HOLDMARK PTY LTD

GROUNDWATER INVESTIGATION

SHEPHERDS BAY URBAN RENEWAL PROJECT, MEADOWBANK NSW

Environmental Investigations

Report No. E2008 AC

29 January 2014

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Report Distribution

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EI Report No. *E2008 AC*

Date: *29 January 2014*

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Revision	Details	Date	Amended By
AC	Original	29 January 2014	

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1 INTRODUCTION

1.1 BACKGROUND

The Shepherds Bay Urban Renewal Concept Plan (MP09_0216) was approved in March 2013 and required:

> *Clause 38 Future Development Applications shall include a detailed contamination assessment (involving sampling and testing of soil) including the presence of acid sulphate soils and salinity.*
>
> *Clause 39 A groundwater assessment (involving sampling and testing of groundwater) shall be undertaken across the entire Concept Plan prior to the first Development Application being lodged for Stage 2 or any other stage of the development.*
>
> *Clause 40 Future Development Applications where necessary shall include a targeted groundwater assessment for the specific stage (based on the recommendations of the groundwater assessment undertaken for the entire Concept Plan)*

Environmental Investigations (EI) was engaged by Mr Adam Fahi of Holdmark Pty Ltd to conduct the groundwater assessment for the entire concept plan (Clause 39) for the Shepherds Bay Urban Renewal Development Project (henceforth 'the concept plan site'), which encompasses Stages 1 to 10 of properties generally bounded by Rothesay Ave Bowden Street, Constitution Road, and Belmore Road and Stage A bounded by Well Street, Parsonage Street, Loop Road and Church Street, Meadowbank, NSW, 2114 . Individual environmental site assessments are also being undertaken on Stages 2 & 3 and Stages 4 & 5 and subsequent stages as required are also being undertaken by EI and are presented in a separate documents.

The Shepherds Bay Urban Renewal Project is located approximately 11km north west of Sydney's central business district, located within the Local Government Area of City of Ryde Council (see **Figure 1**). The site covers a total area of approximately 9.3 hectares as depicted in the concept plan site presented as **Figure 2**. The land was previously used for a range of commercial and industrial purposes which may have contaminated as outlined in the Douglas and Partners (DP) report *Preliminary Screening Contamination Assessment Proposed Shepherds Bay Urban Renewal Constitution Road Meadowbank* (Ref: DP 71920-1, dated October 2010). The DP report identified a potential data gap and recommended that a further groundwater assessment be undertaken.

1.2 PROPOSED DEVELOPMENT

The concept plan Stages 1 and 10 and Stage A comprises:

- 41 Belmore Street, Ryde (Lot 1 DP 1072555);
- 116 Bowden Street, Meadowbank (Lot 2 DP 792836);
- 118-122 Bowden Street, Meadowbank (Lot 102, DP 1037638);
- 2 Constitution Road and 7-9 Hamilton Crescent, Ryde (Lot 2, DP 550006 and Lots 1-2, DP 982743);
- 4-6 Constitution Road, Ryde (Lot 1, DP 104280 and Lots 1-2, DP 930574);
- 8-14 Constitution Road, Ryde (Lot 1, DP 713706);
- 16 Constitution Road, Ryde (Lot 3, DP 7130);
- 18 Constitution Road, Ryde (Lots 1-2, DP 810552);
- 6 Nancarrow Avenue, Ryde (Lot 1, DP 322641);
- 8 Nancarrow Avenue, Ryde (Lot 11, DP 7130);
- 10 Nancarrow Avenue, Ryde (Lot 12, DP 7130);
- 12-16 Nancarrow Avenue, Ryde (Lots 13-15, DP 7130);
- 18 Nancarrow Avenue, Ryde (Lot 16, DP 7130);
- 37-53 Nancarrow Avenue, Ryde (Lot 9, DP 19585, Lot 1, DP 122205, Lots 1-7, DP 19585 and Lots 10-17, DP 19585);
- 8 Parsonage Street, Ryde (Lots 13-14 DP 738232, Lot 7, DP809282, Lot 100, DP 851723 and Lot 15, DP 738232);
- 9-10 Rothesay Avenue, Ryde (Lot 1, DP 703858); and
- 11 Rothesay Avenue, Ryde (Lot 18, DP 7130).

There are a number of properties isolated from the development but there is the potential for these to be amalgamated during the development stages.

The concept plan approval indicates the development includes mixed use residential, retail and commercial land use incorporating:

- building envelopes for 12 buildings incorporating basement level parking;
- Infrastructure works to support the development;
- publically accessible open space and through site links; and
- pedestrian and cycle pathways.

1.3 REGULATORY FRAMEWORK

The following regulatory framework and guidelines were considered during the preparation of this report:

- NEPC (2013) Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater, National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013, National Environment Protection Council, May 2013;
- NEPC (2013) Schedule B(2) Guideline on Site Characterisation, National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013, National Environment Protection Council, May 2013;
- (ANZECC and NHMRC January, 1992) Guidelines for the Assessment and Management of Contaminated Sites, published by the Australian and New Zealand Environment and Conservation Council (ANZECC) and the National Health and Medical Research Council (NHMRC);
- NSW DEC, 2006 Guidelines for the NSW Site Auditor Scheme;
- ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and
- NSW EPA (1995) Sampling Design Guidelines
- NSW Government (1997) Contaminated Land Management Act (1997)
- NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination
- NSW Government Environment and Planning Assessment Act (1997) including the associated State Environment Planning Policies (e.g. SEPP 55)
- DUAP (1998) Managing Contaminated Land
- NSW DECCW (2009) Guidelines for Implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008 under the Protection of the Environment Operations Act (1997)

2 OBJECTIVES AND SCOPE OF WORK

2.1 OBJECTIVES

In accordance with the Concept Approval (Clause 39) the proponent is required to undertake a groundwater assessment across the whole of the area of the concept plan prior to the lodgement of any Stage 2 or other Development Applications. The primary objectives for this groundwater assessment are therefore to:

- Evaluate the potential for site groundwater contamination on the basis of historical land uses, anecdotal and documentary evidence of possible pollutant sources; and
- To make recommendations as to whether further targeted groundwater assessment was required for any of the specific stages of the development (Clause 40).

2.2 SCOPE OF WORKS

In order to achieve the above objective, and in keeping the project cost-effective while meeting the minimum requirements of the EPA/DECC guidelines for consultants reporting on contaminated sites, the scope of works was as follows:

Desktop Study

- Review of the Concept Plan Application, Approval and associated technical documents including the preliminary contamination assessment reports
- Review of available topographical, geological, hydrogeological (including registered water bores), soil landscape and acid sulfate soil maps for the project area;
- Review of selected historical aerial photographs archived at NSW Land and Property Information in order to review previous site use and the historical sequence of land development in the neighbouring area;
- Review of existing contamination reports the main development stages (e.g. Stage 1, Stages 2 & 3 and Stages 4 &5) which included:
  - Workcover NSW (Dangerous Goods) searches relating to possible underground tank approvals and locations;
  - Searches of NSW EPA / OEH Land Information records to confirm the presence or not of statutory notices and notified sites under the Contaminated Land Management Act (1997)
  - Drilling of soil boreholes (all stages) and groundwater monitoring wells (Stage 1), sampling and analysis at a NATA registered laboratory
- Development of a preliminary conceptual site model (CSM) to assess potential receptors, migration and exposure pathways and risk of exposure.

Field Work

- A review of existing underground services on site and Dial Before You Dig (DBYD) searches.
- A detailed site walkover inspection (carried out in conjunction with the various contamination assessment reports for the various stages);
- Drilling and installation of 14 boreholes which were converted to monitoring wells (GW101 to GW114) located in a broad grid pattern across the site;
- Well development, water level gauging and measurement of physico-chemical parameters to assess depth to water, the overall water quality and to allow interpretation of the groundwater flow direction;
- Laboratory analysis of groundwater samples for relevant analytical parameters as determined from the site history survey and field observations during the investigation program; and
- Data interpretation and reporting.

EI have also carried out contamination assessment of the soils which are reported on the separate stages for the development including:

- EI (2013) Stage 1 Environmental Site Assessment 41-45 Belmore Street, Meadowbank, NSW Report Ref No. E1836.1AA dated 25 June 2013 (includes groundwater monitoring wells MW1 to MW6)
- EI (2014) Stages 2 & 3 of the Shepherds Bay Urban Renewal Project, Meadowbank NSW, Report Ref No. E2008 AA dated 10 January 2014
- EI (2014) Stages 4 & 5 of the Shepherds Bay Urban Renewal Project, Meadowbank NSW, Report Ref No. E2008 AB dated 16 January 2014

3 SITE DESCRIPTION

3.1 PROPERTY IDENTIFICATION, LOCATION AND PHYSICAL SETTING

The site identification details and associated information are presented in **Table 3-1** while the site locality is shown in **Figure 1**.

Table 3-1 Site Identification, Location and Zoning

Attribute	Description
Street Addresses	41 Belmore Street, Ryde 116 Bowden Street, 118-122 Bowden Street, Meadowbank; 2 Constitution Road and 7-9 Hamilton Crescent, Ryde; 4-6 Constitution Road, 8-14 Constitution Road, 16 Constitution Road, 18 Constitution Road, Ryde; 6 Nancarrow Ave, 8 Nancarrow Ave, 10 Nancarrow Ave, 12-16 Nancarrow Ave, 18 Nancarrow Ave, 37-53 Nancarrow Avenue, Ryde 8 Parsonage Street, Ryde 9-10 Rothesay Avenue, and 11 Rothesay Avenue, Ryde.
Location Description	Approx. 11 km north west of Sydney central business district, the overall Stage 1 – 10 of the Shepherds Bay Urban Renewal Development Project, is rectangular bounded by Belmore Street (east), Rothesay Avenue (south), Bowden Street (west) and Constitution Road (north). Stage A is bounded by Well Street (north), Parsonage Street (west), Loop Road (south) and Church Street (east, Meadowbank, NSW, 2114.
Site Area/GDA	Stages 1 - 10 of the Shepherds Bay Urban Renewal Project is approx. 9.3 hectares Southern corner GDA Lat:-33.820732713, Long: 151.095191508
Site Owner	Holdmark Pty Ltd
Lot and Deposited Plan	See proposed development in Section 1.2.
State Survey Marks	Two State Survey Marks (SSM) occur around the sites, being SS122873D in Rothesay Avenue (now destroyed) and SS122864 in Belmore Street. (http://maps.six.nsw.gov.au)
Local Government Area	City of Ryde Council
Parish	Hunters Hill
County	Cumberland
Current Zoning	*B4 – Mixed Use* (Ryde Draft Local Environment Plan, 2011)

At the time of this assessment, the site was divided into eight separate allotments comprising various commercial properties in the northern portion of the site, residential and vacant land present in the central eastern portion of the site, a large vacant industrial warehouse in the central western portion of the site, and cleared land which has undergone demolition in the southern portion of the site. The demolished building and current industrial warehouse were historically used for manufacturing of white goods by Hoover. A site plan illustrating the assessment areas are shown in **Figure 2**.

3.2 LOCAL LAND USE

The site is situated within an area of mixed use. Current uses on surrounding land are described in **Table 3 - 2**.

Table 3-2 Local Land Use

Direction Relative to Site	Land Use Description
North	Constitution Road then Commercial and Residential Properties.
South	Rothesay Avenue, beyond which is Parramatta River, with a public reserve (*Anderson Park*) located to the south of Stages 1, 2 and A. The land south of Stage 9 is currently vacant but is understood to be redeveloped as multi-storey residential units.
East	Church Street a six lane major transport corridor with individual residential lots beyond.
West	Commercial units along most of Bowden Street with multi-storey residential apartments at the southern end of Bowden Street.

3.3 REGIONAL SETTINGS

The topographical, geological, soil landscape and hydrogeological information for the locality is summarised in **Table 3-3**.

Table 3-3 Topographical, Geological and Hydrogeological Information

Attribute	Description
Topography	The site slopes essentially south toward the Parramatta River from a RL of approximately 10 to 20m AHD on Constitution Road (H Ramsay & Co. Pty Ltd Survey) to approximately 5m to 2m AHD on Rothesay Avenue. The Stage A site is on a slight knoll ranging from 10.5 to 13 m AHD. The western third of the site is generally lower (less than 10 m AHD) than the eastern two-thirds and contains a main drainage line which drains the urban catchment to the north of Constitution Road and the eastern two thirds of the site which is essentially a broad ridgeline area.

Attribute	Description
Site Drainage	The general slope of the site is in the direction of Parramatta River/Shepherds Bay, with all stormwater present at the site flowing towards this feature via drainage to various stormwater easements and the municipal stormwater system. There are two topographical elements within the overall Shepherds Bay Concept plan area with the western third of the site in an overall drainage depression which drains areas to the north of the Constitution Road and the eastern area a broad sandstone ridge where drainage follows general slope.
Regional Geology	The site is likely underlain by Hawkesbury Sandstone (*Rh)*. Hawkesbury Sandstone is described as medium to coarse-grained quartz sandstone, very minor shale and laminite lenses. *(Ref. 1:100 000 Geological Series Sheet 9130 –Sydney)* There is small lobe of Ashfield Shale/Mittagong Formation just extending into the north eastern corner of the concept area near Constitution and Belmore Road intersection.
Soil Landscapes	The Soil Conservation Service of NSW *Soil Landscapes of the Sydney 1:100,000 Sheet* (Chapman and Murphy, 1989) indicated that the site overlies an *Erosional Landscape – Glenorie (gn),* which typically includes gently undulating to rolling low hills on Wianamatta Group shales. However, the site lies within an area of the map that borders a *Disturbed Terrain (xx*) soil landscape, which includes level plain to hummocky terrain extensively disturbed by human activity including complete disturbance, removal or burial of soils. Soils encountered during the investigation works were considered to be consistent with soils described as part of the Disturbed Terrain landscape. The *Disturbed Terrain (xx*) soil landscape land fill includes soil, rock, building and waste materials. Disturbed terrain may be bare or covered with opportunist weeds such as cobblers peg, purple top and ribwort. Most areas are eventually turned to grassland or lawn. Land use is varied and includes commercial and industrial complexes, sporting and recreational area, quarries and waste disposal sites. Dominant soil materials include of loose black sandy loam, compacted mottled clay, variable transported fill and dark dredged muds and sands. Soils have been disturbed to a depth of at least 0.1m with most of the original soil either removed, buried or greatly disturbed Most disturbed areas are eventually artificially topsoiled and revegetated or covered by buildings, concrete or bitumen. The occurrence and relationship of soil materials is highly variable.
Prospect Parramatta Acid Sulfate Soil Risk Map *(1:25,000 scale; Murphy, 1997)*	Subject land lies within the map class description of No Known Occurrence. In such cases, acid sulfate soils (ASS) are not known or expected to occur and "land management activities are not likely to be affected by ASS materials" Some ASS is likely to be present along the foreshores of Shepherds Bay but the development does not extend to this area.
City of Ryde Council Acid Sulfate Risk Class Map *(1:1,000 scale; Draft Local*	The City of Ryde Council Draft Local Environmental Plan 2011- Acid Sulfate Soils Risk Class Map indicates that the site lies within a Class 5 ASS area. Council consent is therefore required prior to commencing any works within 500m of Class 1, 2, 3 or 4 land, with a ground elevation of below 5m Australian Height Datum (AHD) and where

Attribute	Description
Environmental Plan 2011)	the water table is likely to be lowered below 1m AHD on adjacent Class 1, 2, 3 or 4 land. However, Based on the findings of the subsequent field investigation, the site was underlain by sandstone bedrock and failed to demonstrated field indicators for actual and potential ASSs listed in the ASSMAC (1998) manual (Ref. Table 2.3, Section 2, ASSs Assessment Guidelines). The need for further Acid Sulfate soil management was considered unwarranted and the risks associated with Acid Sulfate soils were considered negligible.
Typical Vadose Zone Soil Types	Weathered sandstone. Some sandy clay near Parramatta River
Depth to Groundwater	Groundwater was encountered between 1.3 to 7.4 m BTOC during the present groundwater investigation and generally flows toward Shepherds Bay.
Groundwater Types	The groundwater includes intermittent seepage zones that may be present in the fill and groundwater within joints, fractures and bedding planes of the underlying sandstone bedrock
Nearest Water Body	Parramatta River and Shepherds Bay is located immediately across Rothesay Avenue at the southern extent of the site and is considered to be marine and part of Sydney Harbour. The river/bay is approximately 240 meters (m) from the upgradient boundary of the site on Constitution Road.

3.4 GROUNDWATER BORE RECORDS AND LOCAL GROUNDWATER USE

An online search of registered groundwater bores was conducted by EI on the 19th of December 2013 through the NSW Natural Resource Atlas database (*Ref.* http://www.nratlas.nsw.gov.au). There were 10 registered bores within about 1 km of the site. A summary of all registered bores being uncovered is presented in **Table 3-4**. A bore location plan as well as the detailed information regarding the identified bores is attached in **Appendix A**.

Table 3-4 Summary of registered groundwater bores within 1 km.

Bore No.	Date Drilled	Drilled Depth (m)	SWL(mBGL)*/ Salinity#	Bore Purpose
				Authorised / Intended
GW104997	20-08-2001	2.40	2.32 / 260	Monitoring Bore
GW104998	20-08-2001	3.10	2.50 / 279	Monitoring Bore
GW104999	20-08-2001	3.60	3.54 / 248	Monitoring Bore
GW112117	13-11-2002	2.50	- / -	Monitoring Bore
GW112118	13-11-2002	4.00	- / -	Monitoring Bore
GW112119	13-11-2002	4.00	- / -	Monitoring Bore
GW112120	13-11-2002	2.50	- / -	Monitoring Bore
GW113341	20-09-2004	15.90	- / -	Monitoring Bore
GW113342	21-09-2004	18.00	- / -	Monitoring Bore
GW113343	21-09-2004	17.10	- / -	Monitoring Bore

Notes

NA = Information not available, * SWL = Standing Water Level, #Salinity Units - not recorded,

All of the located registered bores are indicated to have been authorised for monitoring purposes. The drilled bore depths ranged between 2.40m and 18.00m BGL, with water table (as indicated by recorded standing water levels, SWL) being between 2.32m and 3.54m BGL.

The registered water bores are generally located west and south-east of the main catchment area covered by the Shepherds Bay Concept Plan (see ***Figure 3-1***) and are therefore not considered receptors for any potential site contamination identified at the site.

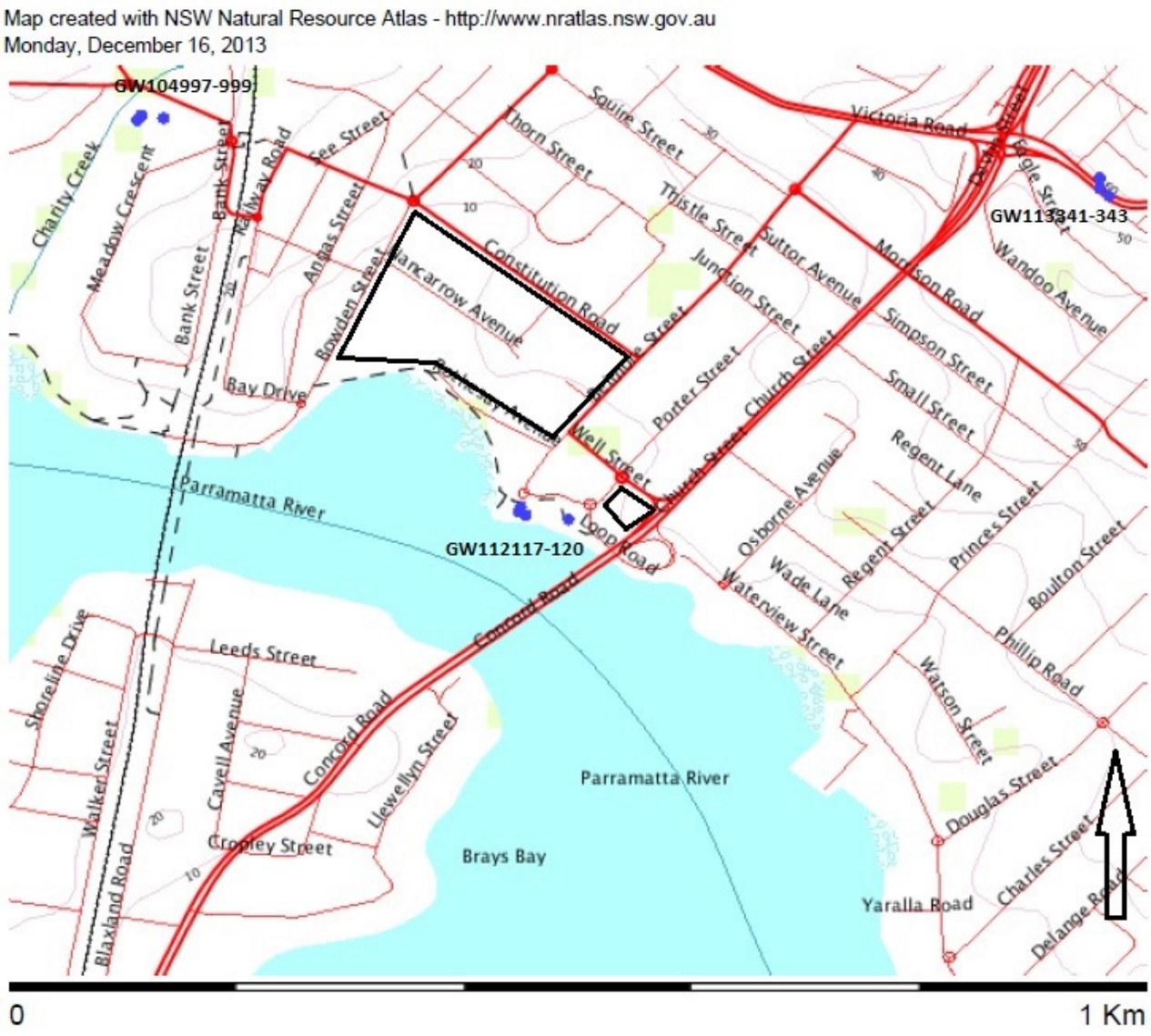


Figure 3-1 Plan of registered water bore locations

The monitoring bores GW112117 to GW112120 appear to be drilled downgradient of the former Council depot in Parsonage Street which was listed on the notified sites on the NSW EPA website (http://www.epa.nsw.gov.au/clm/publiclist.htm).

4 PREVIOUS INVESTIGATIONS

Previous environmental investigations conducted with relation to the Shepherds Bay Urban Development as a whole, as well as parts of the allotment located at 41 Belmore Street. These reports are entitled:

- Environmental Site Screening for Proposed Residential Development at 41-45 Belmore Street, Meadowbank, Environmental Investigation Services (EIS) Project No. E18629FJ-RPT, September 2004;
- Preliminary Screening Contamination Assessment, Douglas Partners (DP) Project No. 71920-1, October 2010;
- Stage 2 Environmental Site Assessment, 41-45 Belmore Street, Meadowbank, NSW (Known as Stage 1) Environmental Investigations Australia (EI) Project No. E1836.1, 25 June 2013.
- Environmental Site Assessment, Stages 2 & 3 Shepherds Bay Urban Renewal Project, Meadowbank NSW, Environmental Investigations Australia (EI) Project No. E2008, 10 January 2014.
- Environmental Site Assessment, Stages 2 & 3 Shepherds Bay Urban Renewal Project, Meadowbank NSW, Environmental Investigations Australia (EI) Project No. E2008, 16 January 2014.

A summary of works and key findings of the above reports by various authors are outlined below within **Table 4-1**, as follows:

Table 4-1 Summary of Works and Key Findings

Assessment Details	Project Tasks and Findings
Environmental Site Screening (EIS, 2004)	
Project Objectives	Assess the soil and groundwater conditions at 41 – 45 Belmore Street, Meadowbank NSW (henceforth 'Belmore St.') in relation to the suitability of the site for the proposed residential land use.
Scope of Works	• Review of a historical site contamination assessment report prepared by EGIS (2000); • Review of regional geology and groundwater conditions, including the location of major underground services in the vicinity of the site; • Design and implementation of a field sampling program, involving soil sampling from test pits BH102 to BH113 and BH203, BH211, BH212 and BH213 for heavy metals, petroleum hydrocarbons (TPH), and polycyclic aromatic hydrocarbons (PAH). In addition, three groundwater samples (BH105, BH106 and BH201) were collected and analysed for TPH, benzene, toluene, ethyl benzene and xylene (BTEX) and pH; • Preparation of a report presenting the results of the assessment of potential soil and groundwater contamination. Field work for the investigation was undertaken on 21, 24, 26 May, 2 June and 2 September, 2004.

Assessment Details	Project Tasks and Findings
Conclusions	Historical information and inspection of the site and surrounding areas indicated that the site has formerly been used for industrial purposes, with the following potential site specific issues identified: • Petroleum hydrocarbon and heavy metal contamination in the vicinity of the landscaped area adjacent to the guard house at the north-east of Belmore St.; • Petroleum hydrocarbon and heavy metal contamination in the vicinity of the courtyard at the central north section of Belmore St.; • Petroleum hydrocarbon and heavy metal contamination in the vicinity of former above ground storage tanks in the subbasement area at the south of Belmore St.; • Potential subsurface contamination associated with the storage of trade waste liquids in a bunded area in the sub-basement level at the south of Belmore St. No specific off-site contamination sources were identified during cursory inspection of the surrounding sites of Belmore St. Elevated concentrations of arsenic and heavy fraction petroleum hydrocarbons were encountered in surficial fill silty sand material (BH212) associated with the landscaped area to the west of the guard house at the north-east of the site. The lateral extent of the fill material at this location was unable to be assessed due to limited access. Elevated concentrations of petroleum hydrocarbons were encountered in residual sandy clay soils overlying shallow sandstone bedrock (BH210) at the north of Belmore St., with the lateral and vertical extent identified and presented in Figure 3 of this report. Groundwater was encountered in three temporary standpipes installed for the project, to a depth of approximately six (6) meters (m). Low levels of toluene and total petroleum hydrocarbons (TPH) C_6 – C_9 fraction were encountered one sample, whilst another identified low levels of TPH C_{10} - C_{36} fractions, however were found to be less than the NSW EPA endorsed health based investigation guideline levels for petroleum hydrocarbon contamination. Provided activities are undertaken in accordance with a formal remedial action plan (RAP), the site is considered suitable for residential use.
Recommendations	Based on the investigation conducted, EIS considered that site could be made suitable for the proposed development provided the following recommendations were undertaken: • Remediation of contaminated soils proximal to BH210 (petroleum) and BH112 (arsenic and heavy fraction petroleum hydrocarbons). These sample locations are present within the north east corner of 41 – 45 Belmore Street, directly south east of Nancarrow Avenue; • Further groundwater investigation should be undertaken if disposal of groundwater is necessary during dewatering of the proposed excavations works; and • Survey of the existing structures for hazardous materials prior to demolition. EI notes that the areas identified as requiring remediation from this investigation are not located within the Stage 2 – 3 development area assessed as part of the ESA report.
Preliminary Screening Assessment (DP, 2010)	
Project Objectives	The objectives of the investigation was to provide a broad scale assessment of the site, being all stages of the works, to identify the likely contaminants of concern and whether

Assessment Details	Project Tasks and Findings
	there are contamination issues that are likely to cause material impact on the proposed redevelopment. The assessment also provides some indication of the additional works that would be required to assess the contamination status of the site, once site access is more readily available.
Scope of Works	• A review of the DP database for jobs conducted within and around the site area to determine the likely site condition; • A review of published geological, soil landscape, acid sulphate soils and salinity mapping; • A review of broad scale history sources including: - Historical aerial photographs; - A search of the Department of Environment, Climate Change and Water (DECCW) register of contaminated sites and licences; - A search for registered groundwater bores using DECCW online search; - A search of the local library for any available local histories (if available). • A site walkover inspection of the sites; • Identification of areas or issues of environmental concern (AECs) and likely issues associated with these AECs; • Preparation of preliminary contamination assessment detailing the results of the assessment and making recommendations for future works.
Conclusions	Based on the limited site history investigation completed by DP, it was considered that there was generally a moderate potential for contamination, although the probability of widespread contamination across the site appeared to be generally limited. Various commercial/industrial site uses over the past 50 or so years including storage of fuel and fuel related products in underground storage tanks, potentially industrial/commercial operations involving the use of chemicals and the use of fuels, solvents and other degreasers at the numerous mechanics, auto shops and smash repairers within the site may also result in soil and/or groundwater contamination. It was considered likely that some potential or actual acid sulphate soil materials are present, particularly in reclaimed areas and the area of the jetty. Overall, it was considered that the contamination issues, if present, would most likely be mainly confirmed to areas close to the original source due to the generally shallow depth of bedrock at the site and can likely be dealt with in a relatively straight forward and staged manner and are unlikely to significantly affect the viability of the redevelopment project.
Recommendations	From a broad scale evaluation standpoint, DP considered that the site can be rendered suitable for the proposed development. Further intrusive and more detailed assessment would be required, preferentially in stages to better define the nature and extent of any contamination issues. Furthermore, it was recommended that a regional groundwater study be conducted as part of the early works to assess the overall groundwater quality and conditions at the site and to

Assessment Details	Project Tasks and Findings
	assist in determining the overall potential for potential contamination issues within all or part of the site.
Stage 2 Environmental Site Assessment of Stage 1 (EI, 2013)	
Project Objectives	The main objective of this ESA was to appraise the degree of site contamination (if any) at 41 – 45 Belmore Street (Belmore St.) and to assess Belmore St.'s suitability for the proposed residential apartment development.
Scope of Works	• A review of the previous Environmental Site Screening conducted by EIS in September 2004; • A detailed site walkover inspection; • A review of underground service plans; • The construction of test boreholes at eighteen (18) locations distributed in a triangular grid pattern across the site with allowance for structural obstacles; • Multiple level soil sampling down to natural soils; • Installation of six (6) groundwater monitoring wells to intercept groundwater (see ***Appendix B***); • Laboratory analysis of soil samples and groundwater for relevant analytical parameters as determined from the site history survey and field observations during the investigation program; and • Data interpretation and reporting.
Conclusions	At the time of this investigation Belmore St. was free of statutory notices issued by the NSW EPA/DECCW under Section 58 of the Contaminated Land Management Act 1997. Belmore St. was cleared of all buildings and the majority of concrete including surface fill was removed, the soil profile across the site was characterised as grey/orange-brown weathered sandstone bedrock with some minor surface brown silty sand. A total of eighteen (18) test boreholes and six groundwater bores were drilled across the site targeted at areas of concern and near the previous investigation which identified the following: • Non-detectable or low concentrations of the screened TPH fractions were identified in the tested soil samples; • No detectable benzene toluene, ethyl benzene or xylene (BTEX) concentrations were identified in any of the tested soil samples being below the adopted EPA (1994*) Threshold concentrations for Sensitive Land Use – Soils*; • Non-detectable or trace concentrations of volatile organic compounds (VOCs) or poly-aromatic hydrocarbons (PAHs) were identified in the tested soil samples. However, all results were below the adopted soil investigation limits (SILs); • No detectable asbestos concentrations or traces of respirable fibres were identified in any of the tested soil samples; • No detectable concentration of any of the screened OCP, OPP or PCB compounds were identified in the tested soil samples, with all laboratory quantitation limits being within the corresponding SILs; • No detectable asbestos concentrations or traces of respirable fibres were identified in any of the tested soil samples;

Assessment Details	Project Tasks and Findings
	• No detectable concentration of any of the screened organochlorine pesticides (OCP), organophosphorous pesticides (OPP) or polychlorinated biphenyl (PCB) compounds were identified in the tested soil samples, with all laboratory quantitation limits being within the corresponding SILs. • Trace concentrations of copper and zinc were identified within groundwater which may be attributed to background levels in the urban area. • Low or Non-detectable concentrations of TPH compounds were identified in the tested groundwater samples being below the Groundwater Investigation Limits (GILs). • Low or Non-detectable concentrations of BTEX compounds were identified in the tested groundwater samples being below the GILs. • Low or non-detectable concentrations for the PAH and VOCs were identified in the tested groundwater samples, being below the GILs.
Recommendations	In view of the above findings, it was concluded that the site soils present a low risk to human health, the environment or the aesthetic enjoyment of the land, and is suitable for the proposed residential apartment development. However, site soils requiring excavation are to be classified in accordance with the DECCW (2009) *Waste Classification Guidelines* prior to off-site disposal.
Stage 2-3 Environmental Site Assessment Shepherds Bay Urban Renewal (EI, 2014)	
Project Objectives	In accordance with the Concept Approval (Clause 38) the proponent is required to undertake a detailed contamination assessment for any future development applications. The primary objectives of this ESA were therefore to: • Evaluate the potential for site contamination on the basis of historical land uses, anecdotal and documentary evidence of possible pollutant sources; and • To investigate the degree of any potential contamination by means of limited intrusive sampling and laboratory analysis, for relevant contaminants.
Scope of Works	• Desktop Study including review/search of relevant topographical, geological, hydrogeological and soil landscape maps, historical aerial photographs, land titles, City of Ryde Council records, NSW EPA / OEH Land Information records, Workcover Stored Chemical Information Database (SCID) and existing underground services on site. • A detailed site walkover inspection; • Construction of test boreholes at twenty nine preliminary locations (BH1 - BH5, BH201 - BH224) distributed in a triangular grid pattern across accessible areas of the site; • Multiple level soil sampling down to natural soils; • Laboratory analysis of selected soil samples for relevant analytical parameters as determined from the site history survey and field observations during the investigation program; and • Data interpretation and reporting.

