Compliant	Compliant	Compliant

Field Consideration	Yes / No	Comments / Non-Conformances
Was appropriate media sampled in accordance with the SAQP?	Y	All soil samples were sampled in accordance with the SAQP.
Was all media identified in the SAQP sampled?	Y	All soil samples specified in the SAQP were sampled.
Were all samples the samples appropriately handled?	Y	All samples collected were received by the laboratories intact.
Were all samples preserved appropriately?	Y	All samples collected were received by laboratories in the correct temperature. Where relevant, samples were stored in acid-preserved containers supplied by laboratories.

1.4 Field Data Precision

Field Consideration	Yes / No	Comments / Non-Conformances
Were the SOPs appropriate and complied with?	Y	The recovery of field duplicates was conducted in accordance with Aargus Fieldwork Protocols to allow for the assessment of field precision.

1.5 Field Data Accuracy

Field Consideration	Yes / No	Comments / Non-Conformances
Were the SOPs appropriate and complied with?	Y	The recovery of rinsate blanks was conducted in accordance with Aargus Fieldwork Protocols to allow for the assessment of field accuracy.

2 LABORATORY DATA QUALITY ASSESSMENT

2.1 Laboratory Data Completeness

Chemical Group	Analytes – Eurofins MGT	Analyes - SGS
Metals	8	8
OCPs	21	27

Primary Samples - Soils									
Metals (8)	**TPH**	**BTEX**	**PAH**	**Phenols**	**OCPs**	**TOTAL (Target)**	**NCs**	**TOTAL (Useable)**	**Overall Completeness**
72	-	-	-	-	63	**135**	**0**	**135**	**100%**

Field QA/QC Samples - Soils										
Sample Type	**Metals (8)**	**TPH**	**BTEX**	**PAH**	**Phenols**	**OCPs**	**TOTAL (Target)**	**NCs**	**TOTAL (Useable)**	**Overall Completeness**
Intra-Lab. Dup.	8	-	-	-	-	23	**31**	**0**	**31**	**100%**
Inter-Lab. Dup.	8	-	-	-	-	27	**35**	**0**	**27**	**100%**
Rinsates	8	-	-	-	-	-	**8**	**0**	**8**	**100%**

Laboratory QA/QC Samples - Soils										
Sample Type	**Metals (8)**	**TPH**	**BTEX**	**PAH**	**Phenols**	**OCPs**	**TOTAL (Target)**	**NCs**	**TOTAL (Useable)**	**Overall Completeness**
Lab. Duplicates	32	0	0	0	0	48	**80**	**0**	**80**	**100%**
Lab. Control Samples	24	0	0	0	0	27	**51**	**1**	**50**	**98%**
Method Blanks	24	0	0	0	0	44	**68**	**0**	**68**	**100%**
Matrix Spikes	24	0	0	0	0	0	**24**	**0**	**24**	**100%**
Matrix Spike Duplicates	0	0	0	0	0	0	**0**	**0**	**0**	**100%**
Surrogates	-	0	0	0	0	9	**9**	**0**	**9**	**100%**

Laboratory Considerations	Yes / No	Comments / Non-Conformances
Were all critical samples analysed according to the SAQP?	Y	All critical samples analysed according to SAQP.
Were all analytes analysed according to the SAQP?	Y	All analytes analysed according to SAQP.
Were the laboratory methods	Y	US EPA Analytical Methods were used.

Laboratory Considerations	**Yes / No**	**Comments / Non-Conformances**
and PQLs appropriate?		PQLs were below relevant
Was sample documentation complete?	Y	The sample documentation was correctly completed on the COC's.
Were sample holding times complied with?	Y	All soil samples met the holding time criteria.
Were an adequate number of laboratory duplicates analysed?	Y	An adequate number of laboratory duplicates were analysed.
Were an adequate number of laboratory blank samples analysed?	Y	An adequate number of laboratory blank samples were analysed.
Were an adequate number of Laboratory Control Samples analysed?	Y	An adequate number of Laboratory Control Samples were analysed.
Were an adequate number of laboratory matrix spikes/duplicates analysed?	N/A	An adequate number of laboratory matrix spikes/duplicates were analysed.
Were an adequate number of surrogates analysed?	N/A	An adequate number of surrogates were analysed.

2.2 Laboratory Data Comparability

Laboratory Considerations	**Yes / No**	**Comments / Non-Conformances**
Were the same analytical methods used for each analyte?	N	The same analytical method was utilised within the same laboratory that primary samples were analysed in. However, the secondary laboratories had different analytical methods, and however, these were based on the USEPA/APHA methods
Were the PQLs used for each analyte less than 20% of their respective assessment criteria?	Y	ALL PQLs used for each analyte less than 20% of their respective assessment criteria
Were the sample PQLs used for each analyte the same?	N	Sample PQL's were the same within each laboratory but differed from the primary to secondary laboratories. This did not affect the results of the assessment as samples were either less than the laboratory PQL or well below the assessment criteria.
Were the same laboratories used for analyses of each contaminant type?	Y	MGT LabMark (Sydney) was the primary laboratory. SGS (Sydney) was the secondary laboratories.
Were the units reported for each analyte the same?	Y	Analytical units of measurement for soil were mg/kg

2.3 Laboratory Data Representativeness

Laboratory Considerations	**Yes / No**	**Comments / Non-Conformances**
Were all samples analysed according to the SAQP?	Y	The majority of the samples were analysed according to the SAQP.

2.4 Laboratory Data Precision

Laboratory Considerations	**Yes / No**	**Comments / Non-Conformances**
Were the RPDs of the field duplicates within control limits?	N	• RPDs of >50% were identified in a number of samples analysed for heavy metals. However, where this was the case, the concentrations of all samples analysed were below the validation criteria and not considered to affect the outcome of the assessment.
Were the RPDs of the laboratory duplicates within control limits?	Y	The RPDs of all laboratory duplicates were within control limits.

Note: Please refer to the ESDAT tables attached at the end of this QA/QC assessment for calculations of the field RPDs.

2.5 Laboratory Data Accuracy

Laboratory Considerations	Yes / No	Comments / Non-Conformances
Were the rinsate free of contaminants?	Y	The concentrations of the analytes were below the PQLs.
Were the trip blanks free of contaminants?	N/A	Not trip blanks were analysed
Were the laboratory blanks free of contaminants?	Y	Laboratory blanks were free of contaminants.
Were the surrogate spikes within control limits?	N/A	No surrogate spikes were analysed
Were laboratory control samples within control limits?	N	One LCS of 67% was outside the criteria level however when at least 80% have passed the QC can be released.
Were matrix spike recoveries within control limits?	Y	Matrix spikes were within control limits.
Were the trip spike recoveries within the control limits?	N/A	Not trip spikes were analysed

Note: Please refer to the tables attached at the end of this QA/QC assessment for tables showing results of field blanks.

APPENDIX M

DAILY WORK SHEETS

Aargus Pty Ltd

Daily Worksheet

Sampling & Monitoring Details for Individual Determinants

Location/Address: 62-82 Marian Rd Bexley
Name of Officer Responsible: Samer Afaran
Title of Officer Responsible: Environmental Scientist/Technician
Phone: 1300137038 Fax: 1300136038
Mobile: Other:

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

Date of Inspection: 11/6/13 Time of Start: 10am Finish: 12:30pm
Description of Weather: Overcast Wind Direction: West
Wind Speed: 17km/hr Rainfall(mm): 0.8mm. Humidity: 94%

Odours present Y/[✓ N] Location: Time:
Odours spraying Y/[✓ N] Location: Time:
Environmental &/or other accidents/concerns:(details)

Additional Sampling

A1 - A9 Primary Samples
X1 - X3 Duplicate Samples
Y1 - Y3 Split Samples
AR1 - Rinsate Sample

Sampling on existing lawns

Actions:

Stormwater controls Y/N [✓ N] ____ Location(s): ________________ Time: ________

Dust suppression Y/N [✓ N] ____ Location(s): ________________ Time: ________

Traffic control Y/N [✓ N] ____ Location(s): ________________ Time: ________

Equipment on site: Esky, Sample jars, trowel, PPE.