Assessment Details	Project Tasks and Findings
Conclusion	Based on the findings of this Environmental Site Assessment, it was concluded that: • Site observations during the assessment revealed the site to be comprised of an irregular rectangular shaped block, covering a total area of approximately 15,347 m2. The site was bound by Nancarrow Avenue to the north-east beyond which were retail and commercial warehouse properties; preliminary construction stages of a high density residential development to the south-east (Stage 1, Shepherds Bay Urban Renewal Project) ; Rothesay Avenue to the south-west beyond which was a public reserve (Anderson Park) bordering Shepherds Bay/Parramatta River, a commercial office (BIC Services Pty Ltd) immediately to the west, and Nancarrow Lane to the north-west beyond which was a commercial office property (JTec Pty Ltd). • The site was free of statutory notices issued by the NSW EPA/DECC; • WorkCover search revealed the presence of a single UST remaining in situ, located within the north western portion of the site (11 Nancarrow Avenue); • Soil sampling and analysis were conducted at twenty nine (29) targeted test bore locations (BH1-BH5, BH201 – BH224) down to a maximum depth of 1.4m BGL. Sampling regime was considered to be appropriate for preliminary investigation purposes, and was mixed judgemental / systematic, triangular sampling pattern, with allowance for structural obstacles (e.g. building walls, underground and overhanging services and other physical obstructions in use by existing operating businesses); • The sub-surface layers comprised of fill materials of various constituents, comprising dark brown to brown clayey sands and brown orange sandy clays, underlain by Hawkesbury Sandstone.; • Groundwater was encountered at depths ranging from 1.3 to 7.4 meters below top of casing, with a groundwater assessment report to be completed by EI for groundwater pertaining to the Shepherds Bay Urban Renewal Project as a whole; • Results of soil samples collected from soil test boreholes BH1 to BH5, and BH201 – BH224 reported concentrations of the screened heavy metals to be below the adopted human health based SILs, with the exception of BH4-1, located within the front yard of 10 Nancarrow Avenue, which reported concentrations of lead exceeding the human health based SIL (2,000 mg/kg); • Sample BH3-1, collected from within a sandy gravelly topsoil from the nature strip in front of 18 Nancarrow Avenue was found to exceed the ecological criteria for zinc.; • BH202-1 and BH214-1 collected from locations considered to be within the Stage 2 residential building footprint were found to exceed the ecological criteria for nickel and copper, respectively; • BH207-1 and BH208-1 collected from locations considered to be within the Stage 3 residential building footprint were found to exceed the ecological criteria for nickel and zinc, respectively; • As the soils associated with samples BH202-1, BH214-1, BH207-1 and BH208-1 are located within the proposed building footprint for the stage 2 and 3 development EI considers that these soils will be removed, therefore the application of the ecological criteria will not be realised at these sample locations; • BH203-1 reported concentrations of TPH F2 (C10-C16 less naphthalene) fraction (170mg/kg) which exceeded ecological based SIL for coarse grained soils. Soil test borehole BH203 was located within the rear yard of 11 Rothesay Avenue, with the

Assessment Details	Project Tasks and Findings
	sample collected from a silty gravel road base fill material, a material known to contain TPH and PAH fractions which are considered to be immobile and of low risk. Vertical delineation of these impacts was achieved at this sample location; • Sample BH205-1 was found to exceed the SILs for TPH F2 fraction (390mg/kg), as well as concentrations of the TPH F3 fraction exceeding the ecological based SILs. The sample was collected from a silty gravel road base fill material, a material known to contain TPH and PAH fractions. Soil sample BH205-2 collected from distinctly weathered natural sandstone soils below the road base material, being soil sample BH205-2 indicated that the TPH F2 fraction impacts are restricted to the road base fill material. Furthermore, sample BH205-1 located within the rear yard of 11 Rothesay Avenue is designated for open space, therefore EI considers that this road base fill material will be removed, and shall not pose a risk to ecological or human health based receiving environments for the end use of the site. • Sample BH223-1 was found to exceed the human health based SILs for TPH F1 and F2 fractions, as well as the ecological based SILs for TPH F3 adopted for this assessment. This sample was collected from within silty sand fill located in the nature strip along Nancarrow Avenue Overall, widespread contamination was not identified from the findings of this this ESA. A lead hotspot was identified within the central north eastern portion of the site (in front of 10 Nancarrow Avenue) as well as the presence of an in situ underground storage tank (UST) within the north-west portion of the site (11 Rothesay Avenue) which require removal.
Recommendations	As construction of basement level car parks will require all fill and residual soil materials will be removed from the site, the following recommendations were made: 1. Preparation and implementation of a Remediation Action Plan to outline the removal of the lead hotspot identified, as well as the known USTs and any unexpected finds. 2. Classification and off-site disposal of contaminated soils in accordance the DECCW (2009) Waste Classification Guidelines. 3. Validate that the excavated areas are left free of contamination by comparing analytical results for excavation surfaces and any backfill material, against the respective DECC/EPA thresholds. 4. Preparation of a final site validation report by a qualified environmental consultant, certifying site suitability for the proposed development.
Stage 4-5 Environmental Site Assessment Shepherds Bay Urban Renewal (EI, 2014)	
Project Objectives	In accordance with the Concept Approval (Clause 38) the proponent is required to undertake a detailed contamination assessment for any future development applications. The primary objectives of this ESA were therefore to: • Evaluate the potential for site contamination on the basis of historical land uses, anecdotal and documentary evidence of possible pollutant sources; and To investigate the degree of any potential contamination by means of limited intrusive sampling and laboratory analysis, for relevant contaminants.

Assessment Details	Project Tasks and Findings
Scope of Works	• Desktop Study including review/search of relevant topographical, geological, hydrogeological and soil landscape maps, historical aerial photographs, land titles, City of Ryde Council records, NSW EPA / OEH Land Information records, Workcover Stored Chemical Information Database (SCID) and existing underground services on site. • A detailed site walkover inspection; • Construction of test boreholes at twenty nine preliminary locations (BH6, BH7, BH301 – BH326) distributed in a triangular grid pattern across accessible areas of the site, some of which (BH6 and BH7) were rock cored for the purposes of assessing underlying rock strata at the site; • Multiple level soil sampling down to natural soils; • Laboratory analysis of selected soil samples for relevant analytical parameters as determined from the site history survey and field observations during the investigation program; and • Data interpretation and reporting.
Conclusions	Based on the findings of this Environmental Site Assessment, it was concluded that: • Site observations during the assessment revealed the site to be comprised of a rectangular shaped block, covering a total area of approximately 1.36 hectares. The site was bound by Constitution Road to the north east beyond which were residential properties; preliminary construction stages of a high density residential development to the south west (Stage 1, Shepherds Bay Urban Renewal Project); Belmore Street Avenue to the south east beyond which was a high density residential development, and Hamilton Crescent West to the north west beyond which were commercial warehouses. • The site was free of statutory notices issued by the NSW EPA/DECC; • WorkCover search revealed the successful removal and validation of three underground storage tanks (UST's) present at 8 - 14 Constitution Road, however failed to indicate the status of any WorkCover licences held for the former BP service station located at 4 - 6 Constitution Road. This is currently being confirmed by WorkCover; • Soil sampling and analysis were conducted at twenty eight (28) targeted test bore locations (BH6, BH7 and BH301 - BH326) down to a maximum depth of 3.1m BGL. Sampling regime was considered to be appropriate for preliminary investigation purposes, and was mixed judgemental / systematic, triangular sampling pattern, with allowance for structural obstacles (e.g. building walls, underground and overhanging services and other physical obstructions in use by existing operating businesses); • The sub-surface layers comprised of fill materials of various constituents, comprising dark brown to brown silts and brown orange clays, underlain by Hawkesbury Sandstone; • Groundwater was encountered at depths ranging from 1.3 to 7.4 meters below top of casing, with a groundwater assessment report to be completed by EI for groundwater pertaining to the Shepherds Bay Urban Renewal Project as a whole; • Results of soil samples collected from soil test boreholes BH6, BH7 and BH301 - BH326 reported concentrations of the screened heavy metals to be below the adopted human health based SILs;

Assessment Details	Project Tasks and Findings
	• Sample BH303-1, collected within a silty fill material reported concentrations of copper (1,500 mg/kg) and zinc (930mg/kg) exceeding the ecological based SIL; • Sample BH7-2, collected from a gravelly sand and is considered to be within the building footprint of the Stage 5 residential development; • Due to the shallow residual soils present at the site, and the large scale development proposed, it is unlikely that the land will remain in its current state during construction of the proposed development and is expected to be disposed of at an off-site location. Therefore, the application of the ecological SILs is considered to be unrealised at the site; • Sample BH306-1 was found to exceed the human health based SIL for Carcinogenic PAH's (as Benzo[a]pyrene TEQ) (23mg/kg), and was collected at a depth of 0.2 meters below ground level within the western corner of the site. Delineation of these impacts was achieved at 1.2 m BGL; • Sample BH325-1 was found to exceed the human health based SIL for Carcinogenic PAH's (as Benzo[a]pyrene TEQ) (23mg/kg), located within the northern corner of the site; • Samples BH306-1 and BH325-1 were collected from areas considered to be within the Stages 4 and 5 residential building footprint, which has proposed the construction of a basement level car park. Due to the construction of the basement, it is considered that soils within the excavation will be removed to depths greater than 1.2m BGL, therefore will not be present at the end use of the site; and • On review of the Preliminary Conceptual Site Model (CSM) developed as part of this ESA, it was concluded that the model does remain valid for the proposed development. However, due to the absence of the majority of contaminants highlighted within the CSM, the potential risk of complete exposure pathways to exist as highlighted within the CSM, is considered to be low. Overall, widespread contamination was not identified from the findings of this this ESA. Concentrations exceeding human health based SILs were identified within the western and northern corners of the site. It is concluded that the site can be remediated to allow the site to be used for residential purposes as outlined in the Stage 4-5 development plan following demolition of the buildings and in accordance with a remedial action plan to address the contamination hotspots, remaining USTs and any unknown or unexpected contamination identified during the demolition and construction process.
Recommendations	Based on the investigation conclusions, it was considered that the site would be suitable for the proposed residential development on completion of the following recommendations: 1. Provide evidence of the successful removal and validation of UST's present at the former BP service station located at 4 – 6 Constitution Road, and the former Renown & Pearlite industrial site located at 8 – 14 Constitution Road. If no evidence of validation is available, further detailed investigation may be required to confirm the contamination status of the property, and its suitability for residential land use. 2. Preparation and implementation of a Remediation Action Plan to outline the removal of the Carcinogenic PAH exceedances identified within the northern and western corners of the site and any unexpected finds identified during construction.

Assessment Details	Project Tasks and Findings
	3. Any material being removed from site (including virgin excavated natural materials or VENM) be classified for off-site disposal in accordance the DECCW (2009) Waste Classification Guidelines. 4. Any material being imported to the site should be assessed for potential contamination in accordance with NSW EPA guidelines as being suitable for the intended use or be classified as VENM. 5. Validate that the excavated areas are left free of contamination by comparing analytical results for excavation surfaces and any backfill material, against the respective DECC/EPA thresholds. 6. Preparation of a final site validation report by a qualified environmental consultant, certifying site suitability for the proposed development.

In summary the previous investigations considered there was moderate potential for groundwater contamination particularly resulting from the presence of underground storage tanks (USTs) particularly on the former service station in Constitution Road and the manufacturing facilities where USTs were reported (Hoover and Renown). The investigations also detected soil contamination in the surficial soils but this did not represent widespread contamination that would prevent the development of the land.

The primary contaminants identified in the previous investigations include:

- Heavy metals resulting from the manufacture and distribution of white goods, corrosion of building fabric, vehicle and machinery maintenance, and general waste;
- Petroleum hydrocarbons from fuel storage and use;
- Polycyclic aromatic hydrocarbons (PAHs) from ash and asphaltic products;
- Volatile and semi volatile hydrocarbons used in the manufacturing and maintenance processes, and;
- Asbestos from building fabric, demolished buildings and vehicle brakes.

5 SITE HISTORY

5.1 LAND TITLES

Historical land titles searches were conducted in the staged contamination assessment reports (EI, 2013, 2014, 2014). The land title searches identified that the overall area was a mix of:

- Vacant land
- Residential properties, and
- Commercial/Industrial use.

The commercial/industrial use comprised a mixture of large manufacturing (such as Hoover Pty Ltd a large white goods manufacturer, & Automatic Totalisator Limited (ATL) a ticketing machine manufacturer) and smaller businesses including; a service station; car workshops; metal fabricators; timber, kitchen and clothing suppliers and company offices within the residential properties. Other utilities such as service roadways, substations and underground services also exist over the area.

5.2 HISTORICAL AERIAL PHOTOGRAPHY

Historical aerial photographs were reviewed as part of the staged assessments (EI, 2013 and EI, 2014) and in DP, (2010). A detailed summary of each lot was provided in Table 2 of the DP (2010) report. A summary of the relevant information is presented in ***Table 5-1***.

Table 5-1 Summary of Aerial Photograph Review

Aerial Photograph	General site development
March 1930 Run 4, Map 3424 B/W Commonwealth Australia Crown B/W	Primarily vacant land with some residential land use identified to the north east, south east and north west of the site with Parramatta River located to the south west of the site.
1943 Sydney 1943 Imagery http://maps.six.nsw.gov.au/ B/W	Land remains primarily unchanged from previous aerial with the exception of an increase in residential developments to the north east and the development of a large flat roofed commercial warehouse to the north east of the site which appears commercial in nature.
May 1951 Run 10, Map 468 – 92 B/W Lands Photo	Surrounding land has undergone significant development. Vacant land remains to the north west, with a large industrial property located to the north of the site. Land use to the north east and south east remains primarily residential. Construction of a large industrial type structure appears to be present at the south east boundary of the site, and is inclusive of the south east portion of site. This industrial development is considered to be the construction of the Hoover site, beyond which remains as vacant land. Parramatta river remains to the south west.

Aerial Photograph	General site development
1961 Run 31 Map 1050 Lands photo, Cumberland 1961 series NSW 5118 B/W	Vacant land remains to the north west, as does the large industrial property located to the north of the site. Land to the north east of the site has been developed for what appears to be commercial use, mixed with residential. Construction of a large industrial warehouse (Hoover) has been completed, with further construction of a large industrial type structure present beyond this hoover industrial warehouse. Parramatta river remains to the south west.
03 August 1986 Run 20, Map 115-162 Department of Lands NSW 3528 Colour, Scale 1:16,000	Surrounding land use appears to have changed significantly, with the demolition of the majority of residential properties, and the construction of multiple commercial / industrial type structures. Land present to the north west remains primarily vacant however has increased in size suggesting that this section of land has been reclaimed. Construction of a large commercial type warehouse structure has occurred, and is located directly at the north, north western boundary of the site. An increase in commercial type warehouses is present to the north east with no residential structures remaining. Land use to the south east remains primarily unchanged from the previous aerial, with Parramatta River present to the south west.
4 May 1999 Run 2, Map 10-29 Land and Property Information NSW 4702 Colour, Scale 1:12,000	Surrounding land use appears remain primarily unchanged from the previous aerial, with the exception of the construction of an industrial type warehouse to the far north of the site.
10 December 2005 Run 9, Map 246-259 Department of Lands NSW4937 Colour, Scale 1:25,000	Surrounding land use remains relatively unchanged from the previous aerial, with the exception of the demolition of commercial / industrial structures that were present to the south east of the site. This area now appears as vacant land.

5.3 WORKCOVER NSW AUTHORITY SEARCH

A search of WorkCover NSW Authority records relating to the sites was undertaken by EI in the individual Concept Area stages, on behalf of the client. Information provided by the Dangerous Goods Licensing Section for Stage 2-3 and 4-5 is summarised in in ***Table 5-2*** below. The potential for dangerous good (USTs etc.) to be present on the Stage 1 area is minimal as most of the site has been excavated to sandstone bedrock.

Table 5-2 Summary of WorkCover Records (Stages 2-3 and 4-5)

Licence Holder / Premises	Type of Infrastructure	Goods Stored	Size	Location of storage	Status
Stage 2-3 Shepherds Bay Urban Renewal Project					
H.T. Chapman Pty Ltd, 9 Rothesay Avenue, Ryde, NSW 2112	Underground Tank	Flammable Liquids	5,000 L	Unknown	Unknown
J.R. Dummett & Co. Pty Ltd, 11 Rothesay Avenue, Ryde, NSW	Underground Tank	Petroleum	5,000 L	South western boundary of site	In Situ

Licence Holder / Premises	Type of Infrastructure	Goods Stored	Size	Location of storage	Status
Ryde Speedy Couriers Pty Ltd, 8 Nancarrow Avenue, Ryde NSW	Underground Tank	Inflammable Liquid – Mineral Spirit	21,040 L	Central portion of site	Removed
Hoover Australia Pty Ltd. 41 – 45 Belmore Street, Meadowbank NSW	Roofed	Flammable Liquids	20,000 L	Paint store area, north eastern boundary of site	Removed
	Roofed	Flammable Liquids	10,000 L	Paint store area, north eastern boundary of site	Removed
	Underground Tank	Flammable Liquids	5,000 L	South western corner of brick warehouse	Removed
	Flammable Liquid Cupboard	Sodium Nitrate Class 5	250 L	Paint store area, north eastern boundary of site	Removed
Stage 4-5 Shepherds Bay Urban Renewal Project					
Renown & Pearlite Pty Ltd 8 – 14 Constitution Road, Ryde NSW 2112	Decanting Cylinders	Liquefied Petroleum Gas (LPG)	2 x 190 kg	Central portion of the site	Removed
	External Roofed Store	Glossalin Ink	5,000 L	South eastern portion of the site	Removed
	Internal Roofed Store	Glossalin Ink / Ethanol Solution	5,000 L	Central portion of the site	Removed
	Underground Tank	Ethanol Solution	5,000 L	Central portion of the site	Removed
	Underground Tank	Ethanol Solution	5,000 L	Central portion of the site	Removed
	Underground Tank	Unleaded Petrol	10,000 L	North eastern corner of the site, parallel with Constitution Road	Removed
BP Ryde, 4 – 6 Constitution Road, Ryde NSW 2112	Underground Tank	Motor Spirit	30,000 L	Southern corner of the site	Removed
	Underground Tank	Motor Spirit	30,000 L	Southern corner of the site	Removed
	Underground Tank	Motor Spirit	15,000 L	Southern corner of the site	Removed
Addlon Trading Company Pty Ltd, 8-10 Constitution Road, Ryde, NSW	Decanting Cylinders	Liquefied Petroleum Gas (LPG)	190 kg	Southern boundary of site	Removed

While the majority of the tanks have been removed from the various sites, limited information is available on their removal, presence of contamination, backfilling and validation in compliance with existing UPSS regulations.

Workcover searches on the other Stages 6 – 10 of the Shepherds Bay Urban Renewal project are currently in progress. During the searches process it was also identified that the main Sydney to Newcastle fuel pipeline from Caltex Banksmeadow and Shell Clyde runs along the foreshore of the proposed Shepherds Bay Urban Renewal project.

5.4 HAZARDOUS CHEMICALS AND REGULATORY COMPLIANCE

A search of the *Contaminated Land – Record of EPA Notices* database maintained by the NSW EPA indicated no involvements or regulations under Section 58 of the *Contaminated Land Management Act 1997* for properties located in the Shepherds Bay Urban Renewal project.

The only EPA notified site (http://www.epa.nsw.gov.au/clm/publiclist.htm) in the Shepherds Bay area was the Former Council Works Depot located at 2 Parsonage Street Meadowbank and based on the information made available to the EPA to date, the contamination at this site the EPA did not consider it to be not significant enough to warrant regulatory intervention under the *Contaminated Land Management Act*.

6 PRELIMINARY CONCEPTUAL SITE MODEL

In accordance with the *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (Amendment 2013) Schedule B2 – Guideline on Site Characterisation* (NEPM 2013), and to aid in the assessment of data collection for the site, EI has developed a preliminary conceptual site model (CSM) with an assessment of plausible pollutant linkages whereby a source of contamination can migrate along a given pathway and have an effect on a particular receptor. The CSM provides a framework to allow for the review of any information collected to ascertain the reliability and useability of the data collected, and to identify any gaps in field investigations.

A site conceptual model (SCM) was developed based on a review of the groundwater well installation and sampling (EI, 2013) and results of this investigation to allow assessment of potential sources of impact, chemicals of concern, exposure pathways and receptors.

For a potential risk to be present at a site, the following components are required:

- A source (e.g. primary sources such as leaking fuel tanks; secondary sources such as impacted soils/groundwater).
- A receptor (e.g. on-site worker, resident, off-site resident, water resources).
- A pathway between the source and receptor (e.g. vapour migration, groundwater migration).

If a source, a receptor and a pathway are all present, then a complete exposure pathway exists. The objective of the qualitative risk assessment is to identify any actual or potentially complete exposure pathways and comment on their significance.

6.1 SUBSURFACE CONDITIONS

The general slope of the concept area is toward the Parramatta River and Shepherds Bay, with stormwater draining via the stormwater easements and the municipal stormwater system. There are two topographical elements within the overall Shepherds Bay Concept plan area with the western third of the site in an overall drainage depression which drains areas to the north of the Constitution Road and the eastern area a broad sandstone ridge where drainage follows general slope.

The western third of the site comprises alluvial or deeper residual soil material overlying the Hawkesbury Sandstone at 3.5 to 6 m BGL and has been cut and filled to form the various commercial premises. Hawkesbury Sandstone is visible in the cut on the eastern boundary of the old ATL factory. Some estuarine sediments (including potential acid sulfate soils) may also be present on the foreshore (GW104).

In the eastern part of the site Hawkesbury Sandstone is encountered at shallow depths (0 to 1.95 m BGL) or is visible in the various cuttings (e.g. the excavation for Stage 1 on Rothesay Street, see Plate 1). Some

Mittagong Formation shales and siltstone may be present in the north-east of the concept area (Monitoring Well GW110).

Some filling was observed in the area drainage line (up to 3 m thick), but was generally thinner in the eastern part of the site (0 to 1.3 m thick).

Groundwater is likely to be present in the surficial soils during wet weather, in the alluvial/residual soils in the western drainage depression and within the fractures and bedding planes of the Hawkesbury Sandstone. The overall groundwater flow would be toward Shepherds Bay generally in the direction of the local topography.

6.2 POTENTIAL SOURCES OF IMPACT

Potential contaminants associated with the site use include; TPH, BTEX, PAHs, possible solvents (from white good manufacturing and maintenance and container printing) and heavy metals, asbestos and potential sources of impacts identified over the concept area include potential impacted soils and groundwater from leaks and spills from petroleum and chemical storage-related infrastructure including underground tanks, product lines, bowsers, fill points, above ground tanks and waste pits.

The results of the previous investigations and this groundwater assessment indicate that widespread soil and groundwater contamination was not present at the site. However, localised areas of impacted soil and groundwater may be present in the vicinity of fuel/chemical storage infrastructure.

6.3 POTENTIAL RECEPTORS

Anticipated receptors for contaminants in soil and groundwater are:

- Construction workers on the site during redevelopment works.
- Future commercial and residential uses/occupants of the proposed development.
- Users of surrounding residential properties, (generally considered up gradient from the concept area).
- Ecological systems and users of Parramatta River/Shepherds Bay on the southern boundary of the site.

6.4 POTENTIAL PATHWAYS

Based on the results of this investigation, potential exposure pathways to impacted soil and groundwater include:

- Dermal contact during any future construction works at the site.
- Inhalation of vapours that migrate from soil and/or groundwater to the surface or into excavations on, or in the vicinity of the site.
- Groundwater migration into basement areas, off site, or discharge to surface water receptors.

6.5 POTENTIALLY COMPLETE EXPOSURE PATHWAYS

The results of the previous ESAs suggest that soil and groundwater impacts are localised in areas of fuel infrastructure and within the shallow soils (including fill), therefore the main exposure pathway is to construction workers during any redevelopment or construction works on the site.

The low concentrations of contaminants detected in the soils and groundwater suggest that migration of vapours is unlikely to pose a risk to current or future commercial/industrial or residential site users. Offsite migration of groundwater impacts is also considered low risk due to the geology and low concentrations of contaminants detected in groundwater. Therefore the risk to on and off-site receptors, including residential land users and surface water bodies, is considered to be low.

7 SAMPLING, ANALYTICAL AND QUALITY PLAN (SAQP)

The SAQP plays a crucial role in ensuring that the data collected as part of this, and ongoing environmental works carried out at the site are representative, and provide a robust basis for site assessment decisions. This SAQP includes the following:

- Data quality objectives, including a summary of the objectives of the ESA;
- Investigation methodology including media to be sampled, details of analytes and parameters to be monitored and a description of intended sampling points;
- Sampling methods and procedures;
- Field screening methods;
- Analysis Methods;
- Sample handling, preservation and storage; and
- Analytical QA/QC.

7.1 DATA QUALITY OBJECTIVES (DQO)

The scope of the ESA works has been devised broadly in accordance with the following Data Quality Objective (DQO) process, as defined in NSW Environmental Protection Agency (EPA) *Guidelines for the NSW Site Auditor Scheme (2nd Edition), 2006 (*NSW Auditor Scheme 2006) and the Australian Standard "Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-volatile and semi-volatile compounds" (AS 4482.1 – 2005). The DQO process for the ESA is outlined in the following sections.

7.1.1 State the Problem

The site (Shepherds Bay Concept Plan area) is required to be suitable for medium to high density residential and open space land use. The Concept Plan approval requires the preparation of a groundwater report to assess the overall groundwater quality in the area of the concept plan (Clause 39) and to make recommendations as to further groundwater testing at the development application for each stage (Clause 40). This investigation will therefore need to assess the groundwater at the site to ensure they are suitable for the intended land use by evaluating the potential for site contamination on the basis of historic land uses, anecdotal and documentary evidence of possible pollutant sources. This investigation concentrates on potential contamination within groundwater present at the site by means of intrusive sampling and laboratory analysis for relevant contaminants. A sampling and analysis plan is required in order to assess the sites suitability for the intended development of residential and open space land use. This ESA summarises the historic land uses and potentially contaminating activities, as well as providing a preliminary assessment of the contamination status of the site.

7.1.2 Identify the Decision

The completeness of the ESA works will therefore be determined by the findings of the report, ensuring that historic land uses and potentially contaminating activities that may have occurred at the site do not currently present a risk of harm to human health or the environment for residential purposes.

The completeness of the ESA will therefore be determined by the identification of potentially contaminating activities which have occurred from historic land uses and likely migration routes, and the interpretation of soil analytical results when compared to the relevant medium density residential site assessment criteria for groundwater.

The required decisions are therefore related to answering the following two questions:

- Is the groundwater quality suitable for the proposed land use and downgradient surface water receptors?
- Is further investigation required to characterise the groundwater quality?
- Will site groundwater require further remediation and/or special management before the site can be used for residential purposes?

7.1.3 Identify Inputs to the Decision

Inputs to the decision will include:

- The collection of groundwater samples (including physico-chemical parameters);
- Logging of the geological profile;
- laboratory analysis of selected soil samples for relevant analytical parameters as defined from the site history and field observations; and
- assessment of analytical results in relation to the adopted health based and environmental screening levels, being the HILB , HSLs and EIL/ESLs of the NEPM 2013;

7.1.4 Define the Boundary of the Assessment

The spatial boundaries of the site were limited to:

- **Lateral** - the geographical boundary of the assessment was defined by the site boundary, as illustrated in **Figure 2**.and **Figure 3**.
- **Vertical** - from the existing ground level to the underlying fractured and bedded sandstone; and
- **Temporal** – This investigation provides a snapshot of the groundwater condition at the site. It does not take into account activities taking place on-site or on the immediately adjacent properties that may compromise the current environmental conditions on site.

7.1.5 Develop a Decision Rule

Laboratory test results will be assessed against the adopted criteria for soils. Should the adopted criteria be exceeded then additional investigations may be required to delineate vertical and lateral extent of contamination. Laboratory test results will be accepted if:

- all contracted laboratories are accredited by NATA for the analyses undertaken;
- all detection limits fall below the adopted criteria;
- analyte concentrations in rinsate (i.e. blank) samples do not vary significantly from concentrations in the distilled water used for equipment rinsing;
- RPDs for duplicate samples are within accepted limits; and
- Laboratory QA/QC protocols and results comply with NEPM requirements.

The data acceptance criteria for Field Quality Control and Laboratory Quality Control samples tested for the identified chemicals of concern are detailed in Table 9-4**.**

7.1.6 Specify Acceptable Limits on Decision Errors

Determination of possible concentration ranges:

Previous investigations (Stage 1, EI, 2013) indicate relatively low level of groundwater contamination.

Identifying the Decision Errors:

Considering that future site redevelopment will involve a residential development, EI has determined that the two decision errors for each respective COC are:

a) deciding that site groundwater exceed the GILs when they truly do not; and

b) deciding that site groundwater are within the GILs when they truly are not.

Evaluating the potential consequences of each decision error:

The consequences of deciding that the groundwater exceed the GILs when they truly do not, will be that additional soil investigations will need to be carried out and/or remediation of affected site groundwater, which will add cost and time delays to the project.

The consequences of deciding that the groundwater do not exceed the GILs when they truly do, will be that contaminated groundwater will be left unmanaged, on the site and potentially endanger human health or pose ongoing risks to the environment. In addition, the future owners of the site may be liable for future damages and environmental clean-up costs.

Evaluating Severity of Decision Error Consequences:

EI concluded that the consequences of deciding that the groundwater do not exceed the GILs when they truly do, would be more severe near the action level since the risk of jeopardising human health and the environment outweigh the consequences of having to pay more for further investigation and/or remediation of affected groundwater.

Definition of the Null Hypothesis:

For groundwater remaining on the site and for each respective COC, the baseline condition or null hypothesis (H_o) is "the groundwater exceed the GILs". The alternative hypothesis (H_a) is "the groundwater are within the GILs".

The *false positive* decision error occurs when the null hypothesis is rejected when it is true. For groundwater to remain on the site, the *false positive* decision error occurs when the decision maker decides the soil is within the GILs for the respective COC when it truly exceeds the GILs.

The *false negative* decision error occurs when the null hypothesis is not rejected when it is false. For groundwater remaining on the site, the *false negative* decision error occurs when the decision maker decides the soil exceeds the GILs for the respective COC when it truly is within the GILs.

Decision Error Limits:

Errors that increase the probability of not carrying out additional soil investigations and/or remediation of affected groundwater when that action is truly required (i.e. false positive decision errors) will be considered acceptable 10% of the time for each respective COC. Errors that increase the probability of carrying out additional soil investigations and/or remediation of affected groundwater when that action is not required (i.e. false negative decision errors) will be considered acceptable 10% of the time for each respective COC.

7.1.7 Optimise the Design for Obtaining Data

Soil sampling procedures that would be implemented to optimise data collection for achieving the DQOs included the following:

- compare the results with the previous groundwater monitoring wells; and
- assess the depth of groundwater wells in relation to the subsurface profile.

7.2 DATA QUALITY INDICATORS

To ensure the data collected as part of the ESA was of quality, the following data quality assurance procedures were adopted, as presented in **Table 7-1** below. An assessment of the data quality indicators (DQI) relating to both field and laboratory procedures shall be carried out, with the details of the assessment presented in **Table 7-2** below.

Table 7-1 Data Quality Assurance Procedures

Item	Objectives
Environmental Consultant	Work would be undertaken by appropriately qualified and experienced personnel to an approved quality management system.
Sample handling and Storage	Work should be undertaken general in accordance with field procedures based on industry accepted standard practice and in accordance with: ▪ Australian Standard AS4482.1 (2005) Guide to the investigation and sampling of sites with potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds; ▪ Australian / New Zealand Standard AS/NZS 5667.11 (1998) Guidance on sampling of groundwater; ▪ National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013, National Environment Protection Council, May 2013.
Transport	Samples would be stored in an ice brick-cooled esky and transported to the laboratory. To ensure the integrity of the samples from collection to receipt by the analytical laboratory, samples will be sent to the laboratories under "chain of custody" (CoC) describing sample preservation and transport duration. One trip blank per sample batch sent to laboratory. Results for trip blanks should all be non-detected.
Volatile losses	One spiked sample should be analysed per batch for groundwater. Volatile losses should be less than 10 percent in the trip spike.
QA samples	Field and laboratory QA samples will be analysed as follows: ▪ intra-laboratory duplicate samples at a rate of 1 in 10 primary samples ▪ inter-laboratory duplicate samples at a rate of 1 in 20 primary samples. Field and Laboratory acceptable limits are between 30–50% RPD as stated by AS 4482.1–2005. Non-compliance is to be documented in the report and sample to be re-analysed or higher level to be conservatively adopted.
Laboratory analyses	The selected laboratories would comply with the respective ISO 9001 quality assurance programs, be NATA registered for the analysis to be undertaken and perform their own internal QA/QC programs, and would use appropriate detection limits for the analyses to be undertaken.
Laboratory Quality Control – Duplicates, spikes, blanks and surrogates – Acceptable Limits	Primary laboratory QA/QC acceptance limits are expected to be as follows: ▪ surrogates: 70% to 130% recovery ▪ matrix Spikes: 70% to 130% recovery for organics or 80%-120% recovery for inorganics ▪ control Samples: 70% to 130% recovery for soil or 80% to 120% recovery for waters ▪ duplicate Samples: <4PQL - +/- 2PQL, 4-10PQL – 0.-25 or 50%RPD, >10PQL – 0-10 or 30%RPD ▪ method Blanks: zero to <PQL.

Table 7-2 Data Quality Indicators (NSW DEC, 2005)

QA/QC Measures	Data Quality Indicators
Precision - A quantitative measure of the variability (or reproducibility) of data	Performance of blind field duplicate sample sets, through calculation of relative percentage differences (RPD); and The RPDs will be assessed as acceptable if less than 30%. RPDs that exceed this range may be considered where: Results are less than 10 times the limits of reporting (LOR); Results are less than 20 times the LOR and the RPD is less than 50%; or Heterogeneous materials or volatile compounds are encountered.
Accuracy - A quantitative measure of the closeness of reported data to the "true" value	Method blanks, which are analysed for the analytes targeted in the primary samples; Matrix spike and matrix spike duplicate sample sets; and Laboratory control samples.
Representativeness - The confidence (expressed qualitatively) that data are representative of each medium present on Site	To ensure the data produced by the laboratory is representative of conditions encountered in the field, the following steps are taken by the laboratory: Blank samples will be run in parallel with field samples to confirm there are no unacceptable instances of laboratory artefacts; Review of relative percentage differences (RPD) values for field and laboratory duplicates to provide an indication that the samples are generally homogeneous, with no unacceptable instances of significant sample matrix heterogeneities; and The appropriateness of collection methodologies, handling, storage and preservation techniques will be assessed to ensure/confirm there was minimal opportunity for sample interference or degradation (i.e. volatile loss during transport due to incorrect preservation / transport methods).
Completeness - A measure of the amount of useable data from a data collection activity	In validating the degree of completeness of the analytical data sets acquired during the program the following is considered: Whether standard operating procedures (SOPs) for sampling protocols have been adhered to; and Copies of all COC documentation are reviewed and presented. It can therefore be considered whether the proportion of "useable data" generated in the data collection activities is sufficient for the purposes of the land use assessment.
Comparability - The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event.	Given that a reported data set can comprise several data sets from separate sampling episodes, issues of comparability between data sets are reduced through adherence to Standard Operating Procedures (SOPs) and regulator-endorsed or published guidelines and standards on each data gathering activity. In addition the data will be collected by experienced samplers and NATA-accredited laboratory methodologies will be employed in all laboratory testing programs.

8 ASSESSMENT METHODOLOGY

8.1 GROUNDWATER INVESTIGATION SUMMARY

Details of the groundwater investigation are summarised in ***Table 8-1***. The detailed borehole logs and presented in ***Appendix*** C and the groundwater field data sheets are presented in ***Appendix D***. The locations of groundwater monitoring wells were consistent with the planned sampling rationale and are shown in **Figure 2**.

Table 8-1 Sampling Methodology

Activity/Item	Details
Date of Field Work	Drilled 30 Oct 2013 – 1 November 2013 (GW101 – GW 113), GW114 20 November 2013
Soil Sampling	No soil samples were collected during this round of groundwater monitoring well installation.
Well Construction	Fourteen (14) groundwater monitoring wells were installed late 2013 as follows: • 3 onsite wells to 9m drilled with air hammer (GW101, 102, 107); • 4 onsite wells drilled to 11.7 – 12.1 m using TC bit the NMLC coring (GW104, 108, 110, 114) • 7 onsite wells drilled to 9 m using a TC auger bit (GW103, 105, 106, 109, 111, 112, 113). All monitoring wells were drilled by Traccess & Terratest using a truck-mounted drill rig, with augers, air hammer or NMLC coring (as above) and well construction details were documented by EI's field environmental scientist in the bore logs presented in **Appendix C**. The relative locations of the groundwater monitoring wells are illustrated in **Figure 3**. Well construction was carried out in general accordance with the standards described in NUDLC, 2012 and details are shown on the borelogs in **Appendix C**. The monitoring wells were constructed as follows: • 50 mm, Class 18 uPVC threaded, machine-slotted screen and casing, with slotted intervals in shallow wells set to screen to at least 500 mm above the standing water level to allow sampling of free-phase product, if present; • base and top of each well was sealed with a UPVC cap; • graded sand filter was used within bore annulus to approximately 300mm above top of screen interval; • granular bentonite was applied above annular sand filter to seal the screened interval and drill cuttings were used to backfill the bore annulus to just below ground level; and • surface completion for the wells was undertaken as per the logs. Any stickup is noted on the borelogs.
Well Development	Well development was conducted for each well directly following installation. This involved well agitation using a dedicated, HDPE, disposable bailer, followed by removal of water and accumulated sediment using a 12V, HDPE submersible bore pump (*Proactive Environmental*, model *Super Twister*). Pumping removed between 2 and 3 well volumes.
Well Survey	Groundwater monitoring wells have not being surveyed due to the wide spread nature of the wells. The reduced levels were estimated from the detailed survey by H.Ramsay & Co.
Well Gauging	The depth to groundwater (standing water level, SWL) was measured at each well after development and prior to purging. Monitoring wells were gauged for depth to groundwater and a transparent HDPE bailer was used to visually assess the presence of phase separated hydrocarbons (PSH) prior to the commencement of well purging. Measured depth to groundwater in the monitoring wells is discussed in **Section 10.2**. No PSH was detected within any of the wells.