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

APPENDIX N

SUMMARY TABLES OF LABORATORY RESULTS

TABLE 1
DUPLICATE SAMPLE

ANALYTE	A1 0-0.1m mg/kg	DUPLICATE X1 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	2.6	<2	-
Cadmium	<0.4	0.6	-
Chromium	9	11	20
Copper	13	13	0
Nickel	5.1	5.6	9
Lead	13	9.6	30
Zinc	38	31	20
Mercury	1	0.91	9

TABLE 2
DUPLICATE SAMPLE

ANALYTE	A2 0-0.1m mg/kg	DUPLICATE X2 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	2.3	<2	-
Cadmium	<0.4	0.5	-
Chromium	<5	11	-
Copper	6.8	11	47
Nickel	<5	<5	-
Lead	7.9	10	23
Zinc	23	26	12
Mercury	0.76	2.2	97

TABLE 3
DUPLICATE SAMPLE

ANALYTE	A3 0-0.1m mg/kg	DUPLICATE X3 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	2.1	<2	-
Cadmium	0.4	0.5	-
Chromium	10	11	-
Copper	12	12	0
Nickel	<5	6	-
Lead	9.6	12	22
Zinc	24	33	32
Mercury	1.1	0.94	16

TABLE 4
DUPLICATE SAMPLE

ANALYTE	COMPOSITE A mg/kg	DUPLICATE AD1 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
OCP			
Heptachlor	<0.05	<0.05	-
Aldrin	<0.05	<0.05	-
Dieldrin	<0.05	<0.05	
DDD	<0.05	<0.05	-
DDE	0.1	0.09	11
DDT	<0.2	<0.2	-
Chlordane (cis & trans)	0.53	<0.05	-

TABLE 5
SPLIT SAMPLE

ANALYTE	A4 0-0.1m mg/kg	SPLIT Y1 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	5.2	<3	-
Cadmium	1	<0.3	-
Chromium	18	14	25
Copper	14	8.8	46
Nickel	5.8	3.8	42
Lead	13	11	17
Zinc	34	19	57
Mercury	3.1	1.4	76

TABLE 6
SPLIT SAMPLE

ANALYTE	A5 0-0.1m mg/kg	SPLIT Y2 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	<2	<3	-
Cadmium	0.5	<0.3	-
Chromium	8.8	9	2
Copper	13	8	48
Nickel	<5	3.7	-
Lead	9.2	8	14
Zinc	26	20	26
Mercury	0.98	0.77	24

TABLE 7
SPLIT SAMPLE

ANALYTE	A6 0-0.1m mg/kg	SPLIT Y3 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	3	<3	-
Cadmium	0.5	<0.3	-
Chromium	9	9.4	4
Copper	27	8.8	102
Nickel	<5	4.3	-
Lead	11	10	10
Zinc	35	22	46
Mercury	0.72	1.4	64

TABLE 8
SPLIT SAMPLE

ANALYTE	COMPOSITE B mg/kg	SPLIT ASS1 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
OCP			
Heptachlor	<0.05	<0.1	-
Aldrin	<0.05	<0.1	-
Dieldrin	0.09	<0.2	
DDD	<0.05	<0.2	-
DDE	0.08	<0.2	-
DDT	<0.2	<0.2	-
Chlordane (cis & trans)	0.21	0.3	35

TABLE 9
RINSATE SAMPLE

ANALYTE	RINSATE AR1 (mg/L) 11.06.2013	Practical Quantitation Limits (PQL)
HEAVY METALS		
Arsenic	<0.001	0.001
Cadmium	<0.0001	0.0001
Chromium	<0.001	0.001
Copper	<0.001	0.001
Nickel	<0.001	0.001
Lead	<0.001	0.001
Zinc	<0.005	0.005
Mercury	<0.0001	0.0001