Activity/Item	Details
Well Purging & field testing	Well purging and sampling of the groundwater monitoring wells was undertaken on 28 November to the 2 December 2014 using a pump with a dedicated HDPE bailer for each well. Measurement of water quality parameters was conducted during well purging, which was continued until water quality parameters stabilised. For each monitoring well, groundwater was initially observed to be slightly turbid to turbid with suspended sediments though suspended matter reduced and water became colourless during purging. Minor odours were noted on in GW109. Field measurements for Dissolved Oxygen (DO), Electrical Conductivity (EC) and pH of the purged water were recorded during bore purging. The purged volume removed from each well and field test results are detailed in ***Appendix D***
Groundwater sampling	Following purging and measurement of physico-chemical measurements. Groundwater samples were then collected by low flow pump directly to laboratory-prepared containers.
Decontamination Procedure	Decontamination was not required on most sampling equipment as it was dedicated to each individual well. The water level probe and water quality kit probes were washed in a solution of potable water and Decon 90 and then rinsed with potable water between measurements.
Sample Preservation	Sample containers were supplied by the laboratory with the following preservatives: • one, 1 litre amber glass, acid-washed and solvent-rinsed bottle; • two, 40ml glass vials, pre-preserved with dilute hydrochloric acid, Teflon-sealed; and • one, 250mL, HDPE bottle, pre-preserved with dilute nitric acid (1 mL). Samples for metals analysis were field-filtered using 0.45 µm pore-size filters. All containers were filled with sample to the brim then capped and stored in ice-filled chests on-site and during transit to the laboratory.
Sample Transport	After sampling, refrigerated sample chests were transported to SGS Australia Pty Ltd using strict Chain-of-Custody (COC) procedures. Inter-laboratory duplicate (ILD) samples were forwarded to Envirolab Services Pty Ltd (Envirolab) for inter-laboratory QA/QC analysis. A Sample Receipt Advice (SRA) was provided by each laboratory to document sample condition upon receipt. Copies of SRA and COC certificates are presented in ***Appendix E***.

9 DATA QUALITY ASSESSMENT

9.1 QUALITY ASSURANCE PROGRAMME

In order to satisfy the objectives of the environmental site assessment (ESA) works, Environmental Investigations (EI) implemented a quality assurance programme, including:

- The use of appropriately qualified / trained Environmental professional staff with over ten years of continuous relevant experience in the assessment and management of contaminated sites, to carry out the environmental site assessment investigation works;
- Calibration of equipment prior to application on site and recording the results of the calibration in appropriate site documentation.
- Appropriate storage (esky and ice bricks) and handling of quality control (QC) samples received from the laboratories for use on site, prior to and during ESA investigation works;
- Undertaking appropriate equipment decontamination and use of a new pair of nitrile gloves by site personnel prior to the collection of each soil sample directly from the push tube liner or drill rig auger;
- Use of a cooler with ice to store collected samples prior to and during transport to the laboratories;
- The collection and analysis of field quality control samples during the ESA investigation works;
- The use of chain of custody (CoC) procedures to ensure the traceability of sample transport and handling; and
- The use of laboratories accredited by the National Association of Testing Authorities (NATA) for the analysis of soil samples collected during the monitoring well installation works.

9.2 ADOPTED ASSESSMENT CRITERIA

The Groundwater Investigation Levels (GILs) that would be used as the action levels for the assessment are summarised in **Table 9-1**. Analytical methods have been selected to be relevant for the selected GILs with respect to contaminant detection limits.

The Groundwater Investigation Levels (GILs) that would be used as the action levels for the assessment were the:

- NEPM (2013) – Groundwater Health Screening Levels (HSLs) for vapour intrusion (for TPHs F1 and F2, BTEX and Naphthalene);
- NEPM (2013) – Groundwater Health-Based Investigation Levels (GIL) for fresh and marine waters in line with the ANZECC (2000);

Table 9-1 Summary of Groundwater Investigation Levels (GILs)

ANALYTE	Units	Freshwater Criteria	Marine Water Criteria	ANALYTE	Units	Freshwater Criteria	Marine Water Criteria
HEAVY METALS				***OPPs***			
Antimony	µg/L	30 [1]	20 [3]	Azinphos Methyl	µg/L	0.02	NR
Arsenic	µg/L	24	50 [1]	Chloropyrifos	µg/L	0.01	0.009
Beryllium	µg/L	4 [1]	NR	Diazinon	µg/L	0.01	NR
Cadmium	µg/L	0.2	5.5	Dimethoate	µg/L	0.15	NR
Chromium III	µg/L	* 10 [1]	27.4	Fenitrothion	µg/L	0.2	NR
Chromium VI	µg/L	1.0	4.4	Malathion	µg/L	0.05	NR
Cobalt	µg/L	100 [3]	1	Parathion	µg/L	0.004	NR
Copper	µg/L	1.4	1.3	Temephos	µg/L	NR	0.05
Lead	µg/L	3.4	4.4	***OCPs***			
Mercury	µg/L	0.6	0.4	Aldrin	µg/L	0.001 [1]	0.001 [2]
Molybdenum	µg/L	300 [3]	300 [3]	Chlordane	µg/L	0.0004 [1]	0.0004 [2]
Nickel	µg/L	11	70	DDT	µg/L	0.01	0.0001 [2]
Selenium	µg/L	11	70 [1]	Dieldrin	µg/L	0.0002 [1]	0.0002 [1]
Silver	µg/L	0.05	1.4	Endosulfan	µg/L	0.2	0.01
Tin (inorganic)	µg/L	NR	NR	Endrin	µg/L	0.02	0.01
Tributyltin	µg/L	0.008 [1]	0.006	Heptachlor	µg/L	0.09	0.001 [2]
Vanadium	µg/L	NR	100	Lindane	µg/L	0.2	NR
Zinc	µg/L	8.0	15	Toxaphene	µg/L	0.2	NR
TPHs				***PCBs***			
C_6 - C_9	µg/L	NR	NR	Total PCBs	µg/L	0.001 [1]	0.004 [2]
C_{10} - C_{14}	µg/L	Total 600 [3]	Total 600 [3]	Aroclor 1242	µg/L	0.6	NR
C_{15} - C_{28}	µg/L			Aroclor 1254	µg/L	0.03	NR
C_{29} - C_{36}	µg/L						
BTEX				***Phenolics***			
Benzene	µg/L	950	700	Phenol	µg/L	320	400
Toluene	µg/L	300 [1]	1000 [3]	2-chlorophenol	µg/L	490	NR
Ethyl benzene	µg/L	150 [3]	150 [3]	4-chlorophenol	µg/L	220	NR
Total Xylenes	µg/L	** 550	70 [3]	2, 4-dichlorophenol	µg/L	160	NR
PAHs				2, 4, 6-trichlorophenol	µg/L	20	NR
Total PAHs	µg/L	3.0 [1]	3.0 [2]	2,3,4,6-tetrachlorophenol	µg/L	20	NR
Naphthalene	µg/L	16	70	Pentachlorophenol	µg/L	10	22
Benzo(a)pyrene	µg/L	0.05 [3]	0.05 [3]	2, 4-dinitrophenol	µg/L	45	NR

Notes: NR = no currently available published criteria.

Freshwater Criteria are ANZECC/ARMCANZ (2000) 95% Freshwater Trigger values, unless otherwise indicated.

Marine Criteria are ANZECC/ARMCANZ (2000) 95% Marine Trigger values, unless otherwise indicated.

* = ANZECC/ARMCANZ (2000) provides no current freshwater trigger value for Cr III. NEPC (1999) GIL Total Chromium is 10 mg/L.

** = ANZECC/ARMCANZ (2000) freshwater trigger value for o-xylene is 350 mg/L + for p-xylene is 200 mg/L.

1 = NEPC (1999) Groundwater Investigation Levels for the protection of freshwater aquatic ecosystems, NEPM.

2 = NEPC (1999) Groundwater Investigation Levels for the protection of marine aquatic ecosystems, NEPM.

3 = Dutch (2000) Groundwater Intervention Values (level at which groundwater remediation is required, The Netherlands).

Table 9-2 Summary of Groundwater Investigation Levels (GILs) (cont.)

ANALYTE	Units	Freshwater Criteria	Marine Water Criteria	ANALYTE	Units	Freshwater Criteria	Marine Water Criteria
CHCs (in SVOCs)				***VOCs***			
Chlorinated Benzenes	µg/L	0.007 - 15.0 [1]	NR	Aniline	µg/L	250	NR
1, 2-dichlorobenzene	µg/L	160	NR	2, 4-dichloroaniline	µg/L	7	NR
1, 3-dichlorobenzene	µg/L	260	NR	3, 4-dichloroaniline	µg/L	3	150
1, 4-dichlorobenzene	µg/L	60	NR	Nitrobenzene	µg/L	550	NR
1, 2, 3-trichlorobenzene	µg/L	10	NR	2, 4-dinitrotoluene	µg/L	65	NR
1, 2, 4-trichlorobenzene	µg/L	170	80	2, 4, 6-trinitrotoluene	µg/L	140	NR
Hexachlorobutadeine	µg/L	0.1 [1]	0.3 [2]	*Miscellaneous*			
1,1,2-trichloroethane	µg/L	6500	1900	Total Cyanide	mg/L	7	4
Hexachloroethane	µg/L	360	NR	Fluoride	mg/L	NR	NR

Notes: NR = no currently available published criteria.

Freshwater Criteria are ANZECC/ARMCANZ (2000) 95% Freshwater Trigger values, unless otherwise indicated.

Marine Criteria are ANZECC/ARMCANZ (2000) 95% Marine Trigger values, unless otherwise indicated.

* = ANZECC/ARMCANZ (2000) provides no current freshwater trigger value for Cr III. NEPC (1999) GIL Total Chromium is 10 mg/L.

** = ANZECC/ARMCANZ (2000) freshwater trigger value for o-xylene is 350 mg/L + for p-xylene is 200 mg/L.

1 = NEPC (1999) Groundwater Investigation Levels for the protection of freshwater aquatic ecosystems, NEPM.

2 = NEPC (1999) Groundwater Investigation Levels for the protection of marine aquatic ecosystems, NEPM.

3 = Dutch (2000) Groundwater Intervention Values (level at which groundwater remediation is required, The Netherlands).

9.3 QUALITY CONTROL PROGRAM

For the purpose of assessing the quality of data presented in this ESA, EI collected field QC samples for analysis. The primary laboratory, SGS Australia Pty Ltd (SGS) and secondary laboratory, Envirolab Services Pty Ltd (Envirolab) also prepared and analysed QC samples. Details of the field and laboratory QC samples are provided in **Table 9-4,** with the allowable acceptance ranges for the data presented in **Table 9-2** below.

Table 9-3 Sampling Methodology

Data Quality Objective	Data Quality Indicator	Acceptable Range
Accuracy	Field – Trip spike (laboratory prepared) Laboratory – Laboratory control spike and matrix spike	70 – 130 % recovery Prescribed by the laboratories
Precision	Field – Blind replicate and spilt duplicate Laboratory – Laboratory duplicate and matrix spike duplicate	< 30 % relative percentage difference (RPD [%]) Prescribed by the laboratories
Representativeness	Field – Trip blank (laboratory prepared) Laboratory – Method blank	< laboratory limit of reporting (LOR) Prescribed by the laboratories
Completeness	Completion (%)	-

Calculation of Relative Percentage Difference (RPD)

The RPD values were calculated using the following equation:

$$RPD = \frac{\frac{([C_O - C_R] \times 100)}{(C_O + C_R)}}{2}$$

C_O = Concentration obtained from the primary sample.

C_R = Concentration obtained from the blind replicate or split sample.

Calculation of Spike Recovery

The trip spike sample recovery values were calculated using the following equation:

$$\frac{X}{T} \times 100\ \%$$

X = Observed value of measurement.

T = True value.

9.3.1 Field QA/QC Data Evaluation

The field quality assurance/quality control (QA/QC) samples collected during the ESA works were as follows:

- Blind field duplicate;

- Inter laboratory duplicate;
- Trip blank;
- Trip spike; and
- Rinsate Blank.

The results of the QA/QC samples including the calculated RPD values are presented in **Table 9-2.**

Blind Field Duplicate

One (1) blind field duplicate (BFD) sample, being sample GWB-1, was collected from the primary sample GW1-1 (EI, 2013) and during this investigation GW104-1. The preparation of the BFD sample was similar in both instances. The duplicate sample was then presented blind to the primary laboratory (SGS) to avoid any potential analytical bias. The BFD was analysed for TPH, BTEX and selected heavy metals with the RPD values calculated found to be within the Data Acceptance Criteria (***Table 9-4***), indicating that the samples collected were representative of the soils present at the respective sampling locations.

Inter Laboratory Duplicate

One (1) inter laboratory duplicate (ILD) sample, being sample GWI-1, was collected from the primary sample GW1-1 (EI, 2013) and GW104-1 this investigation. The RPD values calculated for the ILD sample were found to be within the Data Acceptance Criteria (***Table 9-4***), with the exception of the following:

- Nickel (RPD 66.7%);

The minor RPD exceedances identified within the indicating that the RPDs for the samples were found to be higher than the expected range for groundwater, however, was close to the primary duplicate value. Therefore, EI concluded that that the samples collected were representative of the soils present at the respective sampling locations.

Trip Blank/Trip Spike

No trip blank (TB) sample / trip spike sample (TS) was analysed during this round of sampling.

Assessment of Field QA/QC Data

All groundwater samples were classified in the field with respect physico-chemical parameters and any observable signs of contamination based on visual and odour assessment. The field parameters were to acceptable trends for each well analysed.

All samples, including field QC samples, were transported to the primary and secondary laboratories under strict Chain-of-Custody conditions and appropriate copies of relevant documentation were included in the respective reports.

The overall completeness of documentation produced under the field program of the subject assessment was considered to be adequate for the purposes of drawing valid conclusions regarding the environmental condition of the site.

Based on the results of the field QA/QC data, EI considered the field QA/QC programme carried out during the ESA works to be appropriate and the results to be acceptable.

9.3.2 Laboratory QA/QC Data Evaluation

Details of the laboratory QA/QC data is provided in the *Laboratory Analytical Reports* (**Appendix G***)*. As part of their NATA accreditation, the primary and secondary laboratories carried out a comprehensive QA/QC assessment.

EI note that soil samples were analysed within the holding times prescribed by the laboratories.

The laboratory QA/QC samples collected during the ESA works were as follows:

- Laboratory duplicate (DUP);
- Method blank (MB);
- Laboratory control spike (LCS);
- Matrix spike (MS); and
- Matrix spike duplicate (MSD).

No QC outliers were reported by the primary or secondary laboratories.

9.3.3 Assessment of Laboratory QA/QC Data

The laboratories used for this assessment used certified methods pursuant with their respective NATA accreditations. All laboratory duplicates (DUP), method blanks (MB), laboratory control spikes (LCS), matrix spikes (MS) and matrix spike duplicates (MSD) were compliant with internal laboratory recovery limits.

Due to the rigorous NATA accreditation process and the laboratory QC sample results reviewed, EI considered that the results were within acceptable control limits specified by SGS and Envirolab, in accordance with their NATA accreditation. Therefore the integrity of the analytical data was considered to be suitable for use.

9.4 OVERALL DATA ASSESSMENT

The QA/QC assessment of the field and laboratory data indicated that for the purpose of the ESA works, the results of the field and laboratory QA/QC programme were considered acceptable for use as outlined in the data assessment below.

9.3.1 Accuracy

The spike recovery results for the field (laboratory prepared) spike samples were within the acceptable range, therefore EI considered that the accuracy of the overall field QA/QC data assessed during the ESA works was kept.

The remaining spike recovery results for the laboratory spike samples were within the acceptable range.

9.3.2 Precision

The RPD calculations for the field and laboratory duplicate samples were within the acceptable range.

9.3.3 Representativeness

The results of the field (laboratory prepared) and laboratory blank samples were within the acceptable range, with the exception of copper and zinc identified within the rinsate blank sample, which was found to be due to incorrect rinsate waters supplied by the laboratory.

9.3.4 Completeness

EI has assessed that 100 % of the analytical results were considered valid to be used for the ESA works.

Table 9-4 Summary of groundwater field QC

Sample identification	Description	TRH				BTEX				Heavy Metals							
		F1*	F2**	F3 (>C_{16} - C_{34})	F4 (>C_{34} - C_{40})	Benzene	Toluene	Ethyl benzene	Xylene (total)	Arsenic	Cadmium	Chromium (Total)	Copper	Lead	Mercury	Nickel	Zinc
Intra-laboratory Duplicate																	
GW1-1	Primary Sample	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<1	1.0	<1	40	<1	<0.0001	17	140
GWB-1	Replicate of GW1 – 1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<1	0.9	<1	38	<1	<0.0001	17	140
RPD		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	***10.53***	*0.00*	***5.13***	*0.00*	*0.00*	*0.00*	*0.00*
GW104-1	Primary Sample	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<1	<0.1	<1	2	<1	<0.0001	12	66
GWB-1	Replicate of GW104-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<1	<0.1	<1	2	<1	<0.0001	8	58
RPD		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	***40.00***	***12.90***
Inter-laboratory Duplicate																	
GW1-1	Primary Sample	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<1	1.0	<1	40	<1	<0.0001	17	140
GWI-1	Replicate of GW1 – 1	40	<50	<100	<100	<1	<1	<1	<3	<1	1.0	<1	37	<1	<0.05	16	110
RPD		***46.15***	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*0.00*	*0.00*	*0.00*	***7.79***	0.00	*NA*	***6.06***	***24.00***
GW104-1	Primary Sample	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<1	<0.1	<1	2	<1	<0.0001	12	66
GWI-1	Replicate of GW104-1	<10	<50	<100	<100	<1	<1	<1	<3	<1	<0.1	<1	2	<1	<0.05	6	60
RPD		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*NA*	***66.67***	***9.52***

82.35 RPD exceeds 30-50% range referenced from AS4482.1 (2005)

Note: all soil analysis is reported in mg/kg and waters are reported in µg/L.

10 INVESTIGATION RESULTS

10.1 SUB-SURFACE CONDITIONS

On the basis of observations made during the drilling investigation, a summary of site sub-surface conditions is presented in **Table 10-1** and **Table 10-2**.

Table 10-1 Site geology (Western Shepherds Bay Urban Renewal Area)

Depth Interval (m BGL)	General Description (GW103, 104, 105, 106, 111)
0.0 - 0.15	CONCRETE identified at GW103, GW111 (with asphalt over concrete), No concrete in GW109, 112, 113 & 114
0.0 – 1.2/3.2	FILL sand to gravelly sand. Identified at GW103, 104, 105, and 111 (max). GW106 is directly on Sandstone.
1.7/2.5 – 3.5/6.10	SANDY CLAY red brown with grey some black brown clays in GW104 identified at boreholes GW104, 105, 111 (ESTUARINE SEDIMENTS GW104 & ALLUVIUM)
0.1/6.0 - 9+	SANDSTONE orange / brown with some red mottling, extremely to distinctly weathered (Hawkesbury Sandstone)

Table 10-2 Site geology (Eastern Shepherds Bay Urban Renewal Area)

Depth Interval (m BGL)	General Description (GW101, 102, 107, 108, 109, 110, 112, 113, 114)
0.0 – 0.12/0.17	CONCRETE identified at GW101, 102, 107, 108, & 110
0.0 – 0.4/1.3	FILL sand to gravelly sand. Identified at GW101, 102, 107, 108, 109, 110, 112 (max) and 113.
0.4/1.3 – 0.4/1.95	SANDY CLAY to SANDY CLAY (RESIDUAL SOIL) red brown identified at boreholes GW102, 108, 111, 109, 110, 112, 113 & 114. No RESIDUAL SOIL identified in GW 101 & 107
0.4/1.95 - 9+	SANDSTONE orange / brown with some red mottling, extremely to distinctly weathered (Hawkesbury Sandstone). SILTSTONE and SHALE were identified in GW110 at 1.95-3.65 and 5.25 – 6.12 mBGL which may represent part of the Mittagong Formation or shale layers within the Hawkesbury Sandstone.

The monitoring wells installed in Stage 1 (MW1 to MW6) all encountered Hawkesbury Sandstone at the surface. The general Hawkesbury Sandstone geology profile can also be observed in the Stage 1 excavation in the eastern section of the Shepherds Bay Urban Renewal project (see Plate 1). The photo shows the

shallow surficial soils (fill in residual soils) overlying the cross bedded sandstone. The iron staining on main of the major bedding planes indicates seepage zones may be present resulting from infiltration from periods of prolonged rainfall.

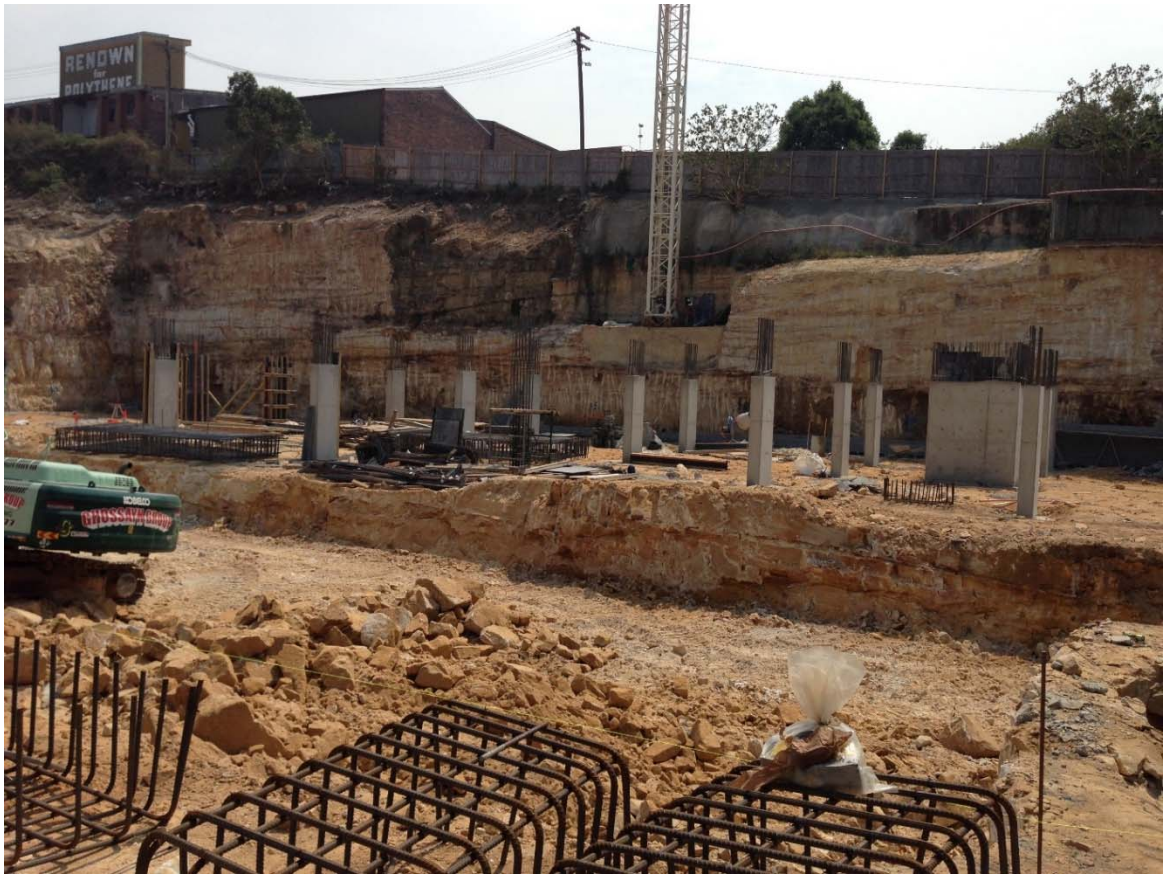


Plate 1 Hawkesbury Sandstone visible in Stage 1 excavation down gradient from Stage 4-5.

10.2 GROUNDWATER RESULTS

10.2.1 Groundwater Field Quality Parameters

Field observations are documented within the borehole logs in **Appendix A,** and the field data sheets produced during well purging are attached as **Appendix B**. As summarised in **Table 10-3**, slight odour was observed in GW109 only during groundwater sampling. Phase-separated hydrocarbons (PSH) were not detected within any of the wells. The wells were all slightly turbid to turbid during sampling.

Field parameters including pH, electrical conductivity (EC) and dissolved oxygen (DO) were measured during groundwater sampling and are summarised in **Table 10-3**.

Table 10-3 Water level measurements and field test results

Sample ID	Date	Depth to Water (m BTOC)	Temp (°C)	pH	Electrical Conductivity (µs/cm)	Total Dissolved Solids (ppm)	Dissolved Oxygen (mg/L)	Redox (mV)
Stage 1 Environmental Site Assessment 41 – 45 Belmore Street, Meadowbank (EI, 2013)								
GW1-1	9/05/2013	7.092	22.3	5.1	320	160	NS	112
GW2-1	9/05/2013	5.879	20.9	6.1	235	131	NS	8
GW3-1	9/05/2013	2.983	19.1	6.3	205	102	NS	NS
GW4-1	9/05/2013	3.363	21.6	5.9	360	180	NS	55
GW5-1	9/05/2013	3.264	22.3	5.8	280	140	NS	4.3
GW6-1	9/05/2013	2.790	22.1	6	310	150	NS	4.3
Groundwater Assessment Shepherds Bay Concept area (EI, 2014)								
GW101-1	2/12/2013	1.337	20.6	5.3	407	204	1.2	122
GW102-1	30/11/2013	2.803	19.2	4.5	988	494	1.8	137
GW103-1	28/11/2013	4.858	21.1	4.7	5951	2978	1.3	133
GW104-1	28/11/2013	3.556	22.5	5.3	316	158	1.5	86
GW105-1	28/11/2013	2.485	24.3	5.3	130	65	1.5	151
GW106-1	28/11/2013	2.830	24.6	5.4	204	103	3.7	161
GW107	28/11/2013	Dry						
GW108-1	28/11/2013	6.987	20.8	6.2	424	212	5.4	126
GW109-1	2/12/2013	2.607	23.4	5.1	614	307	0.7	103
GW110-1	28/11/2013	3.043	24	4.4	302	151	1.5	157
GW111-1	28/11/2013	2.186	25.4	4	771	385	1.1	161
GW112-1	2/12/2013	6.650	22.5	5.4	280	140	1.6	90
GW113-1	2/12/2013	6.000	22.5	4.9	770	385	1.3	155
GW114-1	28/11/2013	7.393	22.5	5.4	393	196	4.6	110

Notes:

NS = 'Not Sampled' i.e. sample was not analysed for the parameter in the field

m BTOC - metres below top of well casing.

EC – electrical conductivity of water sample measured in field using portable EC meter.

µS cm-1 – micro Siemens per centimetre (EC units).

DO – Dissolved Oxygen in units of milligrams per litre (mg/L)

The majority of the water in acidic (pH 4 to 6.2) and low salinity except water in well GW103 which has high salinity and may be influenced by the adjoining marine Shepherds Bay. These are within excepted ranges for Hawkesbury Sandstone.

10.2.2 Groundwater Conditions

In addition to the hydrogeological data provided in **Section 3.3**, onsite groundwater depth and flow direction are described in ***Table 10-4***. A groundwater contour map incorporating the groundwater depths recorded during the GME on November 2013 shows the inferred groundwater flow direction in **Figure 3**.

Table 10-4 Groundwater depth and flow direction

Data Attribute	Details / Description
Measured depth to groundwater	The depth to groundwater in the stage 1 investigation ranged from 2.8 to 7.1 mBTOC (May 2013) and the measured depth to groundwater in wells during this investigation ranged from 1.3 to 7.4 mBTOC. Corrected water levels relative to AHD are presented on Figure 3
Groundwater elevations and flow direction	Corrected groundwater elevations (RWLs) in mAHD ranged from 17.7 mAHD (GW110) at the top of the site to 0.2 m AHD on the foreshore (GW104). The corrected RL for Stage A were approximately 4.7 – 5.2 m AHD. The groundwater depth is also altered by the various excavations particularly the Stage 1 excavation in the eastern part of the site. **Groundwater flow -** Interpreted potentiometric surface contours are illustrated, in **Figure 4**. The inferred local groundwater flow in the site wells was toward Shepherds Bay. A trough in the flow direction is noted at the western end of the site which corresponds to the drainage depression/easements through this area.
Hydraulic gradient	Based on groundwater elevation contouring produced for this assessment (Ref. **Figure 4**), the hydraulic gradient across the western part of the site is approximately 0.02 and between 0.08 – 0.09 in the eastern part of the site. As indicated the hydraulic gradient would also be impacted by the various site rock excavations.

10.3 GROUNDWATER ANALYTICAL RESULTS

Laboratory analytical results for all groundwater samples collected are summarised in Tables 10-5 to 10-8, which also includes the GILs that were adopted for the assessment. Copies of Laboratory Analytical Reports are also attached in ***Appendix E***. In summary:

- Cadmium, Copper and Zinc concentrations exceeded fresh water and marine GILs in all wells,
- Nickel concentrations exceeded fresh water and marine GILs in the majority of the wells except GW1, GW101 and GW105.
- Petroleum hydrocarbons, BTEX compounds and volatile organic compounds did not exceed aquatic protection or vapour intrusion HSLs

Table 10-5 Summary of Heavy Metal Concentrations in Groundwater

Sample ID	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Stage 1 Environmental Site Assessment 41 – 45 Belmore Street, Meadowbank (EI, 2013)								
GW1-1	<1	**1.0**	<1	**40**	<1	<0.0001	**17**	**140**
GW2-1	<1	**0.3**	<1	**10**	<1	<0.0001	**22**	**98**
GW3-1	<1	**0.2**	<1	**11**	<1	<0.0001	**14**	**58**
GW4-1	<1	**0.3**	<1	**6**	<1	<0.0001	**15**	**72**
GW5-1	<1	**0.2**	<1	**26**	2	<0.0001	**13**	**80**
GW6-1	<1	**0.1**	<1	**6**	<1	<0.0001	6	**48**
Groundwater Assessment Shepherds Bay Concept area (EI, 2014)								
GW101-1	<1	**<0.1**	<1	**7**	**5**	0.0001	4	**31**
GW102-1	<1	**0.4**	2	**12**	**28**	0.0002	9	**51**
GW103-1	1	**2.1**	**24**	**10**	**7**	<0.0001	**52**	**600**
GW104-1	<1	**<0.1**	<1	**2**	<1	<0.0001	**12**	**66**
GW105-1	<1	**0.3**	<1	**4**	<1	<0.0001	2	**21**
GW106-1	<1	**0.2**	<1	**9**	<1	<0.0001	**13**	**50**
GW107-1	Well Dry - No Sample Collected							
GW108-1	<1	**0.2**	2	**4**	<1	<0.0001	10	**23**
GW109-1	<1	**1.8**	4	**9**	1	<0.0001	**23**	**61**
GW110-1	3	**<0.1**	<1	**11**	1	<0.0001	**14**	**38**
GW111-1	<1	**0.7**	<1	**15**	**13**	<0.0001	8	**72**
GW112-1	<1	**<0.1**	<1	**7**	<1	<0.0001	**15**	**46**
GW113-1	<1	**<0.1**	<1	**19**	1	<0.0001	**19**	**130**
GW114-1	<1	**0.2**	<1	**2**	<1	<0.0001	**7**	**38**
GILs								
Fresh	**13 / 24 [1]**	**0.06 [2]**	**1**	**1.4**	**3.4**	**0.06 [2]**	**11**	**8 [3]**
Marine	**NR**	**0.7 [2]**	**4.4**	**1.3**	**4.4**	**0.1 [2]**	**7**	**15 [3]**

All results are in units of µg/L, unless otherwise noted

GILs are National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013, Schedule (B1) - Guideline on Investigation Levels for Soil and Groundwater, (NEPM 2013) Groundwater Investigation Limits (GILs) Table 1C for Fresh and Marine Waters, based on ANZECC/ARMCANZ (2000) 95% Fresh and Marine water Trigger values, unless otherwise indicated

NR = No Recommended criteria are currently available for the indicated parameter(s)

1= GIL for Arsenic (III) is 13 µg/L, GIL for Arsenic (V) is 24 µg/L

2 = ANZECC/ARMCANZ (2000) Fresh water trigger values at 99% protection level are applicable for the bio-accumulative metals, cadmium and mercury

3= Figure may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance

Highlighted bold values indicate exceedances of the adopted GILs

Bold values indicate concentration at the adopted GIL

Table 10-6 Summary of Hydrocarbon Concentrations in Groundwater

Sample ID	F1*	F2**	F3 (>C_{16} - C_{34})	F4 (>C_{34} - C_{40})	Benzene	Toluene	Ethyl benzene	Total Xylenes	Naphthalene
Stage 1 Environmental Site Assessment 41 – 45 Belmore Street, Meadowbank (EI, 2013)									
GW1-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW2-1	90	110	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW3-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW4-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW5-1	180	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW6-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
Groundwater Assessment Shepherds Bay Concept area (EI, 2014)									
GW101-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW102-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW103-1	<50	95	<500	<500	<0.5	<0.5	<0.5	<1.5	3.8
GW104-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW105-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW106-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW107	Well Dry - No Sample Collected								
GW108-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW109-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW110-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW111-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW112-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GW113-1	<50	<60	<500	<500	0.6	<0.5	0.7	<1.5	<0.1
GW114-1	<50	<60	<500	<500	<0.5	<0.5	<0.5	<1.5	<0.1
GILs/HSLs									
2m to <4m	1,000	1,000	NR	NR	800	NL	NL	NL	NL
4m to <8m	1,000	1,000	NR	NR	800	NL	NL	NL	NL
8m +	1,000	1,000	NR	NR	900	NL	NL	NL	NL
Fresh					950	180	80	350 (o), 200 (p), 75 (m)	16
Marine					500	180	5	as above	50

All results are in units of µg/L, unless otherwise noted

GILs are National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013, Schedule (B1) - Guideline on Investigation Levels for Soil and Groundwater, (NEPM 2013) Groundwater Health Screening Limits for Vapour Intrusion (GILs) Table 1A(4) - for SAND, being the most conservative value applicable to sandstone strata, unless otherwise indicated

* - To obtain F1 fraction, subtract the sum of BTEX concentrations from the C6 - C10 fraction

** - To obtain F2 fraction, subtract naphthalene from the C10 - C16 fraction

NL = 'Not Limiting', meaning the derived groundwater HSL exceeds the water solubility limit

NR = No Recommended criteria are currently available for the indicated parameter(s)

Highlighted bold values indicate exceedances of the adopted GILs

Table 10-7 Summary of PAH Concentrations in Groundwater

Sample ID	Benzo(α)pyrene	Naphthalene	2-methylnaphthalene	1-methylnaphthalene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Total PAH
Stage 1 Environmental Site Assessment 41 – 45 Belmore Street, Meadowbank (EI, 2013)									
GW1-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
GW2-1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<1
GW3-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
GW4-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
GW5-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
GW6-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
Groundwater Assessment Shepherds Bay Concept area (EI, 2014)									
GW101-1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<1
GW102-1	<0.1	<0.1	<0.1	<0.1	5	0.3	0.4	<0.1	1
GW103-1	<0.1	3.8	0.7	0.5	<0.1	6.6	11	1.5	30
GW104-1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<1
GW105-1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.4	0.1	1
GW106-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<1
GW108-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
GW109-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
GW110-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<1
GW111-1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.8	0.1	2
GW112-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
GW113-1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2	<0.1	<1
GW114-1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
GILs									
Fresh	**NR**	**16**	**NR**	**NR**	**NR**	**NR**	**NR**	**NR**	**NR**
Marine	**NR**	**50** [1]	**NR**	**NR**	**NR**	**NR**	**NR**	**NR**	**NR**

All results are in units of µg/L, unless otherwise noted

GILs are National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013, Schedule (B1) - Guideline on Investigation Levels for Soil and Groundwater, (NEPM 2013) Groundwater Investigation Levels (GILs) Table 1C, unless otherwise indicated

1 - Figure may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance

NR = No Recommended criteria are currently available for the indicated parameter(s)

Highlighted bold values indicate exceedances of the adopted GILs

Bold values indicate concentration at the adopted GIL

Table 10-8 Summary of Volatile Organic Compounds in Groundwater

Sample ID	Trichloroethene (TCE)	Perchloroethylene (PCE)	cis-1,2-dichloroethene	Acetone	Other VOCs
Stage 1 Environmental Site Assessment 41 – 45 Belmore Street, Meadowbank (EI, 2013)					
GW1-1	<0.5	<0.5	<0.5	< 10	ND
GW2-1	<0.5	<0.5	<0.5	<10	ND
GW3-1	<0.5	<0.5	<0.5	<10	ND
GW4-1	<0.5	<0.5	<0.5	<10	ND
GW5-1	<0.5	<0.5	<0.5	<10	ND
GW6-1	<0.5	<0.5	<0.5	<10	ND
Groundwater Assessment Shepherds Bay Concept area (EI, 2014)					
GW101-1	2.3	<0.5	<0.5	21	ND
GW102-1	0.8	<0.5	<0.5	19	ND
GW103-1	9.6	<0.5	0.7	28	ND
GW104-1	<0.5	<0.5	<0.5	<10	ND
GW105-1	<0.5	<0.5	<0.5	<10	ND
GW106-1	<0.5	<0.5	<0.5	<10	ND
GW107	Dry Not sampled				
GW108-1	<0.5	<0.5	<0.5	<10	ND
GW109-1	<0.5	<0.5	<0.5	<10	ND
GW110-1	<0.5	<0.5	<0.5	<10	ND
GW111-1	<0.5	<0.5	<0.5	<10	ND
GW112-1	<0.5	<0.5	<0.5	<10	ND
GW113-1	<0.5	<0.5	<0.5	29	ND
GW114-1	<0.5	<0.5	<0.5	<10	ND
GILs					
Fresh	**NR**	**NR**	**NR**	**NR**	**See**
Marine	**NR**	**NR**	**NR**	**NR**	**ANZECC**

All results are in units of µg/L, unless otherwise noted

GILs are ANZECC/ARMCANZ (2000) 95% Fresh and Marine water Trigger values, unless otherwise indicated

1 - Figure may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance

ND = 'Not Detected' i.e. the reported result was less than the laboratory limit of detection

NR = No Recommended criteria are currently available for the indicated parameter(s)

Highlighted bold values indicate exceedances of the adopted GILs

Bold values indicate concentration at the adopted GIL

11 DISCUSSION

11.1 SITE HYDROGEOLOGY

As indicated above the concept area is divided into two main topographic areas:

- the western third of the site which is essentially a modified drainage depression which drains stormwater from the north of Constitution Road. The area has some deeper alluvial or residual soil in the lower areas grading to sandstone at shallow depths on the edges of the depression. This sandstone has be cut and filled in places. It is expected that the stormwater will follow the main Council drainage and the main culverts or pipe in the drainage easements. Groundwater is expected to occur in the underlying alluvial and residual soil material (particularly around the main central drainage easement) and in the underlying sandstone fractures and bedding planes and flow toward Shepherds Bay, and
- the eastern two thirds of the site is a broad sandstone ridge sloping down to Shepherds Bay. Prior to past commercial and residential development it was expected that the underlying sandstone would have formed benches stepping down to the bay. These benches are formed by the dominant bedding planes and joint patterns in the area. Groundwater would flow in the shallow fill and residual soils and in joints and bedding planes toward Shepherds Bay.

Recharge to the groundwater would be due to stormwater from the upper catchments and from infiltration or rainfall into the fractures within the underlying sandstone. The depth to groundwater would also be influenced by the major excavations that are present particularly the excavation in Stage 1 which is approximately

11.2 SITE GROUNDWATER CONTAMINATION STATUS

Fourteen (14) monitoring wells installed as part of the groundwater investigation and six (6) wells previously installed in Stage 1, generally form a broad grid across the site to assess the overall impact to groundwater from the past and existing commercial/industrial operations. Six (6) of these wells were also drilled on the southern boundary to assess potential off-site migration.

The groundwater sampling and analysis identified:

- Cadmium (highest 2.1 µg/L in GW103), Copper (23 µg/L in GW109) and Zinc (600 µg/L in GW103) concentrations exceeded fresh water and marine GILs in all wells,
- Nickel concentrations (highest 52 µg/L in GW103) exceeded fresh water and marine GILs in the majority of the wells except GW1, GW101 and GW105.
- Petroleum hydrocarbons compounds (GW2, GW5, GW103), PAHs (GW102, 103, 105, 111 and 113), BEX (GW113) and volatile organic compounds (trichloroethene (GW101, 102, 103), cis 1,2 dichloroethene (GW103) and acetone (GW101, 102, 103, 113) were detected at low concentrations in

the wells mentioned above but the concentrations did not exceed aquatic protection or vapour intrusion HSLs

Detectable concentrations of potential organic and inorganic contaminants and many of these were detected in well GW103 on the southern boundary and downgradient from the Stage 2 and 3. It is considered that while the contamination is below human health and vapour intrusion guidelines, the source of the contamination has not been identified. The heavy metals concentrations are a similar order of magnitude in the upgradient wells (GW110 and GW111), except zinc in (GW103) and considered to be regional heavy metal concentrations and are therefore considered to be of low risk to the aquatic environment. This aquatic environment is more likely to be at risk from the heavy metals (and organic compounds) identified in the Parramatta River from former upgradient industries at Rhodes, Homebush and Camellia.

11.3 CONCEPTUAL SITE MODEL (CSM)

Based on the findings of this groundwater investigation it is concluded that the CSM outlined in Section 6 is generally valid, however the potential sources of contamination should be verified during the detailed environmental site investigations being undertaken for Stages 6 to 10 and Stage A and during any subsequent localised remediation and validation works.

12 CONCLUSIONS

The Shepherds Bay Urban Renewal Concept Plan required the assessment of the groundwater quality and part of the consent conditions (Clause 39). The concept plan area is approximately 9.3 ha and is bounded by Bowden Street, Constitution Road, Belmore Street and Rothesay Avenue, Meadowbank, NSW. A smaller stage (Stage A) is located adjacent to Church Street east of the main area. The purpose of the groundwater investigations in addition to compliance with Clause 39, is to assess whether site specific groundwater investigations are required as part of the applications for the individual development stages. Based on the findings of this groundwater assessment, it was concluded that:

- The site slopes essentially south toward the Parramatta River from a RL of approximately 10 to 20m AHD on Constitution Road (H Ramsay & Co. Pty Ltd Survey) to approximately 5m to 2m AHD on Rothesay Avenue. The Stage A site is on a slight knoll ranging from 10.5 to 13 m AHD. The western third of the site is generally lower (less than 10 m AHD) than the eastern two-thirds and contains a main drainage line which drains the urban catchment to the north of Constitution Road and the eastern two thirds of the site which is essentially a broad ridgeline area. The land generally drains toward the south toward Shepherds Bay
- The site was free of statutory notices issued by the NSW EPA. One notified site is located near the concept area and is the former Council depot located in Parsonage Street, Ryde;
- WorkCover searches revealed a number of USTs many of which have been removed. There is, however, limited or no data confirming these were removed in accordance with current UPSS regulations;
- Previous investigations ;
- The site is underlain at shallow depths by Hawkesbury Sandstone which comprises medium to coarse-grained quartz sandstone, very minor shale and laminite lenses. There is small lobe of Ashfield Shale/Mittagong Formation just extending into the north eastern corner of the concept area near Constitution and Belmore Road intersection.
- Potential alluvial material/residual soils occur in the drainage depression in the western third of the site. Some estuarine sediments (potential acid sulfate soils) also occur in the south-west corner of the site (near well GW104).
- Fourteen (14) groundwater monitoring wells were install over the site is a broad grid. Six (6) previous monitoring wells were also installed on the Stage 1 property (EI, 2013). The wells were installed to 9 and 12 m in depth.
- Groundwater was encountered at depths ranging from 1.3 to 7.4 meters below top of casing, with groundwater flow expected to be toward Shepherds Bay. Groundwater is generally present in the underlying sandstone or within the alluvial/residual soil materials in the western third of the site;

- Groundwater sampling identified Cadmium, Copper and Zinc concentrations exceeded fresh water and marine GILs in all wells,
- Groundwater sampling identified Nickel concentrations exceeded fresh water and marine GILs in the majority of the wells except GW1, GW101 and GW105.
- Groundwater samples identified Petroleum hydrocarbons compounds, PAHs, BTEX compounds and volatile organic compounds (trichloroethene, cis 1,2 dichloroethene and acetone) were detected at low concentrations in selected wells but the concentrations did not exceed aquatic protection or vapour intrusion HSLs
- The heavy metals detected in the groundwater were considered to be a regional impact and therefore were considered a low risk to the environment.
- The conceptual site model suggests that the main exposure pathway was to site workers during construction. It also considered that there was a low risk to surface water from the various heavy metals.

In summary and within the limitations of normal environmental assessments (Section 14), it is considered that there is a low risk of widespread groundwater contamination within the Shepherds Bay Urban Renewal Project. It is also considered that any groundwater impact is unlikely to prevent the redevelopment of the sites for residential and open space development.

13 RECOMMENDATIONS

It is assumed that during the proposed construction/urban renewal, any primary sources of groundwater contamination such as underground storage tanks and associated infrastructure would be removed in accordance with the findings of the detailed site investigations for each of the stages. It is also expected that any soil contamination would be remediated in the development stages for the construction of any basement level car parks or building foundations in accordance with NSW EPA guidelines.

Therefore in accordance with Clause 40 the following recommendations are made with regard to targeted groundwater investigations for the specific Development, it is considered that the site shall be suitable for the proposed residential development on completion of the following recommendations:

1. Completion of the individual staged environmental site assessments including Workcover Dangerous Goods searches to assess potential for further underground or above ground contamination sources.
2. Completion of additional groundwater monitor wells and groundwater gauging and sampling in the additional stages to:
    a. Assess the impact of the potential sources identified in 1) above,
    b. Confirm or modify the existing conceptual site model based on any new of additional information (including any potential changes in groundwater flow direction)
    c. Assess whether dewatering or other hydraulic control measure are required for the construction of any basements particularly in Concept Plan Stages 6, 7, 8 and 9. Any future off-site disposal of site groundwater from site excavations, requires waste classification in accordance with the DECCW (2009) *Waste Classification Guidelines* or sampling and analysis against surface water quality guidelines for marine and Sydney Harbour Water Quality Objectives.
3. Preparation and implementation of a Remediation Action Plan for the Development Stages to outline the removal of any hotspot identified, as well as the known USTs and any unexpected finds.
4. Validate that the development areas are remediated in accordance with respective EPA guidelines.
5. Preparation of a final site validation report by a qualified environmental consultant, certifying site suitability for the proposed development.

To assess the groundwater flow directions it is recommended that all new and existing wells be located and surveyed to Australian Height Datum and to Geocentric Datum of Australia 1994 (GDA94) (latitude and longitude) or Grid coordinates: (Map Grid of Australia 1994 (MGA94)) and water levels gauged by experienced environmental consultant.

14 STATEMENT OF LIMITATIONS

The findings presented in this report are the result of discrete and specific sampling methodologies used in accordance with best industry practices and standards. Due to the site-specific nature of soil sampling from point locations, it is considered likely that all variations in subsurface conditions across a site cannot be fully defined, no matter how comprehensive the field investigation program.

While normal assessments of data reliability have been made, EI assumes no responsibility or liability for errors in any data obtained from previous assessments conducted on site, regulatory agencies (e.g. Council, EPA, etc.), statements from sources outside of EI, or developments resulting from situations outside the scope of works of this project.

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

EI's assessment is necessarily based upon the result of the site investigation and the restricted program of surface and subsurface sampling, screening and chemical testing which was set out in the proposal. Neither EI, nor any other reputable consultant, can provide unqualified warranties nor does EI assume any liability for site conditions not observed or accessible during the time of the investigations.

This report was prepared for the above named client and no responsibility is accepted for use of any part of this report in any other context or for any other purpose or by other third parties. This report does not purport to provide legal advice.

15 REFERENCES

Australian and New Zealand Environment and Conservation Council, 2000: *Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy*, October 2000.

DEC (2006) *Guidelines for the NSW Site Auditor Scheme*, 2nd Edn. NSW Dept. of Environment and Conservation, Dec 2006.

DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* NSW Dept. of Environment and Conservation, Mar 2007.

DECCW (2009) *Waste Classification Guidelines*. Department of Environment, Climate Change and Water, New South Wales, DECCW 2009/806, December, 2009.

EPA (1994) *Guidelines for Assessing Service Station Sites*. Environment Protection Authority of New South Wales, Contaminated Sites Unit, EPA 94/119, December 1994.

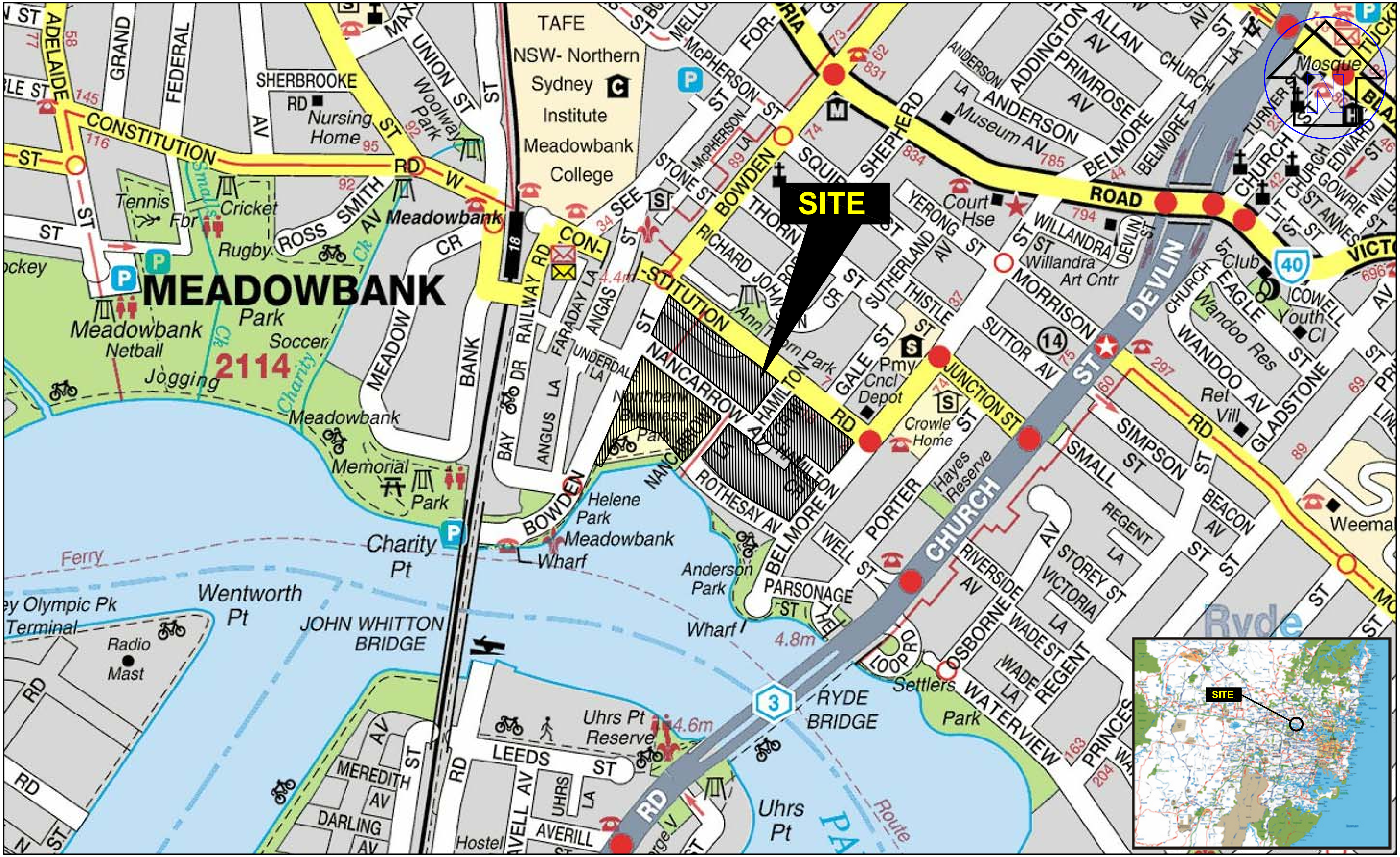
EPA (1995) *Sampling Design Guidelines*. Environment Protection Authority of New South Wales, Contaminated Sites Unit, EPA 95/59, September 1995.

NEPM (2013) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*. National Environmental Protection Council, December 1999, Amendment 2013.

ABBREVIATIONS

AHD	Australian Height Datum
AST	Aboveground Storage Tank
ANZECC	Australian and New Zealand Environment Conservation Council
B(a)P	Benzo(a)Pyrene
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
COC	Chain of Custody
DEC	Department of Environment and Conservation, NSW
DECC	Department of Environment and Climate Change, NSW (formerly DEC)
DECCW	Department of Environment, Climate Change and Water, NSW (formerly DECC)
DP	Deposited Plan
DQO	Data Quality Objective
EI	Environmental Investigations
EIL	Ecological Investigation Level
EPA NSW	Environment Protection Authority, New South Wales
ESA	Environmental Site Assessment
HIL	Health Based Investigation Level
HSL	Health Screening Level
NATA	National Association of Testing Authorities, Australia
NEPC	National Environmental Protection Council
NHMRC	National Health and Medical Research Council
OCPs	Organochlorine Pesticides
OEH	Office of Environment and Heritage, NSW (formerly DECCW)
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photoionisation Detector
PQL	Practical Quantitation Limit
QC	Quality Control
RAP	Remediation Action Plan
RPD	Relative Percentage Difference
SILs	Soil Investigation Levels
SWL	Standing Water Level
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
UPSS	Underground Petroleum Storage System
US EPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound

FIGURES



Environmental Investigations Australia Contamination | Remediation | Geotechnical Suite 6.01, 55 Miller Street, PYRMONT 2009 Ph (02) 9516 0722 Fax (02) 9516 0744	Drawn:	V.T	**Holdmark Pty Ltd** Groundwater Investigation Stages 1-10 Shepherds Bay Urban Renewal, Meadowbank NSW Locality Plan	Figure: 1
	Approved:	M.D		
	Date:	8-01-14		
	Approx Scale:	N.T.S		Project: E2008 AC

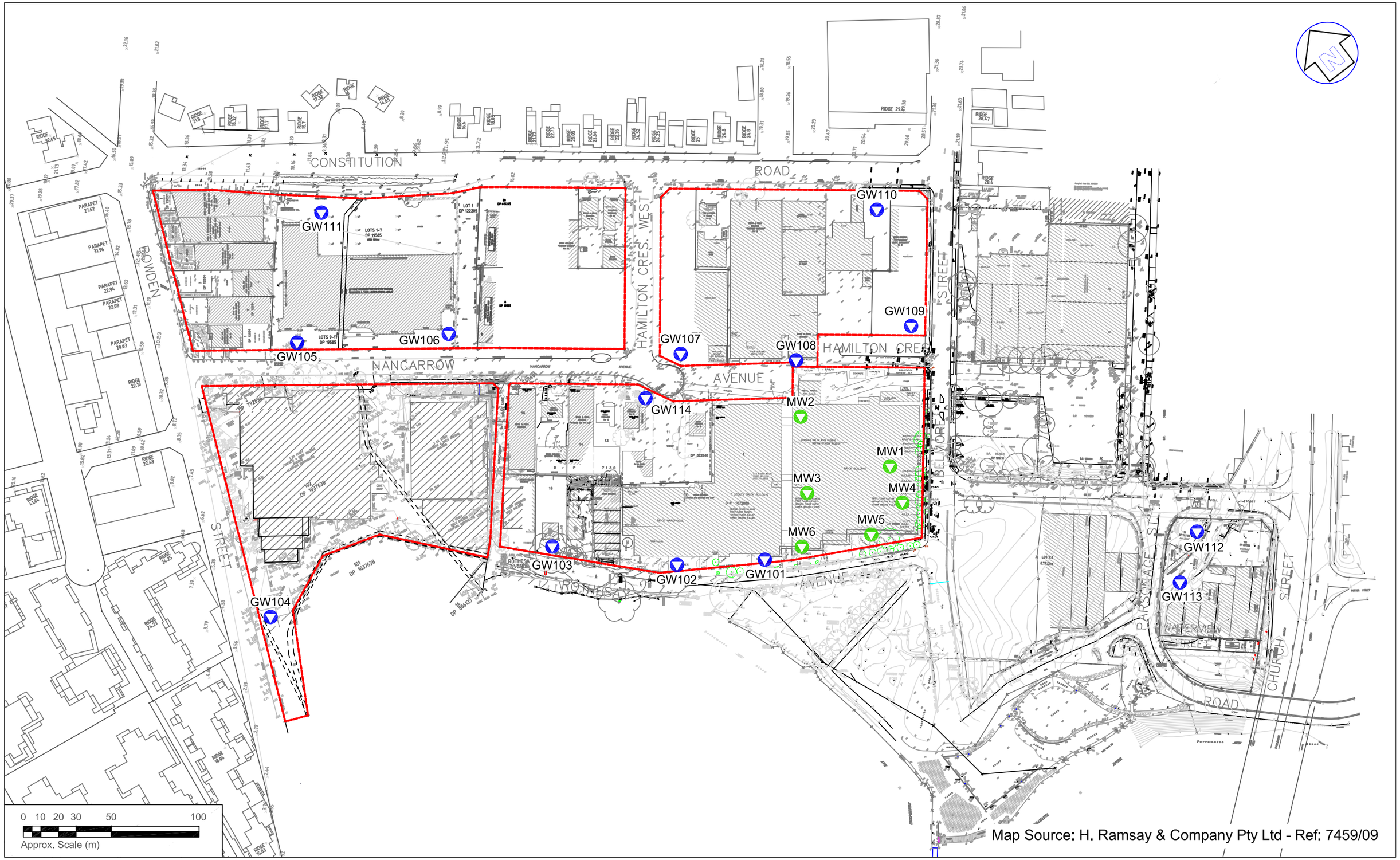
Environmental Investigations Australia
Contamination | Remediation | Geotechnical
Suite 6.01, 55 Miller Street, PYRMONT 2009
Ph (02) 9516 0722 Fax (02) 9516 0744

Drawn:	V.T
Approved:	M.D
Date:	28-01-14
Approx Scale:	N.T.S

Holdmark Pty Ltd
Groundwater Investigation
Stages 1-10
Shepherds Bay Urban Renewal, Meadowbank NSW
Staging Plan

Figure:
2

Project: E2008 AC



LEGEND

- Monitoring well location
- Former monitoring well location (EI, Stage 1 - 2013)
- Approx. site boundary

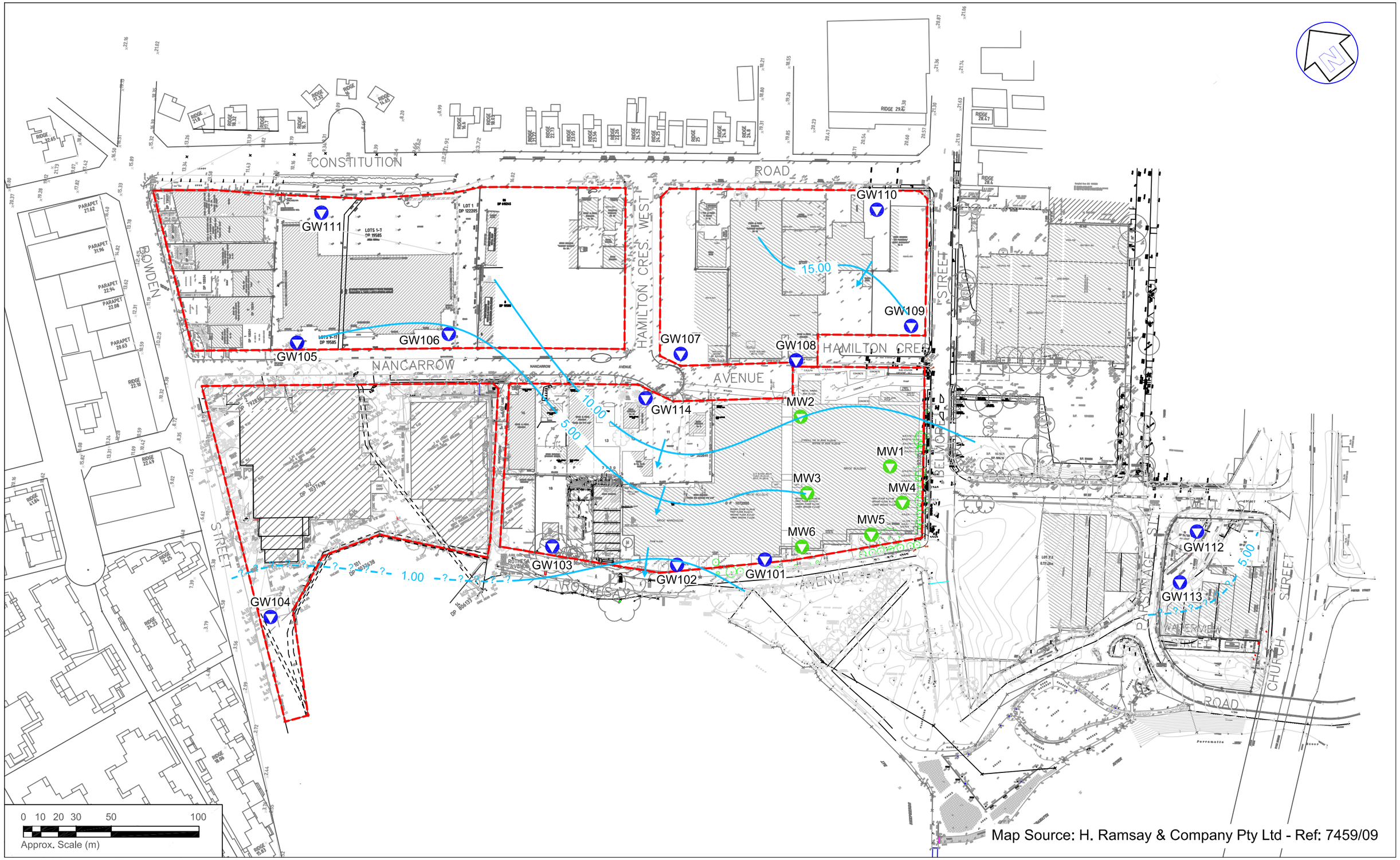
Environmental Investigations Australia
Contamination | Remediation | Geotechnical
Suite 6.01, 55 Miller Street, PYRMONT 2009
Ph (02) 9516 0722 Fax (02) 9516 0741

Drawn:	V.T
Approved:	M.D
Date:	8-01-14
Approx Scale:	1:2000 @ A3

Holdmark Pty Ltd
Groundwater Investigation
Stages 1-10
Shepherds Bay Urban Renewal,
Meadowbank, NSW
Sampling Location Plan

Figure: 3

Project: E2008 AC



LEGEND

- Monitoring well location
- Former monitoring well location (EI, Stage 1 - 2013)
- Approx. site boundary
- Inferred groundwater flow direction
- Inferred groundwater contours (m AHD approx.)

Environmental Investigations Australia
Contamination | Remediation | Geotechnical
Suite 6.01, 55 Miller Street, PYRMONT 2009
Ph (02) 9516 0722 Fax (02) 9516 0741

Drawn:	V.T
Approved:	M.D
Date:	28-01-14
Approx Scale:	1:2000 @ A3

Holdmark Pty Ltd
Groundwater Investigation
Stages 1-10
Shepherds Bay Urban Renewal,
Meadowbank, NSW
Inferred Groundwater Contours

Figure: 4

Project: E2008 AC

APPENDIX A

NRATLAS GROUNDWATER BORE SEARCH

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

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

Work Requested -- GW104997

Works Details (top)

GROUNDWATER NUMBER	GW104997
LIC-NUM	10BL160464
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2001-08-20
FINAL-DEPTH (metres)	2.40
DRILLED-DEPTH (metres)	2.40
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.32
SALINITY	260.00
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6256692.00
EASTING	323049.00
LATITUDE	33 48' 55"
LONGITUDE	151 5' 17"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	LT1 DP206306

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	200 1032187

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	2.40	100			Auger
1	1	Casing	PVC Class 18	0.00	1.90	60	50		Screwed; Seated on Bottom
1	1	Opening	Slots - Horizontal	1.90	2.40	60			PVC Class 18; SL: 35mm; A: 1mm
1		Annulus	Waterworn/Rounded	1.00	2.50				Graded; GS: 1.7-2.4mm; Q: 0m³

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
2.30	2.40	0.10		2.32					260.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	0.70	0.70	FILL,CLAYEY SAND
0.70	1.50	0.80	FILL,SILTY CLAYEY SAND
1.50	2.40	0.90	SILTY SANDY CLAY,GREY

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

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

Work Requested -- GW104998

Works Details (top)

GROUNDWATER NUMBER	GW104998
LIC-NUM	10BL160464
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2001-08-20
FINAL-DEPTH (metres)	3.10
DRILLED-DEPTH (metres)	3.10
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.50
SALINITY	279.00
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6256701.00
EASTING	323055.00
LATITUDE	33 48' 54"
LONGITUDE	151 5' 18"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	LT1 DP206306

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	200 1032187

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	3.10	100			Auger
1	1	Casing	PVC Class 18	0.00	2.50	60	50		Screwed
1	1	Opening	Slots - Horizontal	2.50	3.10	60			PVC Class 18; SL: 35mm; A: 1mm
1		Annulus	Waterworn/Rounded	1.00	2.50				Graded; GS: 2.4-3.1mm; Q: 0m³

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
2.50	3.10	0.60		2.50					279.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.90	0.90	FILL,CLAYEY SAND,BROWN		
0.90	1.40	0.50	FILL,SILTY CLAYEY SAND,GREY		

1.40	3.10	1.70	CLAY,SANDY,MOTTED GREY

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

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

Work Requested -- GW104999

Works Details (top)

GROUNDWATER NUMBER	GW104999
LIC-NUM	10BL160464
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2001-08-20
FINAL-DEPTH (metres)	3.10
DRILLED-DEPTH (metres)	3.60
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	3.54
SALINITY	248.00
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6256697.00
EASTING	323091.00
LATITUDE	33 48' 55"
LONGITUDE	151 5' 19"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	LT3 DP206306

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	200 1032187

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	3.10	100			Auger
1	1	Casing	PVC Class 18	0.00	3.00	60			Screwed; Seated on Bottom
1	1	Opening	Slots - Horizontal	3.00	3.60	60			PVC Class 18; SL: 35mm; A: 1mm
1		Annulus	Waterworn/Rounded	1.00	2.50				Graded; GS: 2.8-3.6mm; Q: 0m³

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
3.50	3.60	0.10		3.54					248.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT

0.00	0.90	0.90	FILL,CLAYEY SAND BROWN
0.90	1.30	0.40	FILL, SILTY CLAYEY SAND GREY
1.30	3.60	2.30	CLAY,SANDY,MOTTED GREY

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

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

Work Requested -- GW112117

Works Details (top)

GROUNDWATER NUMBER	GW112117
LIC-NUM	10BL161257
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2002-11-13
FINAL-DEPTH (metres)	2.50
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	ANDERSON PARK
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	6255965.00
EASTING	323673.00
LATITUDE	33 49' 19"
LONGITUDE	151 5' 41"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	840//752035

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	840 752035

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 Monday, January 6, 2014

Print Report

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

Work Requested -- GW112118

Works Details (top)

GROUNDWATER NUMBER	GW112118
LIC-NUM	10BL161257
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2002-11-13
FINAL-DEPTH (metres)	4.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	ANDERSON PARK
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	6255956.00
EASTING	323670.00
LATITUDE	33 49' 19"
LONGITUDE	151 5' 41"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	840//752035

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	840 752035

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 Monday, January 6, 2014

Print Report

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

Work Requested -- GW112119

Works Details (top)

GROUNDWATER NUMBER	GW112119
LIC-NUM	10BL161257
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2002-11-13
FINAL-DEPTH (metres)	4.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	ANDERSON PARK
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	6255950.00
EASTING	323681.00
LATITUDE	33 49' 19"
LONGITUDE	151 5' 41"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	840//752035

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	840 752035

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 Monday, January 6, 2014

Print Report

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

Work Requested -- GW112120

Works Details (top)

GROUNDWATER NUMBER	GW112120
LIC-NUM	10BL161257
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2002-11-13
FINAL-DEPTH (metres)	2.50
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	ANDERSON PARK
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	6255943.00
EASTING	323750.00
LATITUDE	33 49' 19"
LONGITUDE	151 5' 44"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	840//752035

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	840 752035

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, January 29, 2014

Print Report

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

Work Requested -- GW113341

Works Details (top)

GROUNDWATER NUMBER	GW113341
LIC-NUM	10BL164654
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2004-09-20
FINAL-DEPTH (metres)	15.90
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	CORNER GAS PTY LIMIETED
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	6256610.00
EASTING	324583.00
LATITUDE	33 48' 58"
LONGITUDE	151 6' 17"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	A//26272

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	A 26272

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, January 29, 2014

Print Report

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

Work Requested -- GW113342

Works Details (top)

GROUNDWATER NUMBER	GW113342
LIC-NUM	10BL164654
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2004-09-21
FINAL-DEPTH (metres)	18.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	CORNER GAS PTY LIMIETED
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	6256591.00
EASTING	324583.00
LATITUDE	33 48' 59"
LONGITUDE	151 6' 17"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	B//26272

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	A 26272

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, January 29, 2014

Print Report

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

Work Requested -- GW113343

Works Details (top)

GROUNDWATER NUMBER	GW113343
LIC-NUM	10BL164654
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2004-09-21
FINAL-DEPTH (metres)	17.10
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	CORNER GAS PTY LIMIETED
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	6256576.00
EASTING	324598.00
LATITUDE	33 48' 59"
LONGITUDE	151 6' 17"

GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	C//26272

Licensed (top)

COUNTY	CUMBERLAND
PARISH	HUNTERS HILL
PORTION-LOT-DP	A 26272

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

APPENDIX B

PREVIOUS BOREHOLE LOGS (STAGE 1 MONITORING WELLS)

Environmental Investigations
Contamination Assessment Management & Geotechnical

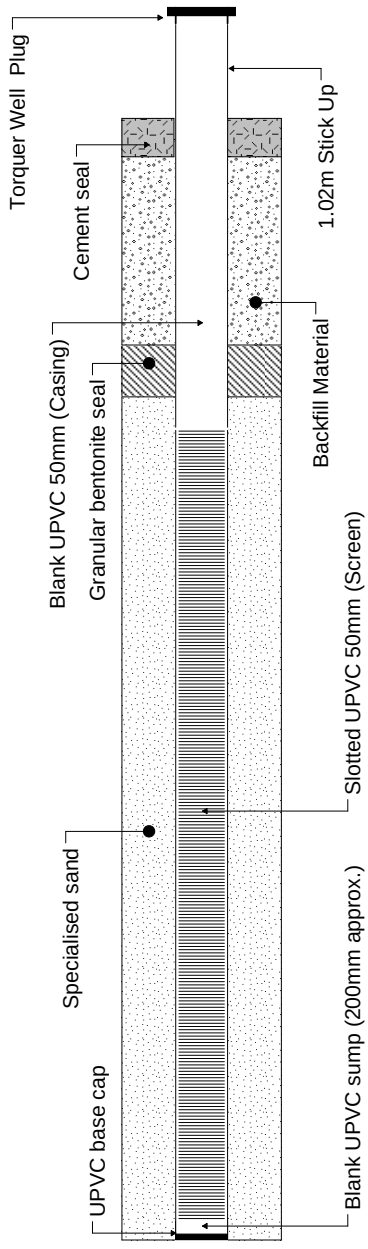
PO Box 215
ST PETERS NSW 2044
Ph: (02) 9516-0722 Fax: (02) 9516-0741

Monitoring Bore: BH1/MW1

Project No: E1836.1
Site Address: 41-45 Belmore Street, Meadowbank, NSW
Client: Holdmark Pty Ltd
Drill Method: Truck Mounted Edson 3000 Rotary Air Drill Rig
Drill date: 07-05-2013

Sheet: 1 of 1
Bore Licence No.:
Hole size: 50mm \ 100mm
Engineer: E.S.
Checked by: E.G.