TABLE A

HEAVY METALS TEST RESULTS

	Analyte	HEAVY METALS (mg/kg)							
Sample Location	Depth (m)	ARSENIC	CADMIUM	CHROMIUM	COPPER	NICKEL	LEAD	ZINC	MERCURY
Aargus June 2008									
BH01F	0.5	9	0.5	20	96	53	89	319	0.14
BH01N	2.5	4	<0.1	6	11	3	17	20	0.11
BH02F	0.5	9	<0.1	16	35	30	29	54	0.12
BH02N	2.5	10	0.2	22	51	15	75	131	0.22
BH03F	0.5	8	0.6	17	28	7	75	109	0.12
BH03N	2.5	<1	<0.1	<1	<2	<1	<2	<5	<0.05
BH04F	0.5	4	<0.1	7	14	4	15	9	<0.05
BH04N	2.5	9	0.9	18	39	17	90	281	0.39
BH05F	0.5	5	<0.1	7	17	4	35	44	0.1
BH05N	2.5	5	<0.1	6	10	3	18	17	0.05
BH06F	0.5	3	<0.1	6	11	9	12	30	<0.05
BH06N	2.5	6	0.6	9	25	8	38	263	0.05
BH07F	0.5	9	<0.1	12	25	23	20	51	0.15
BH07N	2.5	7	<0.1	16	12	8	47	23	0.05
BH08F	0.5	5	0.1	8	16	7	44	42	0.11
BH08N	2.5	6	<0.1	8	18	7	38	60	0.19
BH09F	0.5	7	0.1	68	43	9	97	100	0.14
BH09N	2.5	7	0.3	14	44	12	289	314	7.23
BH10F	0.5	5	<0.1	9	23	19	13	16	0.07
BH10N	2.5	4	<0.1	4	12	6	8	23	0.1
BH11F	0.5	6	0.1	9	16	3	29	33	0.09
BH11N	2.5	1	<0.1	2	5	2	5	10	<0.05
Practical Quantitation Limits (PQL)		1	0.1	1	2	1	2	5	0.05
Aargus June 2013									
A1	0-0.1	2.6	<0.4	9	13	5.1	13	38	1
A2	0-0.1	2.3	<0.4	<5	6.8	<5	7.9	23	0.76
A3	0-0.1	2.1	0.4	10	12	<5	9.6	24	1.1
A4	0-0.1	5.2	1	18	14	5.8	13	34	3.1
A5	0-0.1	<2	0.5	8.8	13	<5	9.2	26	0.98
A6	0-0.1	3	0.5	9	27	<5	11	35	0.72
A7	0-0.1	29	0.7	17	17	5.4	18	52	2.7
A8	0-0.1	10	0.5	25	12	<5	17	27	6.5
A9	0-0.1	7.6	0.7	37	18	<5	25	31	2.6
Practical Quantitation Limits (PQL)		2	0.4	5	5	5	5	5	0.05
NATIONAL ENVIRONMENT PROTECTION MEASURE (1999)									
Health Investigation Levels (HIL) [a] (HIL 'A')		100	20	12%/100 [c]	1000	600	300	7000	10/15 [d]
HIL 'E' [B]		200	40	24%/200	2000	600	600	14000	20/30

Notes a: Residential with gardens and accessible soil including children's day-care centres, preschools, primary schools, townhouses and villas.

b: Parks, recreational open space and playing fields, including secondary schools

c: 12% (120000mg/kg) for Chromium (+3) and 100mg/kg for Chromium (+6).

d: 10mg/kg for Methyl Mercury and 15mg/kg for Inorganic Mercury.