SUBSURFACE PROFILE

SWL (m)	Depth (m)	Symbol	Description	Bore construction details	Sample ID	FCR	PID Readings (ppm)
6.07m BGL (09-05-13)	-1.00 to 11.20		Ground Surface ***Sandstone*** Orange/brown- light brown/grey, highly weathered with minor clay bands, fine-medium grained, dry-moist, no odour Borehole ended at 11.03m		BH1-1 GW1-1	0 0	

FCR = FIELD CONTAMINATION RANKING

0 = No visual signs of contamination and/or detectable odours
1 = Slight visual signs of contamination and/or odours
2 = Obvious visual signs of contamination and/or odour
3 = Strong visual signs of contamination and/or odour

COMMENTS:

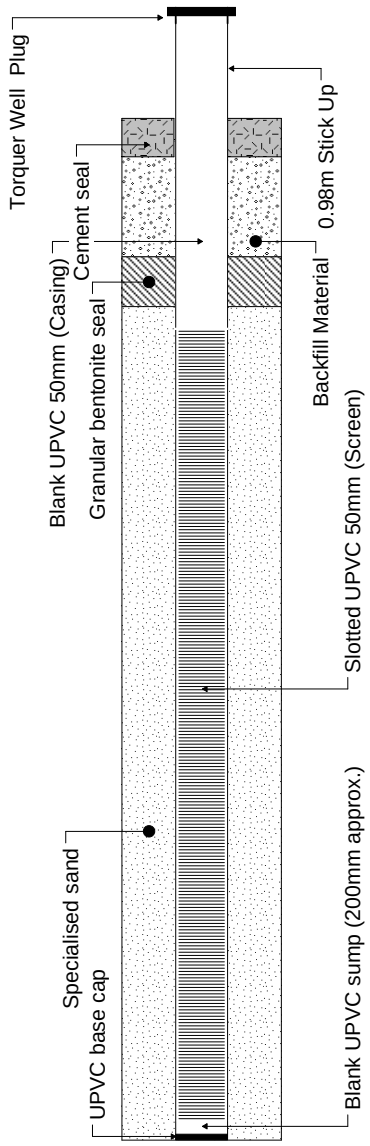
Environmental Investigations
Contamination Assessment Management & Geotechnical
PO Box 215
ST PETERS NSW 2044
Ph: (02) 9516-0722 Fax: (02) 9516-0741

Monitoring Bore: BH2/MW2

Project No: E1836.1
Site Address: 41-45 Belmore Street, Meadowbank, NSW
Client: Holdmark Pty Ltd
Drill Method: Truck Mounted Edson 3000 Rotary Air Drill Rig
Drill date: 07-05-2013

Sheet: 1 of 1
Bore Licence No.:
Hole size: 50mm \ 100mm
Engineer: E.S.
Checked by: E.G.

SUBSURFACE PROFILE

SWL (m)	Depth (m)	Symbol	Description	Bore construction details	Sample ID	FCR	PID Readings (ppm)
4.90m BGL (09-05-13)	-1.00 to 11.20		Ground Surface ***Sandstone*** Orange/brown- light brown/grey, highly weathered with minor clay bands, fine-medium grained, dry-moist, no odour Borehole ended at 10.05m		BH2-1 GW2-1	0 0	

FCR = FIELD CONTAMINATION RANKING

0 = No visual signs of contamination and/or detectable odours
1 = Slight visual signs of contamination and/or odours
2 = Obvious visual signs of contamination and/or odour
3 = Strong visual signs of contamination and/or odour

COMMENTS:

Environmental Investigations
Contamination Assessment Management & Geotechnical

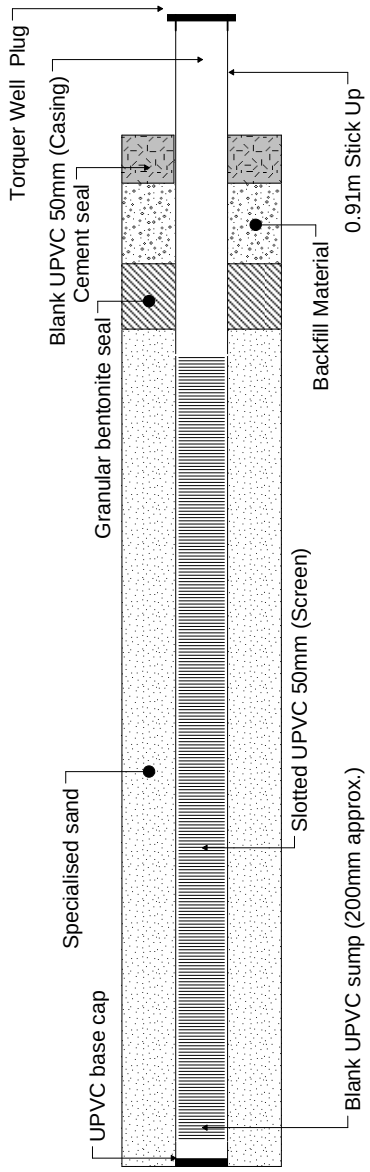
PO Box 215
ST PETERS NSW 2044
Ph: (02) 9516-0722 Fax: (02) 9516-0741

Monitoring Bore: BH3/MW3

Project No: E1836.1
Site Address: 41-45 Belmore Street, Meadowbank, NSW
Client: Holdmark Pty Ltd
Drill Method: Truck Mounted Edson 3000 Rotary Air Drill Rig
Drill date: 07-05-2013

Sheet: 1 of 1
Bore Licence No.:
Hole size: 50mm \ 100mm
Engineer: E.S.
Checked by: E.G.

SUBSURFACE PROFILE

SWL (m)	Depth (m)	Symbol	Description	Bore construction details	Sample ID	FCR	PID Readings (ppm)
2.07m BGL (09-05-13)	-1.00 to 8.80		Ground Surface ***Sandstone*** Orange/brown- light brown/grey, highly weathered with minor clay bands, fine-medium grained, dry-moist, no odour Borehole ended at 8.12m		BH3-1 GW3-1	0 0	

FCR = FIELD CONTAMINATION RANKING

0 = No visual signs of contamination and/or detectable odours
1 = Slight visual signs of contamination and/or odours
2 = Obvious visual signs of contamination and/or odour
3 = Strong visual signs of contamination and/or odour

COMMENTS:

Environmental Investigations
Contamination Assessment Management & Geotechnical

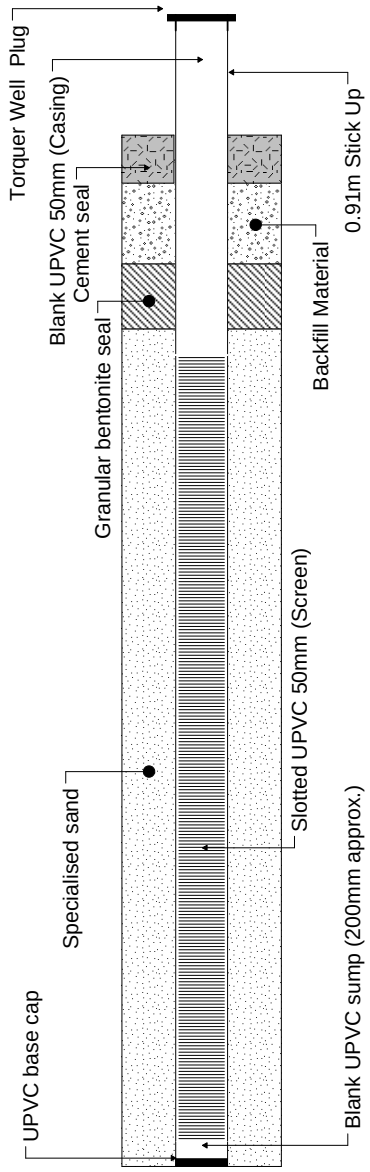
PO Box 215
ST PETERS NSW 2044
Ph: (02) 9516-0722 Fax: (02) 9516-0741

Monitoring Bore: BH4/MW4

Project No: E1836.1
Site Address: 41-45 Belmore Street, Meadowbank, NSW
Client: Holdmark Pty Ltd
Drill Method: Truck Mounted Edson 3000 Rotary Air Drill Rig
Drill date: 07-05-2013

Sheet: 1 of 1
Bore Licence No.:
Hole size: 50mm \ 100mm
Engineer: E.S.
Checked by: E.G.

SUBSURFACE PROFILE

SWL (m)	Depth (m)	Symbol	Description	Bore construction details	Sample ID	FCR	PID Readings (ppm)
2.483m BGL (09-05-13)	-1.00 to 8.80		Ground Surface ***Sandstone*** Orange/brown- light brown/grey, highly weathered with minor clay bands, fine-medium grained, dry-moist, no odour Borehole ended at 8.15m		BH4-1 GW4-1	0 0	

FCR = FIELD CONTAMINATION RANKING

0 = No visual signs of contamination and/or detectable odours
1 = Slight visual signs of contamination and/or odours
2 = Obvious visual signs of contamination and/or odour
3 = Strong visual signs of contamination and/or odour

COMMENTS:

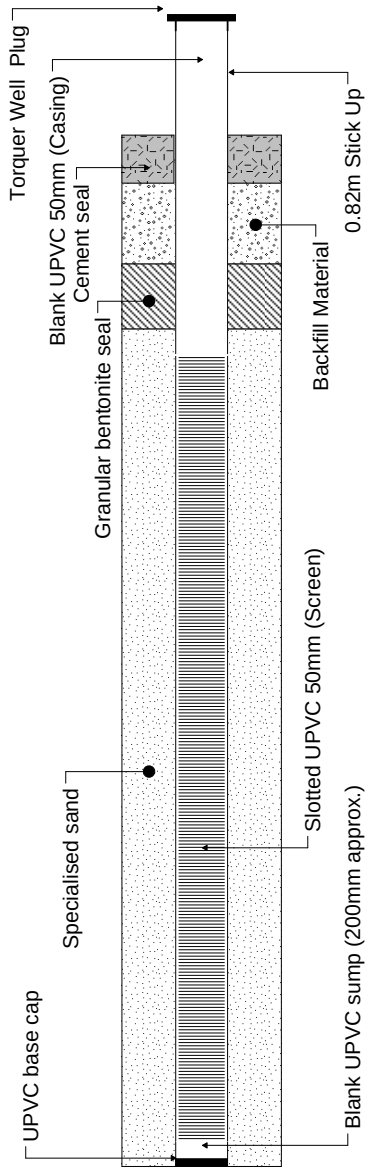
Environmental Investigations
Contamination Assessment Management & Geotechnical
PO Box 215
ST PETERS NSW 2044
Ph: (02) 9516-0722 Fax: (02) 9516-0741

Monitoring Bore: BH5/MW5

Project No: E1836.1
Site Address: 41-45 Belmore Street, Meadowbank, NSW
Client: Holdmark Pty Ltd
Drill Method: Truck Mounted Edson 3000 Rotary Air Drill Rig
Drill date: 07-05-2013

Sheet: 1 of 1
Bore Licence No.:
Hole size: 50mm \ 100mm
Engineer: E.S.
Checked by: E.G.

SUBSURFACE PROFILE

SWL (m)	Depth (m)	Symbol	Description	Bore construction details	Sample ID	FCR	PID Readings (ppm)
2.45m BGL (09-05-13)	-1.00 to 8.80		Ground Surface ***Sandstone*** Orange/brown- light brown/grey, highly weathered with minor clay bands, fine-medium grained, dry-moist, no odour Borehole ended at 8.21m		BH5-1 GW5-1	0 0	

FCR = FIELD CONTAMINATION RANKING

0 = No visual signs of contamination and/or detectable odours
1 = Slight visual signs of contamination and/or odours
2 = Obvious visual signs of contamination and/or odour
3 = Strong visual signs of contamination and/or odour

COMMENTS:

Environmental Investigations
Contamination Assessment Management & Geotechnical

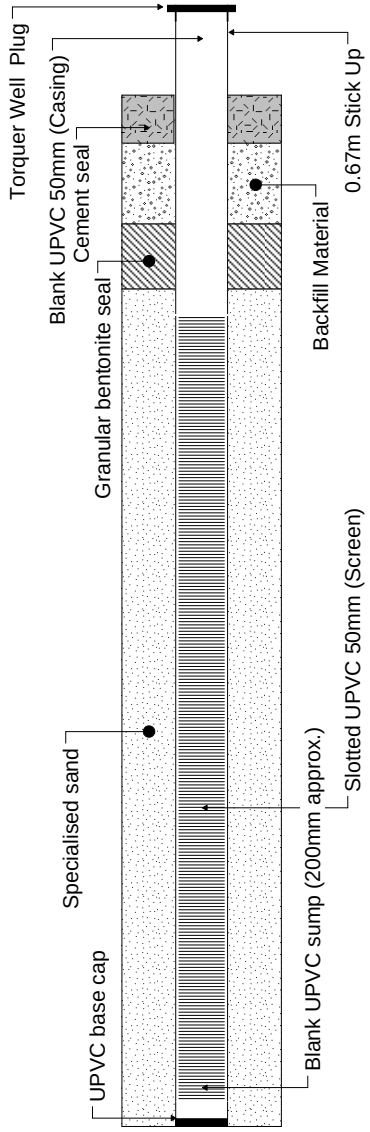
PO Box 215
ST PETERS NSW 2044
Ph: (02) 9516-0722 Fax: (02) 9516-0741

Monitoring Bore: BH6/MW6

Project No: E1836.1
Site Address: 41-45 Belmore Street, Meadowbank, NSW
Client: Holdmark Pty Ltd
Drill Method: Truck Mounted Edson 3000 Rotary Air Drill Rig
Drill date: 07-05-2013

Sheet: 1 of 1
Bore Licence No.:
Hole size: 50mm \ 100mm
Engineer: E.S.
Checked by: E.G.

SUBSURFACE PROFILE

SWL (m)	Depth (m)	Symbol	Description	Bore construction details	Sample ID	FCR	PID Readings (ppm)
2..12m BGL (09-05-13)	-1.00 to 8.80		Ground Surface ***Sandstone*** Orange/brown- light brown/grey, highly weathered with minor clay bands, fine-medium grained, dry-moist, no odour Borehole ended at 8.25m		BH6-1 GW6-1	0 0	

FCR = FIELD CONTAMINATION RANKING

0 = No visual signs of contamination and/or detectable odours
1 = Slight visual signs of contamination and/or odours
2 = Obvious visual signs of contamination and/or odour
3 = Strong visual signs of contamination and/or odour

COMMENTS:

APPENDIX C

BOREHOLE LOGS

BOREHOLE: GW101

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	31/10/13
Position	Refer to site map.	Surface RL	2.58 m	Date Completed	31/10/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90° Hole Dia. 65 mm		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
ADT	M-H		0	0.15				-	FILL: CONCRETE: 150 mm.	-		GW101
				0.25				-	FILL: SAND; medium to coarse grained, poorly graded, light brown-orange.			Gatic Cover in Concrete
				2.33				-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, light brown-orange.			50 mm PVC Pipe in Sand
	L	31/10/13	1		PID 0.50 m 200 ppm GW101-2 D 0.50-0.60 m PID m 200 ppm							50 mm PVC Pipe in Bentonite
				1.50				-	At 1.5 m becoming inferred medium to high strength, inferred distinctly weathered.			
			2	1.08								
			3									
			4							D	-	
Air Hammer			5									50 mm PVC Pipe in Sand
	L-M		6									
				6.50					From 6.5 m grading orange-brown with red mottling, possible irone stone band.			
			7	-3.92								
				7.50					From 7.5 m grading light brown-orange.			
			8	-4.92								
				9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			End cap
			9									
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW102

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	31/10/13
Position	Refer to site map.	Surface RL	3.68 m	Date Completed	31/10/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS
ADT	L-M		0	0.17 3.51				-	FILL: CONCRETE: 170 mm.	-	-	GW102 Gatic Cover in Concrete
								-	FILL: SAND; medium to coarse grained, poorly graded, light brown-orange.			50 mm PVC Pipe in Sand
				0.80 2.88								50 mm PVC Pipe in Bentonite
	M-H		1	1.00 2.68				SC	Clayey SAND; fine to medium grained, poorly graded, red-brown with orange mottling (RESIDUAL SOIL).		L to MD	
								-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, light brown-orange.			
			2	2.00 1.68					From 2.0 m to 3.0 m grading red-brown, possible iron stone band.			
		31/10/13										
			3	3.00 0.68					From 3.0 m grading light brown-orange.			
Air Hammer			4							D		
	L		5								-	50 mm PVC Pipe in Sand
			6									
			7									
			8	8.00 -4.33					At 8.0 m water encountered.	W		
			9	9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			End cap
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW103

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	1/11/13
Position	Refer to site map.	Surface RL	6.61 m	Date Completed	1/11/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level GW103
ADT	L	01/11/13	0	0.12 6.49				-	FILL: CONCRETE: 120 mm.	-		Gatic Cover in Concrete
								-	FILL: SAND; fine to medium grained, poorly graded, brown-dark brown, some fine to medium sub-angular to sub-rounded gravel.			50 mm PVC Pipe in Sand
			1	1.20 5.41				-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, light brown-orange.			50 mm PVC Pipe in Bentonite
	L-M		2									
				2.70 3.91				-	At 2.7 m becoming inferred medium to high strength, inferred distinctly weathered, light brown-orange with red mottling.	D	-	
	M-H		3									
			4									
			5									50 mm PVC Pipe in Sand
			6									
			7	7.00 -0.39					From 7.0 m grading brown-orange.			
			8									
			9	9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			End cap
			10									

GW103

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW104

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 2
Location	Meadowbank, NSW			Date Started	30/10/13
Position	Refer to site map.	Surface RL	3.28 m	Date Completed	30/10/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

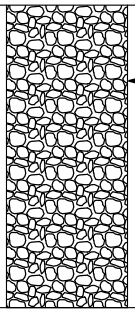
Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
				3.28				-	TOPSOIL/FILL: SAND; fine to medium grained, poorly graded, light grey-grey.	-		GW104
				0.20								
				3.08				-	FILL: Gravelly SAND; fine to medium grained, well graded, light brown-grey, fine to medium sub-angular to sub-rounded sandstone gravel, inferred re-worked natural.			
				0.80								
				2.48					From 0.8 grading light brown-orange.			
	L		1	*1.50*						D	-	Stick upin Concrete
				1.78	SPT 1.50-1.95 m 4,3,6 N=9				From 1.5 sandstone gravel grading fine to coarse, sub-rounded to angular, well graded.			
			2	*2.50*								
		30/10/13		0.78				SC	Clayey SAND; fine to coarse grained, poorly graded, dark brown-black, organic clays present (ALLUVIUM).			50 mm PVC Pipe in Bentonite
			3		SPT 3.00-3.45 m 3,3,5 N=8						L to MD	
					C 3.70-8.80 m					M		
	L-M		4	*4.00*								
				-0.72				Cl-CH	Sandy CLAY; medium to high plasticity, red-brown, fine to medium sand, red-brown with orange mottling. (RESIDUAL SOIL)			
					SPT 4.50-4.95 m 5,6,8 N=14						St	
			5	*5.20*								
				-1.92					At 5.2 m water inflow observed.			50 mm PVC Pipe in Sand
	M-H									W		
			6	*6.10*								
				-2.82	C 6.10-8.80 m			-	SANDSTONE; fine to medium grained, massive to 10-50 mm spacing, bedding dipping 5-10 degrees, <1-5 mm thick, light grey-light brown with iron staining.			End cap
			7									
			8	*8.20*						M		Bentonite
				-4.92				-	CORE LOSS: 600 mm.			
				8.80								Sand
				-5.52	C 8.80-12.00 m			-	CORE LOSS: 600 mm.			
			9	*9.40*								
				-6.12								
				9.60				-	SANDSTONE; fine to medium grained, massive to 10-50 mm spacing, bedding dipping 15-20 degrees, <1-5 mm thick, light brown-orange with iron staining. From 9.6 m grading light grey-orange.			
				-6.32								
			10									
ADT												
NMLC		50-75% Water RETURN										

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW104

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	2 OF 2
Location	Meadowbank, NSW			Date Started	30/10/13
Position	Refer to site map.	Surface RL	3.28 m	Date Completed	30/10/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
NMLC		50-75% Water RETURN	10		C 8.80-12.00 m			-	SANDSTONE; fine to medium grained, massive to 10-50 mm spacing, bedding dipping 15-20 degrees, <1-5 mm thick, light brown-orange with iron staining.	M		GW104  Backfilled Cuttings
			11									
			12	*12.00*					Hole Terminated at 12.00 m Target depth reached, monitoring well installed.			
			13									
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

REPORT OF BOREHOLE: GW104

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 12.00 m

DEPTH RANGE: 6.10 to 11.00 m
DRILL RIG: AUSROC4000
DRILLER: Terratest
LOGGED: SF DATE: 30/10/2013
CHECKED: RE DATE:-

REPORT OF BOREHOLE: GW104

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 12.00 m

DEPTH RANGE: 11.00 to 12.00 m
DRILL RIG: AUSROC4000
DRILLER: Terratest
LOGGED: SF DATE: 30/10/2013
CHECKED: RE DATE:-

BOREHOLE: GW105

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	1/11/13
Position	Refer to site map.	Surface RL	7.09 m	Date Completed	1/11/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
ADT	L	01/11/13	0	0.12 6.97				-	FILL: CONCRETE: 120 mm.	-		GW105
								-	FILL: SAND; fine to medium grained, poorly graded, dark brown-black, trace fine to medium angular to sub-rounded gravel.			Gatic Cover in Concrete
				0.60 6.49				-	FILL: SAND; fine to medium grained, poorly graded, light brown-brown.		-	50 mm PVC Pipe in Sand
			1									
				1.70 5.39				CL-CI	Sandy CLAY; low to medium plasticity, brown-red with grey mottling, fine to medium sand. (RESIDUAL SOIL).	M	S to St	50 mm PVC Pipe in Bentonite
			2									
			3	3.50 3.69 3.49				-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, light brown-orange. At 3.6 m possible ironstone band, 200 mm thick.			
			4									
			5	5.00 2.09				-	At 2.7 m becoming inferred medium to high strength, inferred distinctly weathered.	D	-	50 mm PVC Pipe in Sand
	M-H		6									
			7									
			8	8.00 -0.91					At 8.0 m water inflow observed.	W		
			9	9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			End cap
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW106

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	1/11/13
Position	Refer to site map.	Surface RL	7.48 m	Date Completed	1/11/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level GW106
ADT	L		0	0.10 7.38				-	FILL: SAND; fine to medium grained, poorly graded, dark brown-brown (TOPSOIL).	-		Gatic Cover Concrete
								-	SANDSTONE; inferred very low to low strength, inferred highly to distinctly weathered, light brown-orange.			50 mm PVC Pipe in Bentonite
			1									
			2									
	L-M	01/11/13		2.50 4.98					At 2.5 m becoming inferred low to medium strength, inferred distinctly weathered.			
			3									
			4							D		
				4.50 2.98				-	At 2.7 m becoming inferred medium to high strength, inferred distinctly weathered.		-	50 mm PVC Pipe in Sand
			5									
			6									
	M-H		7									
				8.00 -0.52					At 8.0 m water inflow observed.			
			8							W		
				9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			End Cap
			9									
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW107

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	1/11/13
Position	Refer to site map.	Surface RL	19.45 m	Date Completed	1/11/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
ADT	L		0	0.14 19.31				-	FILL: CONCRETE: 140 mm.	-		GW107
				0.50 18.95				-	FILL: SAND; fine to medium grained, poorly graded, brown-orange, some fine to medium sub-angular to sub-rounded gravel.			
			1					-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, light brown-orange with red mottling.			
	L-M		2									
			3									
			4									
Air Hammer										D	-	
			5	5.00 14.45				-	At 5.0 m becoming inferred medium to high strength, inferred distinctly weathered, brown-red.			
	M-H		6									
			7									
			8									
			9	9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			
			10									

Gatic Cover
Concrete
50 mm PVC Pipe in Bentonite
50 mm PVC Pipe in Sand
End cap

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW108

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 2
Location	Meadowbank, NSW			Date Started	31/10/13
Position	Refer to site map.	Surface RL	17.50 m	Date Completed	31/10/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS
ADT	-		0	0.16				-	FILL: CONCRETE: 155 mm.	-		GW108
				17.35				-	FILL: SAND; medium to coarse grained, poorly graded, brown-dark brown, some fine to medium sub-rounded to sub-angular gravel.	M	-	Gatic Cover in Concrete
	L-M		1	1.20								50 mm PVC Pipe in Sand
				16.30				SP	SAND; medium to coarse grained, poorly graded, light brown-orange.	D to M	L to MD	50 mm PVC Pipe in Bentonite
	M-H			1.70								
NMLC			2	15.80	C 1.70-3.00 m			-	SANDSTONE; fine to coarse grained, massive to 50-150 mm spacing dipping 5-10 degrees, <1-3 mm thick, light brown with iron staining.			
				2.60								
				14.90					CORE LOSS.			
			3	3.00								
				3.15	C 3.00-6.05 m				CORE LOSS.			
				14.35				-	SANDSTONE; fine to medium grained, bedding dipping 5-10 degrees, <1-2 mm thick, 10-50 mm spacing, grey to light brown, with siltstone laminations.			
			4									
			5									
		50-75% Water RETURN	6		C 6.05-9.05 m							50 mm PVC Pipe in Sand
		31/10/13	7									
			8									
			9		C 9.05-12.10 m							
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW108

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	2 OF 2
Location	Meadowbank, NSW			Date Started	31/10/13
Position	Refer to site map.	Surface RL	17.50 m	Date Completed	31/10/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level
NMLC		50-75% Water RETURN	10		C 9.05-12.10 m			-	SANDSTONE; fine to medium grained, bedding dipping 5-10 degrees, <1-2 mm thick, 10-50 mm spacing, grey to light brown, with siltstone laminations.			GW108
			11									End cap Bentonite
			12	12.10								Backfilled Cuttings
									Hole Terminated at 12.10 m Target depth reached, monitoring well installed.			
			13									
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

REPORT OF BOREHOLE: GW108

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 12.10 m

DEPTH RANGE: 1.70 to 6.00 m
DRILL RIG: AUSROC4000
DRILLER: Terratest
LOGGED: SF DATE: 31/10/2013
CHECKED: RE DATE:-

REPORT OF BOREHOLE: GW108

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 12.10 m

DEPTH RANGE: 6.00 to 11.00 m
DRILL RIG: AUSROC4000
DRILLER: Terratest
LOGGED: SF DATE: 31/10/2013
CHECKED: RE DATE:-

REPORT OF BOREHOLE: GW108

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 12.10 m

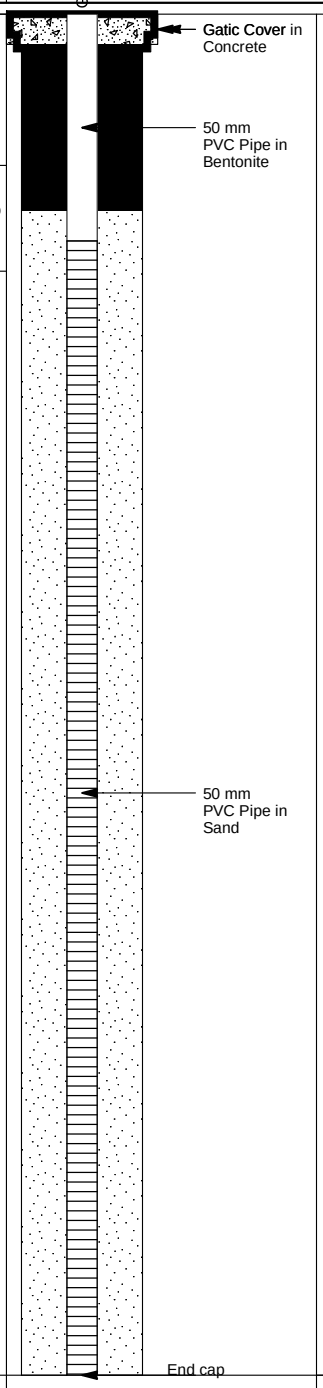
DEPTH RANGE: 11.00 to 12.10 m
DRILL RIG: AUSROC4000
DRILLER: Terratest
LOGGED: SF DATE: 31/10/2013
CHECKED: RE DATE:-

BOREHOLE: GW109

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	1/11/13
Position	Refer to site map.	Surface RL	17.40 m	Date Completed	1/11/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS
ADT	L	01/11/13	0	17.40				-	FILL: Sandy GRAVEL; fine to coarse grained, well graded, brown-grey, fine to medium sand, some brick fragments <30 mm to 200 mm, inferred well compacted (ROADBASE).			ID Static Water Level GW109
				0.20 17.20				-	FILL: Gravelly SAND; fine to medium grained, poorly graded, dark brown-brown, fine to coarse grained angular to sub-rounded gravel.	D	-	
			1	1.00 16.40				CS	Sandy CLAY; low to medium plasticity, dark brown-red with ornage mottling, fine to medium sand, trace fine sub-angular to sub-rounded gravel (RESIDUAL SOIL).	M	S to St	
	L-M			1.70 15.70				-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, light brown-orange.			
			2									
			3	3.50 13.90				-	At 3.5 m becoming inferred medium to high strength, inferred distinctly weathered.			
	H			13.80					At 3.6 m possible ironstone band, 300 mm thick.			
			4									
			5							D	-	
			6									
	M-H											
			7									
				7.50 9.90					From 7.5 m grading to light grey-grey.			
			8									
			9	9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			
			10									



This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW110

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 2
Location	Meadowbank, NSW			Date Started	30/10/13
Position	Refer to site map.	Surface RL	20.80 m	Date Completed	30/10/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
ADT	-		0	0.12				-	FILL: CONCRETE: 120 mm.	-		GW110
				0.30				-	FILL: SAND; fine to medium graiend, poorly graded, light brown-orange.	M		Gatic Cover in Concrete
	L-M			20.50				-	FILL: Sandy CLAY; medium to high plasticity, dark brown-red with black mottling, fine to medium sand, trace sub-rounded to sub-angular gravel, inferred re-worked natural.		-	50 mm PVC Pipe in Sand
			1	1.00								50 mm PVC Pipe in Bentonite
				19.80				CS	Sandy CLAY; medium to high plasticity, red-brown with orange mottling, fine to medium sand (RESIDUAL SOIL).	D to M	S to St	
	M-H			1.95								
			2	18.85	C 1.95-2.60 m			-	SILTSTONE; fine grained, massive to 10-60 mm spacing dipping 5-10 degrees, <1 to 5 mm thick, light grey-orange with iron staining.			
					C 2.60-5.60 m							
		30/10/13	3									
				3.65				-	SANDSTONE; fine to medium grained, massive to 10-100 mm spacing, bedding dipping 5-10 degrees, <1 to 5 mm thick, light grey-light brown with iron staining.			
			4	17.15								
			5	5.25								
				15.55				-	SHALE; bedding dipping 5-10 degrees, <1-3 mm thick, 5-200 mm spacing, light grey-grey.			
					C 5.60-8.60 m							
NMLC		50-75% Water RETURN	6	6.12						-		
				14.68				-	SANDSTONE; fine to medium grained, bedding dipping 5-10 degrees, <1-3 mm thick, 5-30 spacing, orange-light brown.			50 mm PVC Pipe in Sand
			7	7.60								
				13.20					From 6.7 m grading light grey-light brown with iron staining.			
			8									
					C 8.60-11.72 m							
			9									
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW110

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	2 OF 2
Location	Meadowbank, NSW			Date Started	30/10/13
Position	Refer to site map.	Surface RL	20.80 m	Date Completed	30/10/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level GW110
NMLC		50-75% Water RETURN	10		C 8.60-11.72 m			-	SANDSTONE; fine to medium grained, bedding dipping 5-10 degrees, <1-3 mm thick, 5-30 spacing, orange-light brown.	-		End cap
			11	11.72					Hole Terminated at 11.72 m Target depth reached, monitoring well installed.			
			12									
			13									
			14									
			15									
			16									
			17									
			18									
			19									
			20									

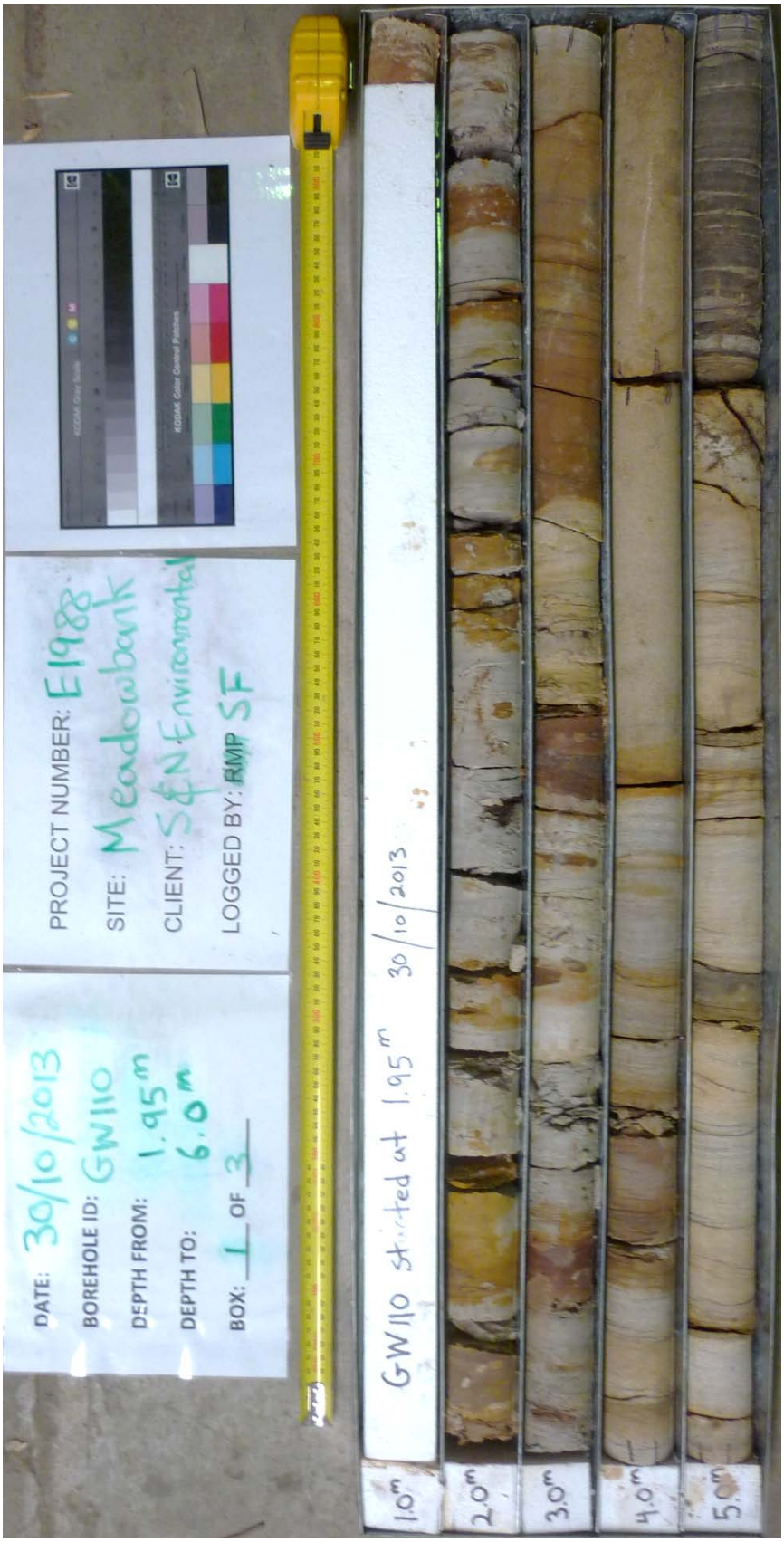
This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

REPORT OF BOREHOLE: GW110

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 11.73 m

DEPTH RANGE: 1.95 to 6.00 m
DRILL RIG: AUSROC4000
DRILLER: Terratest
LOGGED: SF DATE: 30/10/2013
CHECKED: RE DATE:-



REPORT OF BOREHOLE: GW110

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 11.73 m

DEPTH RANGE: 6.00 to 11.00 m
DRILL RIG: AUSROC4000
DRILLER: Terratest
LOGGED: SF DATE: 30/10/2013
CHECKED: RE DATE:-

REPORT OF BOREHOLE: GW110

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 11.73 m

DEPTH RANGE: 11.00 to 11.73 m
DRILL RIG: AUSROC4000
DRILLER: Terratest
LOGGED: SF DATE: 30/10/2013
CHECKED: RE DATE:-

BOREHOLE: GW111

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	1/11/13
Position	Refer to site map.	Surface RL	7.60 m	Date Completed	1/11/13
Job No.	E1988	Contractor	Terratest	Logged	SF Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked	MD Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
ADT	L	01/11/13	0	0.18 / 7.42				-	FILL: ASPHALT: 50 mm.	-		GW111
								-	FILL: CONCRETE: 130 mm.			Gatic Cover in Concrete
			1					-	FILL: SAND; fine to medium grained, poorly graded, dark brown-red, some fine to medium sub-angurlar to sub-rounded gravel.	D		50 mm PVC Pipe in Bentonite
				1.70 / 5.90				-	FILL: Sandy CLAY; low to medium plasticity, dark brown-brown with black mottling, fine to medium sand.		-	50 mm PVC Pipe in Sand
			2									
			3	3.20 / 4.40				CI	CLAY; medium to high plasticity, light brown-red, trace fine sub-rounded to rounded gravel (RESIDUAL SOIL).	M	S to F	50 mm PVC Pipe in Bentonite
	L-M		4									
			5	5.00 / 2.60				CS	Sandy CLAY; low to medium plasticity, brown-red with grey and orange mottling, fine to medium grained sand (RESIDUAL SOIL).		F to St	
			6	6.00 / 1.60				-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, orange-brown with red mottling.	D		50 mm PVC Pipe in Sand
	M-H		7	7.00 / 0.60					At 7.0 m water inflow observed.	W	-	
			8									
			9	9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			End cap
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW112

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	1/11/13
Position	Refer to site map.	Surface RL	11.40 m	Date Completed	1/11/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
ADT	L	01/11/13	0	0.15 11.25				-	FILL: GRAVEL; fine to coarse grained, well graded, grey-dark grey, inferred well compacted.	D		GW112
								-	FILL; Clayey SAND; fine to medium grained, poorly graded, light brown-orange with red mottling.	D to M	-	
			1	1.30 10.10				CS	Sandy CLAY; medium to high plasticity, red-brown with orange mottling, fine to medium sand.		S to F	
	L-M			1.50 9.90				-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, light brown-ornage with red mottling.			
			2	2.00 9.40				-	At 2.0 m becoming inferred medium to high strength, inferred distinctly weathered.			
			3									
			4									
			5							D		
	M-H		6								-	
			7									
			8	8.00 3.40					At 8.0 m water inflow observed.	W		
			9	9.00					Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			
			10									

PIEZOMETER DETAILS
- Gatic Cover in Concrete
- 50 mm PVC Pipe in Sand
- 50 mm PVC Pipe in Bentonite
- 50 mm PVC Pipe in Sand
- End cap

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: GW113

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 1
Location	Meadowbank, NSW			Date Started	1/11/13
Position	Refer to site map.	Surface RL	11.29 m	Date Completed	1/11/13
Job No.	E1988	Contractor	Terratest	Logged SF	Date: 17/1/14
Client	S&N Environmental	Drill Rig	Ausroc 4000 - Truck Mounted	Checked MD	Date: 17/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID / Static Water Level
ADT	L	31/10/13	0	11.29				-	FILL: SAND; fine to medium grained, poorly graded, dark brown-brown.	D	-	GW113
				0.40								Gatic Cover Concrete
				0.50				SP	SAND; fine to medium grained, poorly graded, light brown with orange mottling (RESIDUAL SOIL).		L to MD	50 mm PVC Pipe in Bentonite
				10.79				-	SANDSTONE; inferred low to medium strength, inferred distinctly weathered, light brown-ornage with red mottling, ironstone banding.			
			1									
				2.00								
			2	9.29				-	At 2.0 m becoming inferred medium to high strength, inferred distinctly weathered.			
			3									
			4							D		
	M-H			*4.50*								
				6.79					From 4.5 grading light grey-grey.		-	50 mm PVC Pipe in Sand
			5									
			6									
			7									
				8.00								
			8	3.29					At 8.0 m water inflow observed.	W		
				9.00								End cap
			9						Hole Terminated at 9.00 m Target depth reached, monitoring well installed.			
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: BH04/GW114

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	1 OF 2
Location	Meadowbank, NSW			Date Started	20/11/13
Position	Refer to site map.			Date Completed	20/11/13
Job No.	E1988	Contractor	Traccess	Logged SF	Date: 10/1/14
Client	S&N Environmental	Drill Rig	Multidrill 4000	Checked RE	Date: 10/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS
ADT	L		0		BH04_0.1_0.2 D 0.10-0.20 m			SP	SAND; fine to medium grained, poorly graded, brown-dark brown, with some fine to medium, sub-angular to sub-rounded sandstone gravel, trace roots (TOPSOIL).		L	ID Static Water Level BH04/GW114
				0.40								Steel Monument
	M-H		1		BH04_GEO_0.5_0.6 D 0.50-0.60 m			-	SANDSTONE; inferred extremely low to very low strength, inferred extremely to distinctly weathered, orange-brown.	M to W	-	Stick up in Concrete
				1.20	C 1.20-2.60 m			-	SANDSTONE; fine to coarse grained, massive to 30-150mm spacing, bedding dipping 5-10 degrees, <1-3 mm thick, light grey-orange.			50 mm PVC Pipe in Sand
			2									50 mm PVC Pipe in Bentonite
					C 2.60-4.20 m							
			3									
			4	*4.20*								
					C 4.20-7.20 m				From 4.2 m grading light grey with iron staining.			
				4.50					From 4.5 m fine to medium grained, 10-50 mm spacing, bedding dipping 5-10 degrees, <1-2 mm thick.			
NMLC		50-75% RETURN	5									
			6									50 mm PVC Pipe in Sand
		20/11/13	7		C 7.20-9.90 m							
				8.00					From 8.0 grading orange-brown.			
			8									
			9									End cap
			10									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

BOREHOLE: BH04/GW114

Environmental Investigations Australia
Contamination | Remediation | Geotechnical

Project	Shepherds Bay Urban Renewal Project			Sheet	2 OF 2
Location	Meadowbank, NSW			Date Started	20/11/13
Position	Refer to site map.			Date Completed	20/11/13
Job No.	E1988	Contractor	Traccess	Logged	SF Date: 10/1/14
Client	S&N Environmental	Drill Rig	Multidrill 4000	Checked	RE Date: 10/1/14
		Inclination	-90°		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level
NMLC		50-75% RETURN	10		C 9.90-11.20 m			-	SANDSTONE; fine to coarse grained, massive to 30-150mm spacing, bedding dipping 5-10 degrees, <1-3 mm thick, light grey-orange.			BH04/GW114
			11		C 11.20-12.00 m							
			12	12.00					Hole Terminated at 12.00 m Target depth reached, monitoring well installed.			
			13									
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with Environmental Investigations Australia's accompanying standard notes.

REPORT OF BOREHOLE: BH04

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 12.00 m

DEPTH RANGE: 1.20 to 6.00 m
DRILL RIG: Multidrill - Truck Mounted
DRILLER: Traccess
LOGGED: SF DATE: 20/11/2013
CHECKED: RE DATE:-

REPORT OF BOREHOLE: BH04

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 12.00 m

DEPTH RANGE: 6.00 to 11.00 m
DRILL RIG: Multidrill - Truck Mounted
DRILLER: Traccess
LOGGED: SF DATE: 20/11/2013
CHECKED: RE DATE:-

REPORT OF BOREHOLE: BH04

CLIENT: S&N Environmental
PROJECT: Shepherds Bay
Urban Renewal Projects
LOCATION: Meadowbank, NSW
JOB NO: E1988

COORDS: N/A
DATUM: N/A
SURFACE RL: N/A
INCLINATION: -90°
HOLE DEPTH: 12.00 m

DEPTH RANGE: 11.00 to 12.00 m
DRILL RIG: Multidrill - Truck Mounted
DRILLER: Traccess
LOGGED: SF DATE: 20/11/2013
CHECKED: RE DATE:-

APPENDIX D

Field Data Sheets

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Phone: (02) 9516-0722 Fax: (02) 9516-0741

FIELD DATA SHEET

Project: EI836.1 Sheet: 1 of 2
Site Address: 41-45 Belmore St. Engineer: E.S.
~~Client~~: Meadowbank Sampling Date: 9.5.13

Monitoring Bore ID: 1 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 11.03 mBTOC
Bore Location Description: _____ TOC Stickup +1.02 m (Relative to Ground Level)
Date Purged: 9-5-13 Purging Method: Bailer
SWL Before Purging (m BTOC): 7.092 Time of SWL: _____ Sampling Method: Bailer Time Sample Taken: 12.15pm

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
Pumped	dry	@ 9L.						cloudy to
Recharge	22.3	5.1	320	160	X	112	N	Lt Br/o turbid seds.
								QC's AWB1/GWI-1

Monitoring Bore ID: 2 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 11.03 mBTOC (10.5 TD
Bore Location Description: _____ TOC Stickup +0.98 m (Relative to Ground Level)
Date Purged: _____ Purging Method: _____
SWL Before Purging (m BTOC): 5.879 Time of SWL: _____ Sampling Method: _____ Time Sample Taken: _____

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
10L	pumped	dry.						
Recharge	20.9	6.1	235	131	X	8	N	Lt Br/D. Turbid. seds

Monitoring Bore ID: 3 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9.03 mBTOC
Bore Location Description: _____ TOC Stickup +0.91 m (Relative to Ground Level)
Date Purged: _____ Purging Method: _____
SWL Before Purging (m BTOC): 2.983 Time of SWL: _____ Sampling Method: _____ Time Sample Taken: _____

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
12L	pumped	dry						
Rec	19.1	6.3	205	102	!		N	R/Br Turbid/seds

X DO sensor fail

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FIELD DATA SHEET

Project: E1836.1 Sheet: 2 of 2
Site Address: 41-45 Belmore ST Engineer: ES
Client: Meadowbank Sampling Date: 9-5-13

Monitoring Bore ID: 4 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9.03 mBTOC
Bore Location Description: _____ TOC Stickup +0.88 m (Relative to Ground Level)
Date Purged: _____ Purging Method: _____
SWL Before Purging (m BTOC): 3.363 Time of SWL: _____ Sampling Method: _____ Time Sample Taken: _____

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
13L	purged dry							
Re:	21.6	5.9	360	180	–	55	N	Lt Br / O turbid, sediments

Monitoring Bore ID: 5 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9.025 mBTOC
Bore Location Description: _____ TOC Stickup +0.82 m (Relative to Ground Level)
Date Purged: _____ Purging Method: _____
SWL Before Purging (m BTOC): 3.264 Time of SWL: _____ Sampling Method: _____ Time Sample Taken: _____

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
12L	purged dry.							
Re	22.3	5.8	780	440	–	43	N	Br/R turbid, sediments

Monitoring Bore ID: 6 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 8.915 mBTOC
Bore Location Description: _____ TOC Stickup +0.67 m (Relative to Ground Level)
Date Purged: _____ Purging Method: _____
SWL Before Purging (m BTOC): 2.79 Time of SWL: _____ Sampling Method: _____ Time Sample Taken: _____

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
12L	purged dry							
Re	22.1	6.0	310	150	–	43	N	Br/R turbid, sed.

– DO Gaining

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FIELD DATA SHEET

Project: E2008 Sheet: 1 of 5
Site Address: Shepards Bay Urban Renewal Engineer: ES 11.13
Client: STN Envirn /Holdmark Sampling Date: 28-
2/12/13

Monitoring Bore ID: 101 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 8.98 mBTOC
Bore Location Description: _____ TOC Stickup -0.08 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer / pump
SWL Before Purging (m BTOC): 1.337 Time of SWL: _____ Sampling Method: Low flow Time Sample Taken: 08:45 2/12

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
Purged dry @			34L					
Recharge	20.6	5.3	407	204	1.2	122	N	Lt Grey / opaque.

Monitoring Bore ID: 102 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 8.97 mBTOC
Bore Location Description: _____ TOC Stickup -0.075 m (Relative to Ground Level)
Date Purged: 2.12.13 Purging Method: _____
SWL Before Purging (m BTOC): 2.803 Time of SWL: _____ Sampling Method: Low Flow Time Sample Taken: 0830 2/12

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
Purged dry @			24L					
Re	19.27	4.45	988	494	1.8	137	N	Opaque, Lt. Br/Gy.
								High tide!

Monitoring Bore ID: 103 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9 mBTOC
Bore Location Description: Low gradient, combed weeds TOC Stickup -0.11 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: _____
SWL Before Purging (m BTOC): 4.858 Time of SWL: _____ Sampling Method: Lo Flow Time Sample Taken: 4PM 29/11/13

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
Purged dry @			19L					
Re	21.1	4.7	5951	2978	1.3	139	N	Cr Gy

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FIELD DATA SHEET

Project: E2008 | Sheet: 2 of 5
Site Address: Shepards Bay Urban Renewal | Engineer: ES
Client: SJN Enviro / Haddoard | Sampling Date: 28.11.13

Monitoring Bore ID: 104 Date Drilled: ____ Date Developed: ____ Drilled Depth: ____ mBGL Hole Size: ____ mm Measured Bore Depth: 6.920 mBTOC
Bore Location Description: S-West TOC Stickup: +0.500 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer / pump
SWL Before Purging (m BTOC): 3.558 Time of SWL: ____ Sampling Method: Low flow Time Sample Taken: 10am

Volume Purged (L)	Temp (°C)	pH (units)	EC (us/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y/N)	Sample Description
	1 well vol = 7L							turbid light Br/o.
	Purged Dry @ 15L							
	22.50	5.3	316	158	1.5	86	N	colourless - Lt Br/o opaque
								QCs: GWB-1, GWT-1

Monitoring Bore ID: 105 Date Drilled: ____ Date Developed: ____ Drilled Depth: ____ mBGL Hole Size: ____ mm Measured Bore Depth: 8.55 mBTOC 5ED 9m ?
Bore Location Description: Central west TOC Stickup: -0.09 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer/pump
SWL Before Purging (m BTOC): 2.485 Time of SWL: ____ Sampling Method: low flow Time Sample Taken: 2pm

Volume Purged (L)	Temp (°C)	pH (units)	EC (us/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y/N)	Sample Description
	Purged dry @ 27L							
Re:	24.3	5.3	130	65	1.5	151	N	Light brown, slight turbid.

Monitoring Bore ID: 106 Date Drilled: ____ Date Developed: ____ Drilled Depth: ____ mBGL Hole Size: ____ mm Measured Bore Depth: 9.03 mBTOC
Bore Location Description: central west TOC Stickup: -0.08 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer/pump
SWL Before Purging (m BTOC): 2.830 Time of SWL: ____ Sampling Method: Low flow Time Sample Taken: 2:30pm

Volume Purged (L)	Temp (°C)	pH (units)	EC (us/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y/N)	Sample Description
	Purged Dry @ 19L							
Re	24.6		204	103	3.7	161	N	Lt Br/o.
		5.4						

2.186 7.57 9m?

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FIELD DATA SHEET

Project: F.2008 Sheet: 3 of 5
Site Address: Shepards Bay Urban Renewal Engineer: ES
Client: Holdmark Sampling Date: 28-29/11-2/12/2013,

Monitoring Bore ID: 107 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9.07 mBTOC
Bore Location Description: _____ TOC Stickup _____ m (Relative to Ground Level)
Date Purged: _____ Purging Method: _____
SWL Before Purging (m BTOC): DRY Time of SWL: _____ Sampling Method: _____ Time Sample Taken: _____

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
	DRY!							

Monitoring Bore ID: 108 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9.05 mBTOC
Bore Location Description: _____ TOC Stickup _____ m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer/pump
SWL Before Purging (m BTOC): 6.987 Time of SWL: _____ Sampling Method: Low flow Time Sample Taken: 28.11.13 pm

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
		Purged Dry @ 33L						
Re	20.8	6.2	424	272	5.4	126	N	Lt grey

Monitoring Bore ID: 109 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9.03 mBTOC
Bore Location Description: _____ TOC Stickup -0.10 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer/pump
SWL Before Purging (m BTOC): 2.607 Time of SWL: _____ Sampling Method: Low flow Time Sample Taken: 2.12.13, 3pm

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
	Purged Dry @ 2.5L							
Re	23.4	5.1	614	307	0.7	103	Y	HC sheen, odour
								Grey / thixotr.

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FIELD DATA SHEET

Project: Erosion Sheet: 4 of 5
Site Address: Shepards Bay Urban Renewal Engineer:
Client: Hold Mondo Sampling Date: 28.11.13
2.12.13

Monitoring Bore ID: 110 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9 mBTOC
Bore Location Description: _____ TOC Stickup ~0.1 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer / pump
SWL Before Purging (m BTOC): 3.043 Time of SWL: _____ Sampling Method: Low flow Time Sample Taken: 28.11 PM

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
	Purged Dry @ 4.5L							
Re	24.0	4.4	302	151	1.5	154	N	Lt o/Gy

Monitoring Bore ID: 111 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 7.57 mBTOC 9m SED.
Bore Location Description: NW corner TOC Stickup ~0.1 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer / pump
SWL Before Purging (m BTOC): 2.196 Time of SWL: _____ Sampling Method: Low flow Time Sample Taken: 28.11 PM

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
	Purged Dry @ 20L							
Re	25.4	4.0	371	385	1.1	161	N	Lt Br/O

Monitoring Bore ID: 112 Date Drilled: _____ Date Developed: _____ Drilled Depth: _____mBGL Hole Size: _____mm Measured Bore Depth: 9.070 mBTOC
Bore Location Description: Gatecrawl world carparks TOC Stickup -0.110 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer / pump
SWL Before Purging (m BTOC): 6.650 Time of SWL: _____ Sampling Method: Low flow Time Sample Taken: 2.12.13, 09:20

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y / N)	Sample Description
		Purged Dry @ 15L						
Re	22.5	5.4	280	140	1.6	90	N	Light Grey

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FIELD DATA SHEET

Project: E2008 Sheet: 5 of 5
Site Address: Shepards Bay Urban Renewal Engineer: ES
Client: Holdmark Sampling Date: 2.12.13 28.11.13

Monitoring Bore ID: 113 Date Drilled: ______ Date Developed: ______ Drilled Depth: ______mBGL Hole Size: ______mm Measured Bore Depth: ______mBTOC
Bore Location Description: Golf cart world, under bay TOC Stickup 9.05 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer/pump
SWL Before Purging (m BTOC): 6.00 Time of SWL: ______ Sampling Method: Low flow Time Sample Taken: 2/12 AM

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y/N)	Sample Description
		Purged Dry @ 16L						
Re:	22.5	4.9	770	385	1.3	155	N	Lt Gry/Colourless.

Monitoring Bore ID: 114 Date Drilled: ______ Date Developed: ______ Drilled Depth: ______mBGL Hole Size: ______mm Measured Bore Depth: 9.02 mBTOC
Bore Location Description: Central - On design Kitchens TOC Stickup +0.29 m (Relative to Ground Level)
Date Purged: 27.11.13 Purging Method: Bailer/pump
SWL Before Purging (m BTOC): 7.393 Time of SWL: ______ Sampling Method: Low flow Time Sample Taken: 3.15 Pm 28.11

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y/N)	Sample Description
		Purged Dry @ 9L						
Re	22.5	5.4	393	196	4.6	110	N	Lt Gry/C

Monitoring Bore ID: — Date Drilled: ______ Date Developed: ______ Drilled Depth: ______mBGL Hole Size: ______mm Measured Bore Depth: ______mBTOC
Bore Location Description: ______ TOC Stickup ______ m (Relative to Ground Level)
Date Purged: ______ Purging Method: ______
SWL Before Purging (m BTOC): ______ Time of SWL: ______ Sampling Method: ______ Time Sample Taken: ______

Volume Purged (L)	Temp (°C)	pH (units)	EC (µs/cm) OR mS/cm	TDS (ppm)	DO (mg/L)	Redox (mV)	Odours (Y/N)	Sample Description

7.043
-0.1

APPENDIX E

Laboratory Analytical Reports & CoCs

ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Earin Short	Manager	Huong Crawford
Client	Environmental Investigations	Laboratory	SGS Alexandria Environmental
Address	17 / 1A Coulson Street ERSKINEVILLE NSW 2044	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
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Facsimile	02 9516 0741	Facsimile	+61 2 8594 0499
Email	earin.short@eiaustralia.com.au	Email	au.environmental.sydney@sgs.com
Project	**E2008 - Shephards Bay Urban - Medowbank**	SGS Reference	**SE122902 R0**
Order Number	(Not specified)	Report Number	0000071572
Samples	14	Date Reported	10 Dec 2013
		Date Received	03 Dec 2013

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

SIGNATORIES

Andy Sutton
Senior Organic Chemist

Dong Liang
Metals/Inorganics Team Leader

Huong Crawford
Production Manager

Ly Kim Ha
Organic Section Head

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE122902.001 Water 02 Dec 2013 GW101-1	SE122902.002 Water 02 Dec 2013 GW102-1	SE122902.003 Water 28 Nov 2013 GW103-1	SE122902.004 Water 28 Nov 2013 GW104-1
VOCs in Water Method: AN433/AN434						
Fumigants						
2,2-dichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane (EDB)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Halogenated Aliphatics						
Dichlorodifluoromethane (CFC-12)	µg/L	5	<5	<5	<5	<5
Chloromethane	µg/L	5	<5	<5	<5	<5
Vinyl chloride (Chloroethene)	µg/L	0.3	<0.3	<0.3	<0.3	<0.3
Bromomethane	µg/L	10	<10	<10	<10	<10
Chloroethane	µg/L	5	<5	<5	<5	<5
Trichlorofluoromethane	µg/L	1	<1	<1	<1	<1
Iodomethane	µg/L	5	<5	<5	<5	<5
1,1-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Dichloromethane (Methylene chloride)	µg/L	5	<5	<5	<5	<5
Allyl chloride	µg/L	2	<2	<2	<2	<2
trans-1,2-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-dichloroethene	µg/L	0.5	<0.5	<0.5	**0.7**	<0.5
Bromochloromethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1,1-trichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Carbon tetrachloride	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Dibromomethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene (Trichloroethylene,TCE)	µg/L	0.5	**2.3**	**0.8**	**9.6**	<0.5
1,1,2-trichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene (Perchloroethylene,PCE)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1,1,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
cis-1,4-dichloro-2-butene	µg/L	1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
trans-1,4-dichloro-2-butene	µg/L	1	<1	<1	<1	<1
1,2-dibromo-3-chloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobutadiene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE122902.001 Water 02 Dec 2013 GW101-1	SE122902.002 Water 02 Dec 2013 GW102-1	SE122902.003 Water 28 Nov 2013 GW103-1	SE122902.004 Water 28 Nov 2013 GW104-1
VOCs in Water Method: AN433/AN434 (continued)						
Halogenated Aromatics						
Chlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
2-chlorotoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
4-chlorotoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,4-dichlorobenzene	µg/L	0.3	<0.3	<0.3	<0.3	<0.3
1,2-dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-trichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Monocyclic Aromatic Hydrocarbons						
Benzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Toluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
m/p-xylene	µg/L	1	<1	<1	<1	<1
o-xylene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Styrene (Vinyl benzene)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Isopropylbenzene (Cumene)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
n-propylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
tert-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
sec-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
p-isopropyltoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
n-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Nitrogenous Compounds						
Acrylonitrile	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
2-nitropropane	µg/L	100	<100	<100	<100	<100
Oxygenated Compounds						
Acetone (2-propanone)	µg/L	10	**21**	**19**	**28**	<10
MtBE (Methyl-tert-butyl ether)	µg/L	2	<2	<2	<2	<2
Vinyl acetate	µg/L	10	<10	<10	<10	<10
MEK (2-butanone)	µg/L	10	<10	<10	<10	<10
MIBK (4-methyl-2-pentanone)	µg/L	5	<5	<5	<5	<5
2-hexanone (MBK)	µg/L	5	<5	<5	<5	<5

Parameter	Units	LOR	Sample Number: SE122902.001 Sample Matrix: Water Sample Date: 02 Dec 2013 Sample Name: GW101-1	SE122902.002 Water 02 Dec 2013 GW102-1	SE122902.003 Water 28 Nov 2013 GW103-1	SE122902.004 Water 28 Nov 2013 GW104-1
VOCs in Water Method: AN433/AN434 (continued)						
Polycyclic VOCs						
Naphthalene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Sulphonated Compounds						
Carbon disulfide	µg/L	2	<2	<2	<2	<2
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**93**	**95**	**95**	**99**
d4-1,2-dichloroethane (Surrogate)	%	-	**103**	**106**	**105**	**107**
d8-toluene (Surrogate)	%	-	**88**	**92**	**92**	**91**
Bromofluorobenzene (Surrogate)	%	-	**105**	**106**	**103**	**108**
Totals						
Total Xylenes	µg/L	1.5	<1.5	<1.5	<1.5	<1.5
Total BTEX	µg/L	3	<3	<3	<3	<3
Total VOC	µg/L	10	-	-	-	-
Trihalomethanes						
Chloroform (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromoform (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410						
TRH C6-C10	µg/L	50	<50	<50	<50	<50
TRH C6-C9	µg/L	40	<40	<40	<40	<40
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**106**	**108**	**108**	**112**
d4-1,2-dichloroethane (Surrogate)	%	-	**116**	**120**	**119**	**120**
d8-toluene (Surrogate)	%	-	**107**	**117**	**112**	**109**
Bromofluorobenzene (Surrogate)	%	-	**101**	**100**	**100**	**102**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE122902.001 Water 02 Dec 2013 GW101-1	SE122902.002 Water 02 Dec 2013 GW102-1	SE122902.003 Water 28 Nov 2013 GW103-1	SE122902.004 Water 28 Nov 2013 GW104-1
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410 (continued)						
VPH F Bands						
Benzene (F0)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	<50	<50	<50
TRH (Total Recoverable Hydrocarbons) in Water Method: AN403						
TRH C10-C14	µg/L	50	<50	<50	**65**	<50
TRH C15-C28	µg/L	200	<200	<200	**420**	<200
TRH C29-C36	µg/L	200	<200	<200	<200	<200
TRH C37-C40	µg/L	200	<200	<200	<200	<200
TRH C10-C36	µg/L	450	<450	<450	**490**	<450
TRH C10-C40	µg/L	650	<650	<650	<650	<650
TRH F Bands						
TRH >C10-C16 (F2)	µg/L	60	<60	<60	**95**	<60
TRH >C16-C34 (F3)	µg/L	500	<500	<500	<500	<500
TRH >C34-C40 (F4)	µg/L	500	<500	<500	<500	<500
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420						
Naphthalene	µg/L	0.1	<0.1	<0.1	**3.8**	<0.1
2-methylnaphthalene	µg/L	0.1	<0.1	<0.1	**0.7**	<0.1
1-methylnaphthalene	µg/L	0.1	<0.1	<0.1	**0.5**	<0.1
Acenaphthylene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	0.1	<0.1	**0.2**	**5.0**	<0.1
Fluorene	µg/L	0.1	<0.1	**0.3**	**6.6**	<0.1
Phenanthrene	µg/L	0.1	<0.1	**0.4**	**11**	<0.1
Anthracene	µg/L	0.1	<0.1	<0.1	**1.5**	<0.1
Fluoranthene	µg/L	0.1	<0.1	**0.2**	**0.7**	<0.1
Pyrene	µg/L	0.1	<0.1	<0.1	**0.5**	<0.1
Benzo(a)anthracene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Total PAH (18)	µg/L	1	<1	**1**	**30**	<1
Surrogates						
d5-nitrobenzene (Surrogate)	%	-	**120**	**102**	**119**	**106**
2-fluorobiphenyl (Surrogate)	%	-	**101**	**88**	**95**	**79**
d14-p-terphenyl (Surrogate)	%	-	**116**	**107**	**87**	**77**

Parameter	Units	LOR	Sample Number: SE122902.001 Sample Matrix: Water Sample Date: 02 Dec 2013 Sample Name: GW101-1	SE122902.002 Water 02 Dec 2013 GW102-1	SE122902.003 Water 28 Nov 2013 GW103-1	SE122902.004 Water 28 Nov 2013 GW104-1
Trace Metals (Dissolved) in Water by ICPMS Method: AN318						
Arsenic, As	µg/L	1	<1	<1	**1**	<1
Cadmium, Cd	µg/L	0.1	<0.1	**0.4**	**2.1**	<0.1
Chromium, Cr	µg/L	1	<1	**2**	**24**	<1
Copper, Cu	µg/L	1	**7**	**12**	**10**	**2**
Lead, Pb	µg/L	1	**5**	**28**	**7**	<1
Nickel, Ni	µg/L	1	**4**	**9**	**52**	**12**
Zinc, Zn	µg/L	5	**31**	**51**	**600**	**66**
Mercury (dissolved) in Water Method: AN311/AN312						
Mercury	mg/L	0.0001	**0.0001**	**0.0002**	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE122902.005 Water 28 Nov 2013 GW105-1	SE122902.006 Water 28 Nov 2013 GW106-1	SE122902.007 Water 28 Nov 2013 GW108-1	SE122902.008 Water 02 Dec 2013 GW109-1
VOCs in Water Method: AN433/AN434						
Fumigants						
2,2-dichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane (EDB)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Halogenated Aliphatics						
Dichlorodifluoromethane (CFC-12)	µg/L	5	<5	<5	<5	<5
Chloromethane	µg/L	5	<5	<5	<5	<5
Vinyl chloride (Chloroethene)	µg/L	0.3	<0.3	<0.3	<0.3	<0.3
Bromomethane	µg/L	10	<10	<10	<10	<10
Chloroethane	µg/L	5	<5	<5	<5	<5
Trichlorofluoromethane	µg/L	1	<1	<1	<1	<1
Iodomethane	µg/L	5	<5	<5	<5	<5
1,1-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Dichloromethane (Methylene chloride)	µg/L	5	<5	<5	<5	<5
Allyl chloride	µg/L	2	<2	<2	<2	<2
trans-1,2-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromochloromethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1,1-trichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Carbon tetrachloride	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Dibromomethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene (Trichloroethylene,TCE)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-trichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene (Perchloroethylene,PCE)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,1,1,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
cis-1,4-dichloro-2-butene	µg/L	1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
trans-1,4-dichloro-2-butene	µg/L	1	<1	<1	<1	<1
1,2-dibromo-3-chloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobutadiene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE122902.005 Water 28 Nov 2013 GW105-1	SE122902.006 Water 28 Nov 2013 GW106-1	SE122902.007 Water 28 Nov 2013 GW108-1	SE122902.008 Water 02 Dec 2013 GW109-1
VOCs in Water Method: AN433/AN434 (continued)						
Halogenated Aromatics						
Chlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
2-chlorotoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
4-chlorotoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,4-dichlorobenzene	µg/L	0.3	<0.3	<0.3	<0.3	<0.3
1,2-dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-trichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Monocyclic Aromatic Hydrocarbons						
Benzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Toluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
m/p-xylene	µg/L	1	<1	<1	<1	<1
o-xylene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Styrene (Vinyl benzene)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Isopropylbenzene (Cumene)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
n-propylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
tert-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
sec-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
p-isopropyltoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
n-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Nitrogenous Compounds						
Acrylonitrile	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
2-nitropropane	µg/L	100	<100	<100	<100	<100
Oxygenated Compounds						
Acetone (2-propanone)	µg/L	10	<10	<10	<10	<10
MtBE (Methyl-tert-butyl ether)	µg/L	2	<2	<2	<2	<2
Vinyl acetate	µg/L	10	<10	<10	<10	<10
MEK (2-butanone)	µg/L	10	<10	<10	<10	<10
MIBK (4-methyl-2-pentanone)	µg/L	5	<5	<5	<5	<5
2-hexanone (MBK)	µg/L	5	<5	<5	<5	<5

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE122902.005 Water 28 Nov 2013 GW105-1	SE122902.006 Water 28 Nov 2013 GW106-1	SE122902.007 Water 28 Nov 2013 GW108-1	SE122902.008 Water 02 Dec 2013 GW109-1
VOCs in Water Method: AN433/AN434 (continued)						
Polycyclic VOCs						
Naphthalene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Sulphonated Compounds						
Carbon disulfide	µg/L	2	<2	<2	<2	<2
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**106**	**99**	**104**	**87**
d4-1,2-dichloroethane (Surrogate)	%	-	**113**	**108**	**116**	**91**
d8-toluene (Surrogate)	%	-	**93**	**102**	**96**	**86**
Bromofluorobenzene (Surrogate)	%	-	**113**	**114**	**115**	**107**
Totals						
Total Xylenes	µg/L	1.5	<1.5	<1.5	<1.5	<1.5
Total BTEX	µg/L	3	<3	<3	<3	<3
Total VOC	µg/L	10	-	-	-	-
Trihalomethanes						
Chloroform (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromoform (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410						
TRH C6-C10	µg/L	50	<50	<50	<50	<50
TRH C6-C9	µg/L	40	<40	<40	<40	<40
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**115**	**112**	**118**	**98**
d4-1,2-dichloroethane (Surrogate)	%	-	**112**	**121**	**116**	**94**
d8-toluene (Surrogate)	%	-	**114**	**121**	**120**	**77**
Bromofluorobenzene (Surrogate)	%	-	**106**	**103**	**102**	**115**