TABLE B
TOTAL PETROLEUM HYDROCARBONS (TPH) AND BTEX TEST RESULTS

Analyte		TPH (mg/kg)					BTEX (mg/kg)			
Sample Location	Depth (m)	C6-C9	C10-C14	C15-C28	C29-C36	C10-C36 [a]	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES
Aargus June 2008										
BH01F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH01N	2.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH03F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH04F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH04N	2.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH05F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH07F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH09F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH10F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH10N	2.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
BH11F	0.5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1.5
Practical Quantitation Limits (PQL)		10	50	100	100	NA	0.2	0.5	0.5	1.5
EPA Levels [b]		65	C10-C36 =1000				1	1.4	3.1	14

Notes

a: C10-C36 = (C10-C14) + (C15-C28) + (C29-C36); concentrations less than PQL are assumed equal to PQL.

b: Contaminated Sites: "Guidelines for Assessing Service Station Sites", 1994, EPA

NA: Not Applicable

TABLE C

BENZO(a)PYRENE AND POLYCYCLIC AROMATIC HYDROCARBONS (PAH) TEST RESULTS

Analyte		PAH (mg/kg)	
		BENZO(a)PYRENE (mg/kg)	TOTAL PAH (mg/kg)
Sample Location	Depth (m)		
Aargus June 2008			
BH02F	0.5	<0.5	<8.0
BH04F	0.5	<0.5	<8.0
BH06F	0.5	<0.5	<8.0
BH08F	0.5	0.5	3.2
BH10F	0.5	<0.5	<8.0
Practical Quantitation Limits (PQL)		0.5	NA
NATIONAL ENVIRONMENT PROTECTION MEASURE (1999)			
Health Investigation Levels (HIL) [a] (HIL 'A')		1	20
HIL 'E' [b]		2	40

Notes
a: Residential with gardens and accessible soil including children's day-care centres, preschools, primary schools, townhouses and villas.
b: Parks, recreational open space and playing fields, including secondary schools
NA: Not Applicable

TABLE D
ORGANOCHLORINE PESTICIDES (OCP) and POLYCHLORINATED BIPHENYLS (PCB) TEST RESULTS

Analyte		Organochlorine Pesticides (mg/kg)							
Sample Reference	Depth (m)	HEPTACHLOR	ALDRIN	DIELDRIN	DDD	DDE	DDT	CHLORDANE (trans & cis)	TOTAL PCB (mg/kg)
Aargus June 2008									
BH04F	0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.1	<3
BH10F	0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.1	<3
Practical Quantitation Limits (PQL)		0.05	0.05	0.05	0.05	0.05	0.2	0.1	3
NATIONAL ENVIRONMENT PROTECTION MEASURE (1999)									
Health Investigation Levels (HIL) [a] (HIL 'A')		10	10 [c]	10 [c]	200 [d]			50	10
HIL 'E' [b]		20	20	20	400			100	40

Notes

a: Residential with gardens and accessible soil including children's day-care centres, preschools, primary schools, townhouses and villas.

b: Parks, recreational open space and playing fields, including secondary schools

c: Aldrin + Dieldrin

d: Total of DDD + DDE + DDT

TABLE E
ORGANOCHLORINE PESTICIDES (OCP) TEST RESULTS
COMPOSITED SAMPLES

Analyte		Organochlorine Pesticides (mg/kg)						
Composite Number		HEPTACHLOR	ALDRIN	DIELDRIN	DDD	DDE	DDT	CHLORDANE (trans & cis)
Aargus June 2013								
Composite A	0-0.1	<0.05	<0.05	<0.05	<0.05	0.1	<0.2	0.53
Composite B	0-0.1	<0.05	<0.05	0.09	<0.05	0.08	<0.2	0.21
Composite C	0-0.1	<0.05	<0.05	0.12	<0.05	0.36	0.2	0.18
Practical Quantitation Limits (PQL)		0.05	0.05	0.05	0.05	0.05	0.2	0.1
GUIDELINES FOR THE NSW SITE AUDITOR SCHEME (1998)								
Health-Based Investigation Levels [a] (NEHF A)		10	10 [c]	10 [c]	200 [d]			50
Adjusted HBIL [b]		3.3	3.3 [c]	3.3 [c]	67 [d]			17

Notes
- a: Residential with gardens and accessible soil including children's day-care centres, preschools, primary schools, townhouses and villas.
- b: Adjusted HBIL=HBIL/3
- c: Aldrin + Dieldrin
- d: Total of DDD + DDE + DDT

APPENDIX O

IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL REPORT

Aargus

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 contamination 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.