Parameter	Units	LOR	Sample Number: SE122902.005 Sample Matrix: Water Sample Date: 28 Nov 2013 Sample Name: GW105-1	SE122902.006 Water 28 Nov 2013 GW106-1	SE122902.007 Water 28 Nov 2013 GW108-1	SE122902.008 Water 02 Dec 2013 GW109-1
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410 (continued)						
VPH F Bands						
Benzene (F0)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	<50	<50	<50
TRH (Total Recoverable Hydrocarbons) in Water Method: AN403						
TRH C10-C14	µg/L	50	<50	<50	<50	<50
TRH C15-C28	µg/L	200	<200	<200	<200	<200
TRH C29-C36	µg/L	200	<200	<200	<200	<200
TRH C37-C40	µg/L	200	<200	<200	<200	<200
TRH C10-C36	µg/L	450	<450	<450	<450	<450
TRH C10-C40	µg/L	650	<650	<650	<650	<650
TRH F Bands						
TRH >C10-C16 (F2)	µg/L	60	<60	<60	<60	<60
TRH >C16-C34 (F3)	µg/L	500	<500	<500	<500	<500
TRH >C34-C40 (F4)	µg/L	500	<500	<500	<500	<500
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420						
Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	0.1	**0.1**	<0.1	<0.1	<0.1
Fluorene	µg/L	0.1	**0.2**	<0.1	<0.1	<0.1
Phenanthrene	µg/L	0.1	**0.4**	**0.1**	<0.1	<0.1
Anthracene	µg/L	0.1	**0.1**	<0.1	<0.1	<0.1
Fluoranthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Total PAH (18)	µg/L	1	**1**	<1	<1	<1
Surrogates						
d5-nitrobenzene (Surrogate)	%	-	**113**	**116**	**120**	**114**
2-fluorobiphenyl (Surrogate)	%	-	**92**	**85**	**97**	**87**
d14-p-terphenyl (Surrogate)	%	-	**76**	**77**	**72**	**126**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE122902.005 Water 28 Nov 2013 GW105-1	SE122902.006 Water 28 Nov 2013 GW106-1	SE122902.007 Water 28 Nov 2013 GW108-1	SE122902.008 Water 02 Dec 2013 GW109-1
Trace Metals (Dissolved) in Water by ICPMS Method: AN318							
Arsenic, As	µg/L	1		<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1		**0.3**	**0.2**	**0.2**	**1.8**
Chromium, Cr	µg/L	1		<1	<1	**2**	**4**
Copper, Cu	µg/L	1		**4**	**9**	**4**	**9**
Lead, Pb	µg/L	1		<1	<1	<1	**1**
Nickel, Ni	µg/L	1		**2**	**13**	**10**	**23**
Zinc, Zn	µg/L	5		**21**	**50**	**23**	**61**
Mercury (dissolved) in Water Method: AN311/AN312							
Mercury	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE122902.009 Water 28 Nov 2013 GW110-1	SE122902.010 Water 28 Nov 2013 GW111-1	SE122902.011 Water 02 Dec 2013 GW112-1	SE122902.012 Water 02 Dec 2013 GW113-1
VOCs in Water Method: AN433/AN434							
Fumigants							
2,2-dichloropropane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane (EDB)	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Halogenated Aliphatics							
Dichlorodifluoromethane (CFC-12)	µg/L	5		<5	<5	<5	<5
Chloromethane	µg/L	5		<5	<5	<5	<5
Vinyl chloride (Chloroethene)	µg/L	0.3		<0.3	<0.3	<0.3	<0.3
Bromomethane	µg/L	10		<10	<10	<10	<10
Chloroethane	µg/L	5		<5	<5	<5	<5
Trichlorofluoromethane	µg/L	1		<1	<1	<1	<1
Iodomethane	µg/L	5		<5	<5	<5	<5
1,1-dichloroethene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Dichloromethane (Methylene chloride)	µg/L	5		<5	<5	<5	<5
Allyl chloride	µg/L	2		<2	<2	<2	<2
trans-1,2-dichloroethene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
cis-1,2-dichloroethene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Bromochloromethane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,1,1-trichloroethane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,1-dichloropropene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Carbon tetrachloride	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Dibromomethane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Trichloroethene (Trichloroethylene,TCE)	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,1,2-trichloroethane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,3-dichloropropane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Tetrachloroethene (Perchloroethylene,PCE)	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,1,1,2-tetrachloroethane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
cis-1,4-dichloro-2-butene	µg/L	1		<1	<1	<1	<1
1,1,2,2-tetrachloroethane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
1,2,3-trichloropropane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
trans-1,4-dichloro-2-butene	µg/L	1		<1	<1	<1	<1
1,2-dibromo-3-chloropropane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Hexachlorobutadiene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE122902.009 Water 28 Nov 2013 GW110-1	SE122902.010 Water 28 Nov 2013 GW111-1	SE122902.011 Water 02 Dec 2013 GW112-1	SE122902.012 Water 02 Dec 2013 GW113-1
VOCs in Water Method: AN433/AN434 (continued)						
Halogenated Aromatics						
Chlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
2-chlorotoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
4-chlorotoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,4-dichlorobenzene	µg/L	0.3	<0.3	<0.3	<0.3	<0.3
1,2-dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-trichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Monocyclic Aromatic Hydrocarbons						
Benzene	µg/L	0.5	<0.5	<0.5	<0.5	**0.6**
Toluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	**0.7**
m/p-xylene	µg/L	1	<1	<1	<1	<1
o-xylene	µg/L	0.5	<0.5	<0.5	<0.5	**0.6**
Styrene (Vinyl benzene)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Isopropylbenzene (Cumene)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
n-propylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
tert-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
sec-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
p-isopropyltoluene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
n-butylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Nitrogenous Compounds						
Acrylonitrile	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
2-nitropropane	µg/L	100	<100	<100	<100	<100
Oxygenated Compounds						
Acetone (2-propanone)	µg/L	10	<10	<10	<10	**29**
MtBE (Methyl-tert-butyl ether)	µg/L	2	<2	<2	<2	<2
Vinyl acetate	µg/L	10	<10	<10	<10	<10
MEK (2-butanone)	µg/L	10	<10	<10	<10	<10
MIBK (4-methyl-2-pentanone)	µg/L	5	<5	<5	<5	<5
2-hexanone (MBK)	µg/L	5	<5	<5	<5	<5

Parameter	Units	LOR	Sample Number: SE122902.009 Sample Matrix: Water Sample Date: 28 Nov 2013 Sample Name: GW110-1	SE122902.010 Water 28 Nov 2013 GW111-1	SE122902.011 Water 02 Dec 2013 GW112-1	SE122902.012 Water 02 Dec 2013 GW113-1
VOCs in Water Method: AN433/AN434 (continued)						
Polycyclic VOCs						
Naphthalene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Sulphonated Compounds						
Carbon disulfide	µg/L	2	<2	<2	<2	<2
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**102**	**108**	**101**	**102**
d4-1,2-dichloroethane (Surrogate)	%	-	**111**	**118**	**107**	**109**
d8-toluene (Surrogate)	%	-	**101**	**92**	**100**	**98**
Bromofluorobenzene (Surrogate)	%	-	**118**	**112**	**120**	**110**
Totals						
Total Xylenes	µg/L	1.5	<1.5	<1.5	<1.5	<1.5
Total BTEX	µg/L	3	<3	<3	<3	<3
Total VOC	µg/L	10	-	-	-	-
Trihalomethanes						
Chloroform (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Bromoform (THM)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410						
TRH C6-C10	µg/L	50	<50	<50	<50	<50
TRH C6-C9	µg/L	40	<40	<40	<40	<40
Surrogates						
Dibromofluoromethane (Surrogate)	%	-	**116**	**118**	**115**	**116**
d4-1,2-dichloroethane (Surrogate)	%	-	**111**	**117**	**120**	**116**
d8-toluene (Surrogate)	%	-	**112**	**111**	**119**	**112**
Bromofluorobenzene (Surrogate)	%	-	**100**	**113**	**103**	**99**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE122902.009 Water 28 Nov 2013 GW110-1	SE122902.010 Water 28 Nov 2013 GW111-1	SE122902.011 Water 02 Dec 2013 GW112-1	SE122902.012 Water 02 Dec 2013 GW113-1
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410 (continued)							
VPH F Bands							
Benzene (F0)	µg/L	0.5		<0.5	<0.5	<0.5	**0.6**
TRH C6-C10 minus BTEX (F1)	µg/L	50		<50	<50	<50	<50
TRH (Total Recoverable Hydrocarbons) in Water Method: AN403							
TRH C10-C14	µg/L	50		<50	<50	<50	<50
TRH C15-C28	µg/L	200		<200	<200	<200	<200
TRH C29-C36	µg/L	200		<200	<200	<200	<200
TRH C37-C40	µg/L	200		<200	<200	<200	<200
TRH C10-C36	µg/L	450		<450	<450	<450	<450
TRH C10-C40	µg/L	650		<650	<650	<650	<650
TRH F Bands							
TRH >C10-C16 (F2)	µg/L	60		<60	<60	<60	<60
TRH >C16-C34 (F3)	µg/L	500		<500	<500	<500	<500
TRH >C34-C40 (F4)	µg/L	500		<500	<500	<500	<500
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420							
Naphthalene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	0.1		<0.1	**0.2**	<0.1	**0.1**
Phenanthrene	µg/L	0.1		**0.2**	**0.8**	<0.1	**0.2**
Anthracene	µg/L	0.1		<0.1	**0.1**	<0.1	<0.1
Fluoranthene	µg/L	0.1		<0.1	**0.2**	**0.1**	**0.2**
Pyrene	µg/L	0.1		<0.1	**0.1**	<0.1	**0.1**
Benzo(a)anthracene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Total PAH (18)	µg/L	1		<1	**2**	<1	<1
Surrogates							
d5-nitrobenzene (Surrogate)	%	-		**122**	**109**	**118**	**123**
2-fluorobiphenyl (Surrogate)	%	-		**82**	**85**	**104**	**85**
d14-p-terphenyl (Surrogate)	%	-		**61**	**63**	**125**	**111**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE122902.009 Water 28 Nov 2013 GW110-1	SE122902.010 Water 28 Nov 2013 GW111-1	SE122902.011 Water 02 Dec 2013 GW112-1	SE122902.012 Water 02 Dec 2013 GW113-1
Trace Metals (Dissolved) in Water by ICPMS Method: AN318						
Arsenic, As	µg/L	1	**3**	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	**0.7**	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	**11**	**15**	**7**	**19**
Lead, Pb	µg/L	1	**1**	**13**	<1	**1**
Nickel, Ni	µg/L	1	**14**	**8**	**15**	**19**
Zinc, Zn	µg/L	5	**38**	**72**	**46**	**130**
Mercury (dissolved) in Water Method: AN311/AN312						
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number SE122902.013 Sample Matrix Water Sample Date 28 Nov 2013 Sample Name GW114-1	SE122902.014 Water 28 Nov 2013 GWB-1
VOCs in Water Method: AN433/AN434				
Fumigants				
2,2-dichloropropane	µg/L	0.5	<0.5	-
1,2-dichloropropane	µg/L	0.5	<0.5	-
cis-1,3-dichloropropene	µg/L	0.5	<0.5	-
trans-1,3-dichloropropene	µg/L	0.5	<0.5	-
1,2-dibromoethane (EDB)	µg/L	0.5	<0.5	-
Halogenated Aliphatics				
Dichlorodifluoromethane (CFC-12)	µg/L	5	<5	-
Chloromethane	µg/L	5	<5	-
Vinyl chloride (Chloroethene)	µg/L	0.3	<0.3	-
Bromomethane	µg/L	10	<10	-
Chloroethane	µg/L	5	<5	-
Trichlorofluoromethane	µg/L	1	<1	-
Iodomethane	µg/L	5	<5	-
1,1-dichloroethene	µg/L	0.5	<0.5	-
Dichloromethane (Methylene chloride)	µg/L	5	<5	-
Allyl chloride	µg/L	2	<2	-
trans-1,2-dichloroethene	µg/L	0.5	<0.5	-
1,1-dichloroethane	µg/L	0.5	<0.5	-
cis-1,2-dichloroethene	µg/L	0.5	<0.5	-
Bromochloromethane	µg/L	0.5	<0.5	-
1,2-dichloroethane	µg/L	0.5	<0.5	-
1,1,1-trichloroethane	µg/L	0.5	<0.5	-
1,1-dichloropropene	µg/L	0.5	<0.5	-
Carbon tetrachloride	µg/L	0.5	<0.5	-
Dibromomethane	µg/L	0.5	<0.5	-
Trichloroethene (Trichloroethylene,TCE)	µg/L	0.5	<0.5	-
1,1,2-trichloroethane	µg/L	0.5	<0.5	-
1,3-dichloropropane	µg/L	0.5	<0.5	-
Tetrachloroethene (Perchloroethylene,PCE)	µg/L	0.5	<0.5	-
1,1,1,2-tetrachloroethane	µg/L	0.5	<0.5	-
cis-1,4-dichloro-2-butene	µg/L	1	<1	-
1,1,2,2-tetrachloroethane	µg/L	0.5	<0.5	-
1,2,3-trichloropropane	µg/L	0.5	<0.5	-
trans-1,4-dichloro-2-butene	µg/L	1	<1	-
1,2-dibromo-3-chloropropane	µg/L	0.5	<0.5	-
Hexachlorobutadiene	µg/L	0.5	<0.5	-

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE122902.013 Water 28 Nov 2013 GW114-1	SE122902.014 Water 28 Nov 2013 GWB-1
VOCs in Water Method: AN433/AN434 (continued)					
Halogenated Aromatics					
Chlorobenzene	µg/L	0.5		<0.5	-
Bromobenzene	µg/L	0.5		<0.5	-
2-chlorotoluene	µg/L	0.5		<0.5	-
4-chlorotoluene	µg/L	0.5		<0.5	-
1,3-dichlorobenzene	µg/L	0.5		<0.5	-
1,4-dichlorobenzene	µg/L	0.3		<0.3	-
1,2-dichlorobenzene	µg/L	0.5		<0.5	-
1,2,4-trichlorobenzene	µg/L	0.5		<0.5	-
1,2,3-trichlorobenzene	µg/L	0.5		<0.5	-
Monocyclic Aromatic Hydrocarbons					
Benzene	µg/L	0.5		<0.5	<0.5
Toluene	µg/L	0.5		<0.5	<0.5
Ethylbenzene	µg/L	0.5		<0.5	<0.5
m/p-xylene	µg/L	1		<1	<1
o-xylene	µg/L	0.5		<0.5	<0.5
Styrene (Vinyl benzene)	µg/L	0.5		<0.5	-
Isopropylbenzene (Cumene)	µg/L	0.5		<0.5	-
n-propylbenzene	µg/L	0.5		<0.5	-
1,3,5-trimethylbenzene	µg/L	0.5		<0.5	-
tert-butylbenzene	µg/L	0.5		<0.5	-
1,2,4-trimethylbenzene	µg/L	0.5		<0.5	-
sec-butylbenzene	µg/L	0.5		<0.5	-
p-isopropyltoluene	µg/L	0.5		<0.5	-
n-butylbenzene	µg/L	0.5		<0.5	-
Nitrogenous Compounds					
Acrylonitrile	µg/L	0.5		<0.5	-
2-nitropropane	µg/L	100		<100	-
Oxygenated Compounds					
Acetone (2-propanone)	µg/L	10		<10	-
MtBE (Methyl-tert-butyl ether)	µg/L	2		<2	-
Vinyl acetate	µg/L	10		<10	-
MEK (2-butanone)	µg/L	10		<10	-
MIBK (4-methyl-2-pentanone)	µg/L	5		<5	-
2-hexanone (MBK)	µg/L	5		<5	-

Parameter	Units	LOR	Sample Number: SE122902.013 Sample Matrix: Water Sample Date: 28 Nov 2013 Sample Name: GW114-1	Sample Number: SE122902.014 Sample Matrix: Water Sample Date: 28 Nov 2013 Sample Name: GWB-1
VOCs in Water Method: AN433/AN434 (continued)				
Polycyclic VOCs				
Naphthalene	µg/L	0.5	<0.5	<0.5
Sulphonated Compounds				
Carbon disulfide	µg/L	2	<2	-
Surrogates				
Dibromofluoromethane (Surrogate)	%	-	**103**	**103**
d4-1,2-dichloroethane (Surrogate)	%	-	**112**	**113**
d8-toluene (Surrogate)	%	-	**99**	**93**
Bromofluorobenzene (Surrogate)	%	-	**111**	**112**
Totals				
Total Xylenes	µg/L	1.5	<1.5	<1.5
Total BTEX	µg/L	3	<3	<3
Total VOC	µg/L	10	-	-
Trihalomethanes				
Chloroform (THM)	µg/L	0.5	<0.5	-
Bromodichloromethane (THM)	µg/L	0.5	<0.5	-
Dibromochloromethane (THM)	µg/L	0.5	<0.5	-
Bromoform (THM)	µg/L	0.5	<0.5	-
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410				
TRH C6-C10	µg/L	50	<50	<50
TRH C6-C9	µg/L	40	<40	<40
Surrogates				
Dibromofluoromethane (Surrogate)	%	-	**116**	**118**
d4-1,2-dichloroethane (Surrogate)	%	-	**119**	**120**
d8-toluene (Surrogate)	%	-	**116**	**111**
Bromofluorobenzene (Surrogate)	%	-	**101**	**102**

Parameter	Units	LOR	Sample Number: SE122902.013 Sample Matrix: Water Sample Date: 28 Nov 2013 Sample Name: GW114-1	Sample Number: SE122902.014 Sample Matrix: Water Sample Date: 28 Nov 2013 Sample Name: GWB-1
Volatile Petroleum Hydrocarbons in Water Method: AN433/AN434/AN410 (continued)				
VPH F Bands				
Benzene (F0)	µg/L	0.5	<0.5	<0.5
TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	<50
TRH (Total Recoverable Hydrocarbons) in Water Method: AN403				
TRH C10-C14	µg/L	50	<50	<50
TRH C15-C28	µg/L	200	<200	<200
TRH C29-C36	µg/L	200	<200	<200
TRH C37-C40	µg/L	200	<200	<200
TRH C10-C36	µg/L	450	<450	<450
TRH C10-C40	µg/L	650	<650	<650
TRH F Bands				
TRH >C10-C16 (F2)	µg/L	60	<60	<60
TRH >C16-C34 (F3)	µg/L	500	<500	<500
TRH >C34-C40 (F4)	µg/L	500	<500	<500
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420				
Naphthalene	µg/L	0.1	<0.1	-
2-methylnaphthalene	µg/L	0.1	<0.1	-
1-methylnaphthalene	µg/L	0.1	<0.1	-
Acenaphthylene	µg/L	0.1	<0.1	-
Acenaphthene	µg/L	0.1	<0.1	-
Fluorene	µg/L	0.1	<0.1	-
Phenanthrene	µg/L	0.1	<0.1	-
Anthracene	µg/L	0.1	<0.1	-
Fluoranthene	µg/L	0.1	<0.1	-
Pyrene	µg/L	0.1	<0.1	-
Benzo(a)anthracene	µg/L	0.1	<0.1	-
Chrysene	µg/L	0.1	<0.1	-
Benzo(b&j)fluoranthene	µg/L	0.1	<0.1	-
Benzo(k)fluoranthene	µg/L	0.1	<0.1	-
Benzo(a)pyrene	µg/L	0.1	<0.1	-
Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1	-
Dibenzo(a&h)anthracene	µg/L	0.1	<0.1	-
Benzo(ghi)perylene	µg/L	0.1	<0.1	-
Total PAH (18)	µg/L	1	<1	-

Parameter	Units	LOR	Sample Number: SE122902.013 Sample Matrix: Water Sample Date: 28 Nov 2013 Sample Name: GW114-1	Sample Number: SE122902.014 Sample Matrix: Water Sample Date: 28 Nov 2013 Sample Name: GWB-1
PAH (Polynuclear Aromatic Hydrocarbons) in Water Method: AN420 (continued)				
Surrogates				
d5-nitrobenzene (Surrogate)	%	-	**113**	-
2-fluorobiphenyl (Surrogate)	%	-	**87**	-
d14-p-terphenyl (Surrogate)	%	-	**60**	-
Trace Metals (Dissolved) in Water by ICPMS Method: AN318				
Arsenic, As	µg/L	1	<1	<1
Cadmium, Cd	µg/L	0.1	**0.2**	<0.1
Chromium, Cr	µg/L	1	<1	<1
Copper, Cu	µg/L	1	**2**	**2**
Lead, Pb	µg/L	1	<1	<1
Nickel, Ni	µg/L	1	**7**	**8**
Zinc, Zn	µg/L	5	**38**	**58**
Mercury (dissolved) in Water Method: AN311/AN312				
Mercury	mg/L	0.0001	<0.0001	<0.0001

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 (dissolved) in Water **Method: ME-(AU)-[ENV]AN311/AN312**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB049256	mg/L	0.0001	<0.0001	29 - 72%	103%	99%

PAH (Polynuclear Aromatic Hydrocarbons) in Water **Method: ME-(AU)-[ENV]AN420**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Naphthalene	LB049100	µg/L	0.1	<0.1	0%	91%
2-methylnaphthalene	LB049100	µg/L	0.1	<0.1	0%	NA
1-methylnaphthalene	LB049100	µg/L	0.1	<0.1	0%	NA
Acenaphthylene	LB049100	µg/L	0.1	<0.1	0%	95%
Acenaphthene	LB049100	µg/L	0.1	<0.1	0%	90%
Fluorene	LB049100	µg/L	0.1	<0.1	0%	NA
Phenanthrene	LB049100	µg/L	0.1	<0.1	0%	87%
Anthracene	LB049100	µg/L	0.1	<0.1	0%	84%
Fluoranthene	LB049100	µg/L	0.1	<0.1	0%	91%
Pyrene	LB049100	µg/L	0.1	<0.1	0%	84%
Benzo(a)anthracene	LB049100	µg/L	0.1	<0.1	0%	NA
Chrysene	LB049100	µg/L	0.1	<0.1	0%	NA
Benzo(b&j)fluoranthene	LB049100	µg/L	0.1	<0.1	0%	NA
Benzo(k)fluoranthene	LB049100	µg/L	0.1	<0.1	0%	NA
Benzo(a)pyrene	LB049100	µg/L	0.1	<0.1	0%	109%
Indeno(1,2,3-cd)pyrene	LB049100	µg/L	0.1	<0.1	0%	NA
Dibenzo(a&h)anthracene	LB049100	µg/L	0.1	<0.1	0%	NA
Benzo(ghi)perylene	LB049100	µg/L	0.1	<0.1	0%	NA
Total PAH (18)	LB049100	µg/L	1	<1		

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
d5-nitrobenzene (Surrogate)	LB049100	%	-	114%	12%	114%
2-fluorobiphenyl (Surrogate)	LB049100	%	-	98%	11%	96%
d14-p-terphenyl (Surrogate)	LB049100	%	-	102%	1%	98%

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.

Trace Metals (Dissolved) in Water by ICPMS Method: ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Arsenic, As	LB049267	µg/L	1	<1	0%	93%	96%
Cadmium, Cd	LB049267	µg/L	0.1	<0.1	0 - 2%	97%	100%
Chromium, Cr	LB049267	µg/L	1	<1	0%	100%	101%
Copper, Cu	LB049267	µg/L	1	<1	2 - 5%	102%	98%
Lead, Pb	LB049267	µg/L	1	<1	0 - 1%	97%	99%
Nickel, Ni	LB049267	µg/L	1	<1	4 - 8%	101%	100%
Zinc, Zn	LB049267	µg/L	5	<5	2 - 3%	100%	102%

TRH (Total Recoverable Hydrocarbons) in Water Method: ME-(AU)-[ENV]AN403

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
TRH C10-C14	LB049100	µg/L	50	<50	0%	93%
TRH C15-C28	LB049100	µg/L	200	<200	0%	96%
TRH C29-C36	LB049100	µg/L	200	<200	0%	95%
TRH C37-C40	LB049100	µg/L	200	<200	0%	NA
TRH C10-C36	LB049100	µg/L	450	<450	0%	NA
TRH C10-C40	LB049100	µg/L	650	<650	0%	NA

TRH F Bands

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
TRH >C10-C16 (F2)	LB049100	µg/L	60	<60	0%	94%
TRH >C16-C34 (F3)	LB049100	µg/L	500	<500	0%	95%
TRH >C34-C40 (F4)	LB049100	µg/L	500	<500	0%	95%

VOCs in Water Method: ME-(AU)-[ENV]AN433/AN434

Fumigants

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
2,2-dichloropropane	LB049077	µg/L	0.5	<0.5	NA
1,2-dichloropropane	LB049077	µg/L	0.5	<0.5	NA
cis-1,3-dichloropropene	LB049077	µg/L	0.5	<0.5	NA
trans-1,3-dichloropropene	LB049077	µg/L	0.5	<0.5	NA
1,2-dibromoethane (EDB)	LB049077	µg/L	0.5	<0.5	NA

Halogenated Aliphatics

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Dichlorodifluoromethane (CFC-12)	LB049077	µg/L	5	<5	NA
Chloromethane	LB049077	µg/L	5	<5	NA
Vinyl chloride (Chloroethene)	LB049077	µg/L	0.3	<0.3	NA
Bromomethane	LB049077	µg/L	10	<10	NA
Chloroethane	LB049077	µg/L	5	<5	NA
Trichlorofluoromethane	LB049077	µg/L	1	<1	NA
Iodomethane	LB049077	µg/L	5	<5	NA
1,1-dichloroethene	LB049077	µg/L	0.5	<0.5	95%
Dichloromethane (Methylene chloride)	LB049077	µg/L	5	<5	NA
Allyl chloride	LB049077	µg/L	2	<2	NA
trans-1,2-dichloroethene	LB049077	µg/L	0.5	<0.5	NA
1,1-dichloroethane	LB049077	µg/L	0.5	<0.5	NA
cis-1,2-dichloroethene	LB049077	µg/L	0.5	<0.5	NA
Bromochloromethane	LB049077	µg/L	0.5	<0.5	NA
1,2-dichloroethane	LB049077	µg/L	0.5	<0.5	102%
1,1,1-trichloroethane	LB049077	µg/L	0.5	<0.5	NA
1,1-dichloropropene	LB049077	µg/L	0.5	<0.5	NA
Carbon tetrachloride	LB049077	µg/L	0.5	<0.5	NA
Dibromomethane	LB049077	µg/L	0.5	<0.5	NA
Trichloroethene (Trichloroethylene,TCE)	LB049077	µg/L	0.5	<0.5	120%

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.

VOCs in Water **Method: ME-(AU)-[ENV]AN433/AN434 (continued)**

				MB	LCS %Recovery
1,1,2-trichloroethane	LB049077	µg/L	0.5	<0.5	NA
1,3-dichloropropane	LB049077	µg/L	0.5	<0.5	NA
Tetrachloroethene (Perchloroethylene,PCE)	LB049077	µg/L	0.5	<0.5	NA
1,1,1,2-tetrachloroethane	LB049077	µg/L	0.5	<0.5	NA
cis-1,4-dichloro-2-butene	LB049077	µg/L	1	<1	NA
1,1,2,2-tetrachloroethane	LB049077	µg/L	0.5	<0.5	NA
1,2,3-trichloropropane	LB049077	µg/L	0.5	<0.5	NA
trans-1,4-dichloro-2-butene	LB049077	µg/L	1	<1	NA
1,2-dibromo-3-chloropropane	LB049077	µg/L	0.5	<0.5	NA
Hexachlorobutadiene	LB049077	µg/L	0.5	<0.5	NA

Halogenated Aromatics

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Chlorobenzene	LB049077	µg/L	0.5	<0.5	117%
Bromobenzene	LB049077	µg/L	0.5	<0.5	NA
2-chlorotoluene	LB049077	µg/L	0.5	<0.5	NA
4-chlorotoluene	LB049077	µg/L	0.5	<0.5	NA
1,3-dichlorobenzene	LB049077	µg/L	0.5	<0.5	NA
1,4-dichlorobenzene	LB049077	µg/L	0.3	<0.3	NA
1,2-dichlorobenzene	LB049077	µg/L	0.5	<0.5	NA
1,2,4-trichlorobenzene	LB049077	µg/L	0.5	<0.5	NA
1,2,3-trichlorobenzene	LB049077	µg/L	0.5	<0.5	NA

Monocyclic Aromatic Hydrocarbons

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Benzene	LB049077	µg/L	0.5	<0.5	122%
Toluene	LB049077	µg/L	0.5	<0.5	119%
Ethylbenzene	LB049077	µg/L	0.5	<0.5	125%
m/p-xylene	LB049077	µg/L	1	<1	119%
o-xylene	LB049077	µg/L	0.5	<0.5	119%
Styrene (Vinyl benzene)	LB049077	µg/L	0.5	<0.5	NA
Isopropylbenzene (Cumene)	LB049077	µg/L	0.5	<0.5	NA
n-propylbenzene	LB049077	µg/L	0.5	<0.5	NA
1,3,5-trimethylbenzene	LB049077	µg/L	0.5	<0.5	NA
tert-butylbenzene	LB049077	µg/L	0.5	<0.5	NA
1,2,4-trimethylbenzene	LB049077	µg/L	0.5	<0.5	NA
sec-butylbenzene	LB049077	µg/L	0.5	<0.5	NA
p-isopropyltoluene	LB049077	µg/L	0.5	<0.5	NA
n-butylbenzene	LB049077	µg/L	0.5	<0.5	NA

Nitrogenous Compounds

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Acrylonitrile	LB049077	µg/L	0.5	<0.5	NA

Oxygenated Compounds

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Acetone (2-propanone)	LB049077	µg/L	10	<10	NA
MtBE (Methyl-tert-butyl ether)	LB049077	µg/L	2	<2	NA
Vinyl acetate	LB049077	µg/L	10	<10	NA
MEK (2-butanone)	LB049077	µg/L	10	<10	NA
MIBK (4-methyl-2-pentanone)	LB049077	µg/L	5	<5	NA
2-hexanone (MBK)	LB049077	µg/L	5	<5	NA

Polycyclic VOCs

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.

VOCs in Water **Method: ME-(AU)-[ENV]AN433/AN434 (continued)**

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Naphthalene	LB049077	µg/L	0.5	<0.5	NA

Sulphonated Compounds

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Carbon disulfide	LB049077	µg/L	2	<2	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Dibromofluoromethane (Surrogate)	LB049077	%	-	85%	89%
d4-1,2-dichloroethane (Surrogate)	LB049077	%	-	86%	91%
d8-toluene (Surrogate)	LB049077	%	-	97%	90%
Bromofluorobenzene (Surrogate)	LB049077	%	-	103%	93%

Totals

Parameter	QC Reference	Units	LOR	MB
Total Xylenes	LB049077	µg/L	1.5	<1.5
Total BTEX	LB049077	µg/L	3	<3

Trihalomethanes

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Chloroform (THM)	LB049077	µg/L	0.5	<0.5	129%
Bromodichloromethane (THM)	LB049077	µg/L	0.5	<0.5	NA
Dibromochloromethane (THM)	LB049077	µg/L	0.5	<0.5	NA
Bromoform (THM)	LB049077	µg/L	0.5	<0.5	NA

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.

Volatile Petroleum Hydrocarbons in Water **Method: ME-(AU)-[ENV]AN433/AN434/AN410**

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
TRH C6-C10	LB049077	µg/L	50	<50	113%
TRH C6-C9	LB049077	µg/L	40	<40	103%

Surrogates

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Dibromofluoromethane (Surrogate)	LB049077	%	-	95%	101%
d4-1,2-dichloroethane (Surrogate)	LB049077	%	-	94%	106%
d8-toluene (Surrogate)	LB049077	%	-	95%	104%
Bromofluorobenzene (Surrogate)	LB049077	%	-	94%	99%

VPH F Bands

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Benzene (F0)	LB049077	µg/L	0.5	<0.5	NA
TRH C6-C10 minus BTEX (F1)	LB049077	µg/L	50	<50	122%

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN020	Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.
AN083	Separatory funnels are used for aqueous samples and extracted by transferring an appropriate volume (mass) of liquid into a separatory funnel and adding 3 serial aliquots of dichloromethane. Samples receive a single extraction at pH 7 to recover base / neutral analytes and two extractions at pH < 2 to recover acidic analytes. QC samples are prepared by spiking organic free water with target analytes and extracting as per samples.
AN311/AN312	Mercury by Cold Vapour AAS in Waters: 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.
AN318	Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the Draft NEPM 2011, >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). F2 is not corrected for Naphthalene.
AN403	Additionally, the volatile C6-C9/C6-C10 fractions may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Petroleum Hydrocarbons (TPH) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the eluent solvents.
AN403	The GC/FID method is not well suited to the analysis of refined high boiling point materials (ie lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol if care to control volatility is taken. This method will detect naturally occurring hydrocarbons, lipids, animal fats, phenols and PAHs if they are present at sufficient levels, dependant on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
AN433/AN434	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN433/AN434/AN410	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.

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

STATEMENT OF QA/QC PERFORMANCE

SE122902 R0

CLIENT DETAILS

Contact	Earin Short
Client	Environmental Investigations
Address	17 / 1A Coulson Street ERSKINEVILLE NSW 2044
Telephone	02 9516 0722
Facsimile	02 9516 0741
Email	earin.short@eiaustralia.com.au
Project	**E2008 - Shephards Bay Urban - Medowbank**
Order Number	(Not specified)
Samples	14

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	SE122902 R0
Report Number	0000071573
Date Reported	10 Dec 2013

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS Environmental Services' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met (within the SGS Alexandria Environmental laboratory).

SAMPLE SUMMARY

Sample counts by matrix	14 Waters	Type of documentation received	COC
Date documentation received	3/12/2013	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	4.2°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

HOLDING TIME SUMMARY

SE122902 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
GW101-1	SE122902.001	LB049256	02 Dec 2013	03 Dec 2013	30 Dec 2013	06 Dec 2013	30 Dec 2013	09 Dec 2013
GW102-1	SE122902.002	LB049256	02 Dec 2013	03 Dec 2013	30 Dec 2013	06 Dec 2013	30 Dec 2013	09 Dec 2013
GW103-1	SE122902.003	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013
GW104-1	SE122902.004	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013
GW105-1	SE122902.005	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013
GW106-1	SE122902.006	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013
GW108-1	SE122902.007	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013
GW109-1	SE122902.008	LB049256	02 Dec 2013	03 Dec 2013	30 Dec 2013	06 Dec 2013	30 Dec 2013	09 Dec 2013
GW110-1	SE122902.009	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013
GW111-1	SE122902.010	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013
GW112-1	SE122902.011	LB049256	02 Dec 2013	03 Dec 2013	30 Dec 2013	06 Dec 2013	30 Dec 2013	09 Dec 2013
GW113-1	SE122902.012	LB049256	02 Dec 2013	03 Dec 2013	30 Dec 2013	06 Dec 2013	30 Dec 2013	09 Dec 2013
GW114-1	SE122902.013	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013
GWB-1	SE122902.014	LB049256	28 Nov 2013	03 Dec 2013	26 Dec 2013	06 Dec 2013	26 Dec 2013	09 Dec 2013

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
GW101-1	SE122902.001	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW102-1	SE122902.002	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW103-1	SE122902.003	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW104-1	SE122902.004	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW105-1	SE122902.005	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW106-1	SE122902.006	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW108-1	SE122902.007	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW109-1	SE122902.008	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW110-1	SE122902.009	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW111-1	SE122902.010	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW112-1	SE122902.011	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW113-1	SE122902.012	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GW114-1	SE122902.013	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	06 Dec 2013
GWB-1	SE122902.014	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
GW101-1	SE122902.001	LB049267	02 Dec 2013	03 Dec 2013	31 May 2014	06 Dec 2013	31 May 2014	09 Dec 2013
GW102-1	SE122902.002	LB049267	02 Dec 2013	03 Dec 2013	31 May 2014	06 Dec 2013	31 May 2014	09 Dec 2013
GW103-1	SE122902.003	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013
GW104-1	SE122902.004	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013
GW105-1	SE122902.005	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013
GW106-1	SE122902.006	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013
GW108-1	SE122902.007	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013
GW109-1	SE122902.008	LB049267	02 Dec 2013	03 Dec 2013	31 May 2014	06 Dec 2013	31 May 2014	09 Dec 2013
GW110-1	SE122902.009	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013
GW111-1	SE122902.010	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013
GW112-1	SE122902.011	LB049267	02 Dec 2013	03 Dec 2013	31 May 2014	06 Dec 2013	31 May 2014	09 Dec 2013
GW113-1	SE122902.012	LB049267	02 Dec 2013	03 Dec 2013	31 May 2014	06 Dec 2013	31 May 2014	09 Dec 2013
GW114-1	SE122902.013	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013
GWB-1	SE122902.014	LB049267	28 Nov 2013	03 Dec 2013	27 May 2014	06 Dec 2013	27 May 2014	09 Dec 2013

TRH (Total Recoverable Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
GW101-1	SE122902.001	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW102-1	SE122902.002	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW103-1	SE122902.003	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW104-1	SE122902.004	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW105-1	SE122902.005	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW106-1	SE122902.006	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW108-1	SE122902.007	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW109-1	SE122902.008	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW110-1	SE122902.009	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW111-1	SE122902.010	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013

HOLDING TIME SUMMARY

SE122902 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

TRH (Total Recoverable Hydrocarbons) in Water (continued)

Method: ME-(AU)-[ENV]AN403

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
GW112-1	SE122902.011	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW113-1	SE122902.012	LB049100	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GW114-1	SE122902.013	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013
GWB-1	SE122902.014	LB049100	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	09 Dec 2013

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
GW101-1	SE122902.001	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW102-1	SE122902.002	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW103-1	SE122902.003	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW104-1	SE122902.004	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW105-1	SE122902.005	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW106-1	SE122902.006	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW108-1	SE122902.007	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW109-1	SE122902.008	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW110-1	SE122902.009	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW111-1	SE122902.010	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW112-1	SE122902.011	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW113-1	SE122902.012	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW114-1	SE122902.013	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GWB-1	SE122902.014	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
GW101-1	SE122902.001	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW102-1	SE122902.002	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW103-1	SE122902.003	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW104-1	SE122902.004	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW105-1	SE122902.005	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW106-1	SE122902.006	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW108-1	SE122902.007	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW109-1	SE122902.008	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW110-1	SE122902.009	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW111-1	SE122902.010	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW112-1	SE122902.011	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW113-1	SE122902.012	LB049077	02 Dec 2013	03 Dec 2013	09 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GW114-1	SE122902.013	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013
GWB-1	SE122902.014	LB049077	28 Nov 2013	03 Dec 2013	05 Dec 2013	04 Dec 2013	13 Jan 2014	10 Dec 2013

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
2-fluorobiphenyl (Surrogate)	GW101-1	SE122902.001	%	40 - 130%	101
	GW102-1	SE122902.002	%	40 - 130%	88
	GW103-1	SE122902.003	%	40 - 130%	95
	GW104-1	SE122902.004	%	40 - 130%	79
	GW105-1	SE122902.005	%	40 - 130%	92
	GW106-1	SE122902.006	%	40 - 130%	85
	GW108-1	SE122902.007	%	40 - 130%	97
	GW109-1	SE122902.008	%	40 - 130%	87
	GW110-1	SE122902.009	%	40 - 130%	82
	GW111-1	SE122902.010	%	40 - 130%	85
	GW112-1	SE122902.011	%	40 - 130%	104
	GW113-1	SE122902.012	%	40 - 130%	85
	GW114-1	SE122902.013	%	40 - 130%	87
d14-p-terphenyl (Surrogate)	GW101-1	SE122902.001	%	40 - 130%	116
	GW102-1	SE122902.002	%	40 - 130%	107
	GW103-1	SE122902.003	%	40 - 130%	87
	GW104-1	SE122902.004	%	40 - 130%	77
	GW105-1	SE122902.005	%	40 - 130%	76
	GW106-1	SE122902.006	%	40 - 130%	77
	GW108-1	SE122902.007	%	40 - 130%	72
	GW109-1	SE122902.008	%	40 - 130%	126
	GW110-1	SE122902.009	%	40 - 130%	61
	GW111-1	SE122902.010	%	40 - 130%	63
	GW112-1	SE122902.011	%	40 - 130%	125
	GW113-1	SE122902.012	%	40 - 130%	111
	GW114-1	SE122902.013	%	40 - 130%	60
d5-nitrobenzene (Surrogate)	GW101-1	SE122902.001	%	40 - 130%	120
	GW102-1	SE122902.002	%	40 - 130%	102
	GW103-1	SE122902.003	%	40 - 130%	119
	GW104-1	SE122902.004	%	40 - 130%	106
	GW105-1	SE122902.005	%	40 - 130%	113
	GW106-1	SE122902.006	%	40 - 130%	116
	GW108-1	SE122902.007	%	40 - 130%	120
	GW109-1	SE122902.008	%	40 - 130%	114
	GW110-1	SE122902.009	%	40 - 130%	122
	GW111-1	SE122902.010	%	40 - 130%	109
	GW112-1	SE122902.011	%	40 - 130%	118
	GW113-1	SE122902.012	%	40 - 130%	123
	GW114-1	SE122902.013	%	40 - 130%	113

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	GW101-1	SE122902.001	%	40 - 130%	105
	GW102-1	SE122902.002	%	40 - 130%	106
	GW103-1	SE122902.003	%	40 - 130%	103
	GW104-1	SE122902.004	%	40 - 130%	108
	GW105-1	SE122902.005	%	40 - 130%	113
	GW106-1	SE122902.006	%	40 - 130%	114
	GW108-1	SE122902.007	%	40 - 130%	115
	GW109-1	SE122902.008	%	40 - 130%	107
	GW110-1	SE122902.009	%	40 - 130%	118
	GW111-1	SE122902.010	%	40 - 130%	112
	GW112-1	SE122902.011	%	40 - 130%	120
	GW113-1	SE122902.012	%	40 - 130%	110
	GW114-1	SE122902.013	%	40 - 130%	111
	GWB-1	SE122902.014	%	40 - 130%	112
d4-1,2-dichloroethane (Surrogate)	GW101-1	SE122902.001	%	40 - 130%	103
	GW102-1	SE122902.002	%	40 - 130%	106
	GW103-1	SE122902.003	%	40 - 130%	105
	GW104-1	SE122902.004	%	40 - 130%	107
	GW105-1	SE122902.005	%	40 - 130%	113

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

VOCs in Water (continued)

Method: ME-(AU)-[ENV]AN433/AN434

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d4-1,2-dichloroethane (Surrogate)	GW106-1	SE122902.006	%	40 - 130%	108
	GW108-1	SE122902.007	%	40 - 130%	116
	GW109-1	SE122902.008	%	40 - 130%	91
	GW110-1	SE122902.009	%	40 - 130%	111
	GW111-1	SE122902.010	%	40 - 130%	118
	GW112-1	SE122902.011	%	40 - 130%	107
	GW113-1	SE122902.012	%	40 - 130%	109
	GW114-1	SE122902.013	%	40 - 130%	112
	GWB-1	SE122902.014	%	40 - 130%	113
d8-toluene (Surrogate)	GW101-1	SE122902.001	%	40 - 130%	88
	GW102-1	SE122902.002	%	40 - 130%	92
	GW103-1	SE122902.003	%	40 - 130%	92
	GW104-1	SE122902.004	%	40 - 130%	91
	GW105-1	SE122902.005	%	40 - 130%	93
	GW106-1	SE122902.006	%	40 - 130%	102
	GW108-1	SE122902.007	%	40 - 130%	96
	GW109-1	SE122902.008	%	40 - 130%	86
	GW110-1	SE122902.009	%	40 - 130%	101
	GW111-1	SE122902.010	%	40 - 130%	92
	GW112-1	SE122902.011	%	40 - 130%	100
	GW113-1	SE122902.012	%	40 - 130%	98
	GW114-1	SE122902.013	%	40 - 130%	99
	GWB-1	SE122902.014	%	40 - 130%	93
Dibromofluoromethane (Surrogate)	GW101-1	SE122902.001	%	40 - 130%	93
	GW102-1	SE122902.002	%	40 - 130%	95
	GW103-1	SE122902.003	%	40 - 130%	95
	GW104-1	SE122902.004	%	40 - 130%	99
	GW105-1	SE122902.005	%	40 - 130%	106
	GW106-1	SE122902.006	%	40 - 130%	99
	GW108-1	SE122902.007	%	40 - 130%	104
	GW109-1	SE122902.008	%	40 - 130%	87
	GW110-1	SE122902.009	%	40 - 130%	102
	GW111-1	SE122902.010	%	40 - 130%	108
	GW112-1	SE122902.011	%	40 - 130%	101
	GW113-1	SE122902.012	%	40 - 130%	102
	GW114-1	SE122902.013	%	40 - 130%	103
	GWB-1	SE122902.014	%	40 - 130%	103

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Bromofluorobenzene (Surrogate)	GW101-1	SE122902.001	%	60 - 130%	101
	GW102-1	SE122902.002	%	60 - 130%	100
	GW103-1	SE122902.003	%	60 - 130%	100
	GW104-1	SE122902.004	%	60 - 130%	102
	GW105-1	SE122902.005	%	60 - 130%	106
	GW106-1	SE122902.006	%	60 - 130%	103
	GW108-1	SE122902.007	%	60 - 130%	102
	GW109-1	SE122902.008	%	60 - 130%	115
	GW110-1	SE122902.009	%	60 - 130%	100
	GW111-1	SE122902.010	%	60 - 130%	113
	GW112-1	SE122902.011	%	60 - 130%	103
	GW113-1	SE122902.012	%	60 - 130%	99
	GW114-1	SE122902.013	%	60 - 130%	101
	GWB-1	SE122902.014	%	60 - 130%	102
d4-1,2-dichloroethane (Surrogate)	GW101-1	SE122902.001	%	60 - 130%	116
	GW102-1	SE122902.002	%	60 - 130%	120
	GW103-1	SE122902.003	%	60 - 130%	119
	GW104-1	SE122902.004	%	60 - 130%	120
	GW105-1	SE122902.005	%	60 - 130%	112
	GW106-1	SE122902.006	%	60 - 130%	121
	GW108-1	SE122902.007	%	60 - 130%	116

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Volatile Petroleum Hydrocarbons in Water (continued) **Method: ME-(AU)-[ENV]AN433/AN434/AN410**

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
d4-1,2-dichloroethane (Surrogate)	GW109-1	SE122902.008	%	60 - 130%	94
	GW110-1	SE122902.009	%	60 - 130%	111
	GW111-1	SE122902.010	%	60 - 130%	117
	GW112-1	SE122902.011	%	60 - 130%	120
	GW113-1	SE122902.012	%	60 - 130%	116
	GW114-1	SE122902.013	%	60 - 130%	119
	GWB-1	SE122902.014	%	60 - 130%	120
d8-toluene (Surrogate)	GW101-1	SE122902.001	%	60 - 130%	107
	GW102-1	SE122902.002	%	60 - 130%	117
	GW103-1	SE122902.003	%	60 - 130%	112
	GW104-1	SE122902.004	%	60 - 130%	109
	GW105-1	SE122902.005	%	60 - 130%	114
	GW106-1	SE122902.006	%	60 - 130%	121
	GW108-1	SE122902.007	%	60 - 130%	120
	GW109-1	SE122902.008	%	60 - 130%	77
	GW110-1	SE122902.009	%	60 - 130%	112
	GW111-1	SE122902.010	%	60 - 130%	111
	GW112-1	SE122902.011	%	60 - 130%	119
	GW113-1	SE122902.012	%	60 - 130%	112
	GW114-1	SE122902.013	%	60 - 130%	116
	GWB-1	SE122902.014	%	60 - 130%	111
Dibromofluoromethane (Surrogate)	GW101-1	SE122902.001	%	60 - 130%	106
	GW102-1	SE122902.002	%	60 - 130%	108
	GW103-1	SE122902.003	%	60 - 130%	108
	GW104-1	SE122902.004	%	60 - 130%	112
	GW105-1	SE122902.005	%	60 - 130%	115
	GW106-1	SE122902.006	%	60 - 130%	112
	GW108-1	SE122902.007	%	60 - 130%	118
	GW109-1	SE122902.008	%	60 - 130%	98
	GW110-1	SE122902.009	%	60 - 130%	116
	GW111-1	SE122902.010	%	60 - 130%	118
	GW112-1	SE122902.011	%	60 - 130%	115
	GW113-1	SE122902.012	%	60 - 130%	116
	GW114-1	SE122902.013	%	60 - 130%	116
	GWB-1	SE122902.014	%	60 - 130%	118

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Sample Number	Parameter	Units	LOR	Result
LB049256.001	Mercury	mg/L	0.0001	<0.0001

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Number		Parameter	Units	LOR	Result
LB049100.001		Naphthalene	µg/L	0.1	<0.1
		2-methylnaphthalene	µg/L	0.1	<0.1
		1-methylnaphthalene	µg/L	0.1	<0.1
		Acenaphthylene	µg/L	0.1	<0.1
		Acenaphthene	µg/L	0.1	<0.1
		Fluorene	µg/L	0.1	<0.1
		Phenanthrene	µg/L	0.1	<0.1
		Anthracene	µg/L	0.1	<0.1
		Fluoranthene	µg/L	0.1	<0.1
		Pyrene	µg/L	0.1	<0.1
		Benzo(a)anthracene	µg/L	0.1	<0.1
		Chrysene	µg/L	0.1	<0.1
		Benzo(a)pyrene	µg/L	0.1	<0.1
		Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1
		Dibenzo(a&h)anthracene	µg/L	0.1	<0.1
		Benzo(ghi)perylene	µg/L	0.1	<0.1
	Surrogates	d5-nitrobenzene (Surrogate)	%	-	114
		2-fluorobiphenyl (Surrogate)	%	-	98
		d14-p-terphenyl (Surrogate)	%	-	102

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Number	Parameter	Units	LOR	Result
LB049267.001	Arsenic, As	µg/L	1	<1
	Cadmium, Cd	µg/L	0.1	<0.1
	Chromium, Cr	µg/L	1	<1
	Copper, Cu	µg/L	1	<1
	Lead, Pb	µg/L	1	<1
	Nickel, Ni	µg/L	1	<1
	Zinc, Zn	µg/L	5	<5

TRH (Total Recoverable Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN403

Sample Number	Parameter	Units	LOR	Result
LB049100.001	TRH C10-C14	µg/L	50	<50
	TRH C15-C28	µg/L	200	<200
	TRH C29-C36	µg/L	200	<200
	TRH C37-C40	µg/L	200	<200

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB049077.001	Fumigants	2,2-dichloropropane	µg/L	0.5	<0.5
		1,2-dichloropropane	µg/L	0.5	<0.5
		cis-1,3-dichloropropene	µg/L	0.5	<0.5
		trans-1,3-dichloropropene	µg/L	0.5	<0.5
		1,2-dibromoethane (EDB)	µg/L	0.5	<0.5
	Halogenated Aliphatics	Dichlorodifluoromethane (CFC-12)	µg/L	5	<5
		Chloromethane	µg/L	5	<5
		Vinyl chloride (Chloroethene)	µg/L	0.3	<0.3
		Bromomethane	µg/L	10	<10
		Chloroethane	µg/L	5	<5
		Trichlorofluoromethane	µg/L	1	<1
		Iodomethane	µg/L	5	<5
		1,1-dichloroethene	µg/L	0.5	<0.5
		Dichloromethane (Methylene chloride)	µg/L	5	<5
		Allyl chloride	µg/L	2	<2
		trans-1,2-dichloroethene	µg/L	0.5	<0.5
		1,1-dichloroethane	µg/L	0.5	<0.5
		cis-1,2-dichloroethene	µg/L	0.5	<0.5

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

VOCs in Water (continued)

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result
LB049077.001	Halogenated Aliphatics	Bromochloromethane	µg/L	0.5	<0.5
		1,2-dichloroethane	µg/L	0.5	<0.5
		1,1,1-trichloroethane	µg/L	0.5	<0.5
		1,1-dichloropropene	µg/L	0.5	<0.5
		Carbon tetrachloride	µg/L	0.5	<0.5
		Dibromomethane	µg/L	0.5	<0.5
		Trichloroethene (Trichloroethylene,TCE)	µg/L	0.5	<0.5
		1,1,2-trichloroethane	µg/L	0.5	<0.5
		1,3-dichloropropane	µg/L	0.5	<0.5
		Tetrachloroethene (Perchloroethylene,PCE)	µg/L	0.5	<0.5
		1,1,1,2-tetrachloroethane	µg/L	0.5	<0.5
		cis-1,4-dichloro-2-butene	µg/L	1	<1
		1,1,2,2-tetrachloroethane	µg/L	0.5	<0.5
		1,2,3-trichloropropane	µg/L	0.5	<0.5
		trans-1,4-dichloro-2-butene	µg/L	1	<1
		1,2-dibromo-3-chloropropane	µg/L	0.5	<0.5
		Hexachlorobutadiene	µg/L	0.5	<0.5
	Halogenated Aromatics	Chlorobenzene	µg/L	0.5	<0.5
		Bromobenzene	µg/L	0.5	<0.5
		2-chlorotoluene	µg/L	0.5	<0.5
		4-chlorotoluene	µg/L	0.5	<0.5
		1,3-dichlorobenzene	µg/L	0.5	<0.5
		1,4-dichlorobenzene	µg/L	0.3	<0.3
		1,2-dichlorobenzene	µg/L	0.5	<0.5
		1,2,4-trichlorobenzene	µg/L	0.5	<0.5
		1,2,3-trichlorobenzene	µg/L	0.5	<0.5
	Monocyclic Aromatic Hydrocarbons	Benzene	µg/L	0.5	<0.5
		Toluene	µg/L	0.5	<0.5
		Ethylbenzene	µg/L	0.5	<0.5
		m/p-xylene	µg/L	1	<1
		o-xylene	µg/L	0.5	<0.5
		Styrene (Vinyl benzene)	µg/L	0.5	<0.5
		Isopropylbenzene (Cumene)	µg/L	0.5	<0.5
		n-propylbenzene	µg/L	0.5	<0.5
		1,3,5-trimethylbenzene	µg/L	0.5	<0.5
		tert-butylbenzene	µg/L	0.5	<0.5
		1,2,4-trimethylbenzene	µg/L	0.5	<0.5
		sec-butylbenzene	µg/L	0.5	<0.5
		p-isopropyltoluene	µg/L	0.5	<0.5
		n-butylbenzene	µg/L	0.5	<0.5
	Nitrogenous Compounds	Acrylonitrile	µg/L	0.5	<0.5
	Oxygenated Compounds	Acetone (2-propanone)	µg/L	10	<10
		MtBE (Methyl-tert-butyl ether)	µg/L	2	<2
		Vinyl acetate	µg/L	10	<10
		MEK (2-butanone)	µg/L	10	<10
		MIBK (4-methyl-2-pentanone)	µg/L	5	<5
		2-hexanone (MBK)	µg/L	5	<5
	Polycyclic VOCs	Naphthalene	µg/L	0.5	<0.5
	Sulphonated	Carbon disulfide	µg/L	2	<2
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	85
		d4-1,2-dichloroethane (Surrogate)	%	-	86
		d8-toluene (Surrogate)	%	-	97
		Bromofluorobenzene (Surrogate)	%	-	103
	Trihalomethanes	Chloroform (THM)	µg/L	0.5	<0.5
		Bromodichloromethane (THM)	µg/L	0.5	<0.5
		Dibromochloromethane (THM)	µg/L	0.5	<0.5
		Bromoform (THM)	µg/L	0.5	<0.5

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number	Parameter	Units	LOR

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Volatile Petroleum Hydrocarbons in Water (continued) — **Method: ME-(AU)-[ENV]AN433/AN434/AN410**

Sample Number		Parameter	Units	LOR	Result
LB049077.001		TRH C6-C9	µg/L	40	<40
	Surrogates	Dibromofluoromethane (Surrogate)	%	-	95
		d4-1,2-dichloroethane (Surrogate)	%	-	94
		d8-toluene (Surrogate)	%	-	95
		Bromofluorobenzene (Surrogate)	%	-	94

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE122902.010	LB049256.014	Mercury	µg/L	0.0001	<0.0001	<0.0001	200	29
SE122945.007	LB049256.021	Mercury	µg/L	0.0001	0.003	0.0064	200	72

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE122902.004	LB049100.012		Naphthalene	µg/L	0.1	<0.1	<0.1	200	0
			2-methylnaphthalene	µg/L	0.1	<0.1	<0.1	200	0
			1-methylnaphthalene	µg/L	0.1	<0.1	<0.1	200	0
			Acenaphthylene	µg/L	0.1	<0.1	<0.1	200	0
			Acenaphthene	µg/L	0.1	<0.1	<0.1	200	0
			Fluorene	µg/L	0.1	<0.1	<0.1	200	0
			Phenanthrene	µg/L	0.1	<0.1	<0.1	200	0
			Anthracene	µg/L	0.1	<0.1	<0.1	200	0
			Fluoranthene	µg/L	0.1	<0.1	<0.1	200	0
			Pyrene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(a)anthracene	µg/L	0.1	<0.1	<0.1	200	0
			Chrysene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(b&j)fluoranthene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(k)fluoranthene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(a)pyrene	µg/L	0.1	<0.1	<0.1	200	0
			Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1	<0.1	200	0
			Dibenzo(a&h)anthracene	µg/L	0.1	<0.1	<0.1	200	0
			Benzo(ghi)perylene	µg/L	0.1	<0.1	<0.1	200	0
		Surrogates	d5-nitrobenzene (Surrogate)	µg/mL	-	0.1	0.1	30	12
			2-fluorobiphenyl (Surrogate)	µg/mL	-	0.1	0.1	30	11
			d14-p-terphenyl (Surrogate)	µg/mL	-	0.1	0.1	30	1

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE122902.010	LB049267.014	Arsenic, As	µg/L	1	<1	<1	200	0
		Cadmium, Cd	µg/L	0.1	0.7	0.7	30	2
		Chromium, Cr	µg/L	1	<1	<1	124	0
		Copper, Cu	µg/L	1	15	14	22	2
		Lead, Pb	µg/L	1	13	13	23	1
		Nickel, Ni	µg/L	1	8	8	27	4
		Zinc, Zn	µg/L	5	72	70	22	3
SE122902.014	LB049267.019	Arsenic, As	µg/L	1	<1	<1	200	0
		Cadmium, Cd	µg/L	0.1	<0.1	<0.1	200	0
		Chromium, Cr	µg/L	1	<1	<1	200	0
		Copper, Cu	µg/L	1	2	2	62	5
		Lead, Pb	µg/L	1	<1	<1	200	0
		Nickel, Ni	µg/L	1	8	7	28	8
		Zinc, Zn	µg/L	5	58	57	24	2

TRH (Total Recoverable Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN403

Original	Duplicate		Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE122902.004	LB049100.012		TRH C10-C14	µg/L	50	<50	<50	200	0
			TRH C15-C28	µg/L	200	<200	<200	200	0
			TRH C29-C36	µg/L	200	<200	<200	200	0
			TRH C37-C40	µg/L	200	<200	<200	200	0
			TRH C10-C36	µg/L	450	<450	<450	200	0
			TRH C10-C40	µg/L	650	<650	<650	200	0
		TRH F Bands	TRH >C10-C16 (F2)	µg/L	60	<60	<60	200	0
			TRH >C16-C34 (F3)	µg/L	500	<500	<500	200	0
			TRH >C34-C40 (F4)	µg/L	500	<500	<500	200	0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

PAH (Polynuclear Aromatic Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB049100.002	Naphthalene	µg/L	0.1	36	40	60 - 140	91
	Acenaphthylene	µg/L	0.1	38	40	60 - 140	95
	Acenaphthene	µg/L	0.1	36	40	60 - 140	90
	Phenanthrene	µg/L	0.1	35	40	60 - 140	87
	Anthracene	µg/L	0.1	34	40	60 - 140	84
	Fluoranthene	µg/L	0.1	37	40	60 - 140	91
	Pyrene	µg/L	0.1	34	40	60 - 140	84
	Benzo(a)pyrene	µg/L	0.1	44	40	60 - 140	109

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB049267.002	Arsenic, As	µg/L	1	19	20	80 - 120	93
	Cadmium, Cd	µg/L	0.1	19	20	80 - 120	97
	Chromium, Cr	µg/L	1	20	20	80 - 120	100
	Copper, Cu	µg/L	1	20	20	80 - 120	102
	Lead, Pb	µg/L	1	19	20	80 - 120	97
	Nickel, Ni	µg/L	1	20	20	80 - 120	101
	Zinc, Zn	µg/L	5	20	20	80 - 120	100

TRH (Total Recoverable Hydrocarbons) in Water

Method: ME-(AU)-[ENV]AN403

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB049100.002		TRH C10-C14	µg/L	50	1100	1200	60 - 140	93
		TRH C15-C28	µg/L	200	1100	1200	60 - 140	96
		TRH C29-C36	µg/L	200	1100	1200	60 - 140	95
	TRH F Bands	TRH >C10-C16 (F2)	µg/L	60	1100	1200	60 - 140	94
		TRH >C16-C34 (F3)	µg/L	500	1100	1200	60 - 140	95
		TRH >C34-C40 (F4)	µg/L	500	570	600	60 - 140	95

VOCs in Water

Method: ME-(AU)-[ENV]AN433/AN434

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB049077.002	Halogenated	1,1-dichloroethene	µg/L	0.5	43	45.45	60 - 140	95
	Aliphatics	1,2-dichloroethane	µg/L	0.5	46	45.45	60 - 140	102
		Trichloroethene (Trichloroethylene,TCE)	µg/L	0.5	55	45.45	60 - 140	120
	Halogenated	Chlorobenzene	µg/L	0.5	53	45.45	60 - 140	117
	Monocyclic	Benzene	µg/L	0.5	56	45.45	60 - 140	122
	Aromatic	Toluene	µg/L	0.5	54	45.45	60 - 140	119
		Ethylbenzene	µg/L	0.5	57	45.45	60 - 140	125
		m/p-xylene	µg/L	1	110	90.9	60 - 140	119
		o-xylene	µg/L	0.5	54	45.45	60 - 140	119
	Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	4.4	5	60 - 140	89
		d4-1,2-dichloroethane (Surrogate)	µg/L	-	4.5	5	60 - 140	91
		d8-toluene (Surrogate)	µg/L	-	4.5	5	60 - 140	90
		Bromofluorobenzene (Surrogate)	µg/L	-	4.7	5	60 - 140	93
	Trihalomethan	Chloroform (THM)	µg/L	0.5	59	45.45	60 - 140	129

Volatile Petroleum Hydrocarbons in Water

Method: ME-(AU)-[ENV]AN433/AN434/AN410

Sample Number		Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB049077.002		TRH C6-C10	µg/L	50	1100	946.63	60 - 140	113
		TRH C6-C9	µg/L	40	840	818.71	60 - 140	103
	Surrogates	Dibromofluoromethane (Surrogate)	µg/L	-	5.1	5	60 - 140	101
		d4-1,2-dichloroethane (Surrogate)	µg/L	-	5.3	5	60 - 140	106
		d8-toluene (Surrogate)	µg/L	-	5.2	5	60 - 140	104
		Bromofluorobenzene (Surrogate)	µg/L	-	4.9	5	60 - 140	99
	VPH F Bands	TRH C6-C10 minus BTEX (F1)	µg/L	50	780	639.67	60 - 140	122

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub -sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Mercury (dissolved) in Water

Method: ME-(AU)-[ENV]AN311/AN312

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE122902.001	LB049256.004	Mercury	mg/L	0.0001	0.0080	0.0001	0.008	99

Trace Metals (Dissolved) in Water by ICPMS

Method: ME-(AU)-[ENV]AN318

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE122902.001	LB049267.004	Arsenic, As	µg/L	1	19	<1	20	96
		Cadmium, Cd	µg/L	0.1	20	<0.1	20	100
		Chromium, Cr	µg/L	1	20	<1	20	101
		Copper, Cu	µg/L	1	27	7	20	98
		Lead, Pb	µg/L	1	24	5	20	99
		Nickel, Ni	µg/L	1	24	4	20	100
		Zinc, Zn	µg/L	5	51	31	20	102

MATRIX SPIKE DUPLICATES

SE122902 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here:
http://www.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-11.pdf

*	Non-accredited analysis.
-	Sample not analysed for this analyte.
^	Analysis performed by external laboratory.

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.

①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
†	Refer to Analytical Report comments for further information.

Sheet 1 of 1

Site: Shepherds Bay Urban Meadowbank, NSW

Project ID: E2008

Laboratory: SGS Australia
Unit 16, 33 Maddox Street,
ALEXANDRIA NSW 2015
P: 02 8594 0400 F: 02 8594 0499

Sample ID	Laboratory ID	Container Type	Sampling Date:	Sampling Time:	WATER	SOIL	COMPOSITE	OTHER	Heavy Metals [A]	Heavy Metals [B]	TPH / BTEX	PAHs	OCPs / PCBs / OPPs	TPH (C_{10} - C_{36}) only	Asbestos	VOCs	sPOCAs	pH (1:5)	EC (1:5)	Peroxid PH
GW101-1	1	15, 2VC	2.12.13	AM	/				/		/	/				/				
GW102-1	2		2.12.13	✓	/				/		/	/				/				
GW103-1	3		28.11.13	PM	/				/		/	/				/				
GW104-1	4		↓	AM	/				/		/	/				/				
GW105-1	5		↓	✓	/				/		/	/				/				
GW106-1	6		↓	PM	/				/		/	/				/				
GW108-1	7		↓	✓	/				/		/	/				/				
GW109-1	8		2.12.13	✓	/				/		/	/				/				
GW110-1	9		28.11.13	✓	/				/		/	/				/				
GW111-1	10		✓	✓	/				/		/	/				/				
GW112-1	11		2.12.13	AM	/				/		/	/				/				
GW113-1	12		✓	✓	/				/		/	/				/				
GW114-1	13	1	28.11.13	PM	/				/		/	/				/				
GWB-1	14	↓	✓	AM	/				/		/									

SGS
Received 03/12/13
By SS
Time 12.35 am/pm
Samples intact (yes)/no
Ice/Cooler Pack (yes)/no
Temperature on Receipt 4.2 °C
Storage Location WH1-114
SGS REF No SE122902

Environmental Investigations
Contamination Assessment Management & Geotechnics
17/1A Coulson Street,
ERSKINEVILLE NSW 2043
PO Box 215
ST PETERS NSW 2044
Ph: 9516 0722
Fx: 9516 0741
service@eiaustralia.com.au

Comments:

[A] Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel
[B] Antimony, Barium, Beryllium, Cobalt, Manganese, Tin, Vanedium

Laboratory Turnaround:

- ☐ Same Day
- ☐ 24 Hours
- ☐ 48 Hours
- ☐ 72 Hours
- ☑ Standard
- ☐ Other _____

Investigator: I attest that these samples were collected in accordance with standard EI field sampling procedures.

Sampler Name: E. Skeat (Print) E. Skeat (Signature) Date: 3.12.13

Sampler's Comments:

Received by: (print & Signature)

Date: 03/12 Time: 12.35

Container Type:
J= solvent washed, acid rinsed, Teflon sealed, glass jar; S= solvent washed, acid rinsed glass bottle;
P= natural HDPE plastic bottle; VC= glass vial, Teflon Septum; ZLB = Zip-Lock Bag

IMPORTANT:
PLEASE E-MAIL LABORATORY RESULTS TO:
service@eiaustralia.com.au

SGS

AUSTRALIA – ENVIRONMENTAL SERVICES SYDNEY – PROFORMA FORM

SAMPLE INFORMATION

Approved: D. Liang

JOB No. SE122902 (Rev 02)

Sample No.	P 100ml UP	P 250ml UP	P 500ml UP	P 1L UP	G 100 Amber UP	G 200 Amber UP	G 500 Amber UP	G 1L Amber UP	G 40ml vial Up (Rev 02)	G 40ml Vial HCl	P 100ml HCl	G 40ml Vial H2SO4	P 100ml H2SO4	P 250ml H2SO4	G 500ml Amber H2SO4	G 1L H2SO4	P 100/250ml HN03 Total	P 100ml HN03 Filtered	P 250ml NaOH	P 250ml Zn Acetate	Plastic Bag	G 250ml Soil Jar	Ploom melted Bottle			Sample Matrix	Lab Bottles Supplied By	Comments
1-14								1	2														1			water	SGS	Full

SAMPLE RECEIPT ADVICE

SE122902

CLIENT DETAILS

Contact	Earin Short
Client	Environmental Investigations
Address	17 / 1A Coulson Street ERSKINEVILLE NSW 2044
Telephone	02 9516 0722
Facsimile	02 9516 0741
Email	earin.short@eiaustralia.com.au
Project	**E2008 - Shephards Bay Urban - Medowbank**
Order Number	(Not specified)
Samples	14

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
Samples Received	Tue 3/12/2013
Report Due	Tue 10/12/2013
SGS Reference	**SE122902**

SUBMISSION DETAILS

This is to confirm that 14 samples were received on Tuesday 3/12/2013. Results are expected to be ready by Tuesday 10/12/2013. Please quote SGS reference SE122902 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	14 Waters	Type of documentation received	COC
Date documentation received	3/12/2013	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	4.2°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes		

Samples will be held for one month for water samples and two months for soil samples from date of report, unless otherwise instructed.

COMMENTS

SAMPLE RECEIPT ADVICE

SE122902

CLIENT DETAILS

Client Environmental Investigations

Project E2008 - Shephards Bay Urban - Medowbank

SUMMARY OF ANALYSIS

No.	Sample ID	Mercury (dissolved) in Water	PAH (Polynuclear Aromatic Hydrocarbons) in	Trace Metals (Dissolved) in Water by ICPMS	TRH (Total Recoverable Hydrocarbons) in Water	VOCs in Water	Volatile Petroleum Hydrocarbons in Water
001	GW101-1	1	22	7	9	79	8
002	GW102-1	1	22	7	9	79	8
003	GW103-1	1	22	7	9	79	8
004	GW104-1	1	22	7	9	79	8
005	GW105-1	1	22	7	9	79	8
006	GW106-1	1	22	7	9	79	8
007	GW108-1	1	22	7	9	79	8
008	GW109-1	1	22	7	9	79	8
009	GW110-1	1	22	7	9	79	8
010	GW111-1	1	22	7	9	79	8
011	GW112-1	1	22	7	9	79	8
012	GW113-1	1	22	7	9	79	8
013	GW114-1	1	22	7	9	79	8
014	GWB-1	1	-	7	9	12	8

The above table represents SGS Environmental Services' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details.
Testing as per this table shall commence immediately unless the client intervenes with a correction.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 101721

Client:

Environmental Investigations
17/1A Coulson St
Erskineville
NSW 2043

Attention: E Short

Sample log in details:

Your Reference:	**E2008, Meadowbank**		
No. of samples:	1 Water		
Date samples received / completed instructions received	03/12/2013	/	03/12/2013

Analysis Details:

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

Report Details:

Date results requested by: / Issue Date:	10/12/13	/	9/12/13
Date of Preliminary Report:	Not issued		

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Water		
Our Reference:	UNITS	101721-1
Your Reference	----------	GWI-1
Date Sampled	----------	28/11/2013
Type of sample		Water
Date extracted	-	03/12/2013
Date analysed	-	04/12/2013
TRHC$_6$ - C$_9$	µg/L	<10
TRHC$_6$ - C$_{10}$	µg/L	<10
TRHC$_6$ - C$_{10}$ less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	101
Surrogate toluene-d8	%	95
Surrogate 4-BFB	%	102

svTRH (C10-C40) in Water		
Our Reference:	UNITS	101721-1
Your Reference	----------	GWI-1
Date Sampled	----------	28/11/2013
Type of sample		Water
Date extracted	-	04/12/2013
Date analysed	-	05/12/2013
$TRHC_{10}$ - C_{14}	µg/L	<50
$TRHC_{15}$ - C_{28}	µg/L	<100
$TRHC_{29}$ - C_{36}	µg/L	<100
$TRH{>}C_{10}$ - C_{16}	µg/L	<50
$TRH{>}C_{10}$ - C_{16} less Naphthalene (F2)	µg/L	<50
$TRH{>}C_{16}$ - C_{34}	µg/L	<100
$TRH{>}C_{34}$ - C_{40}	µg/L	<100
Surrogate o-Terphenyl	%	105

HM in water - dissolved		
Our Reference:	UNITS	101721-1
Your Reference	----------	GWI-1
Date Sampled	----------	28/11/2013
Type of sample		Water
Date prepared	-	04/12/2013
Date analysed	-	04/12/2013
Arsenic-Dissolved	µg/L	<1
Cadmium-Dissolved	µg/L	<0.1
Chromium-Dissolved	µg/L	<1
Copper-Dissolved	µg/L	2
Lead-Dissolved	µg/L	<1
Mercury-Dissolved	µg/L	<0.05
Nickel-Dissolved	µg/L	6
Zinc-Dissolved	µg/L	60

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note Naphthalene is determined from the VOC analysis.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			03/12/2013	[NT]	[NT]	LCS-W1	03/12/2013
Date analysed	-			04/12/2013	[NT]	[NT]	LCS-W1	04/12/2013
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	116%
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	116%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	118%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	120%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	117%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	114%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	113%
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	103	[NT]	[NT]	LCS-W1	100%
Surrogate toluene-d8	%		Org-016	97	[NT]	[NT]	LCS-W1	100%
Surrogate 4-BFB	%		Org-016	97	[NT]	[NT]	LCS-W1	99%

QUALITY CONTROL svTRH (C10-C40) in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			04/12/2013	[NT]	[NT]	LCS-W1	04/12/2013
Date analysed	-			05/12/2013	[NT]	[NT]	LCS-W1	05/12/2013
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	84%
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	96%
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	86%
TRH>C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	84%
TRH>C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	96%
TRH>C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	86%
Surrogate o-Terphenyl	%		Org-003	103	[NT]	[NT]	LCS-W1	105%

QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			04/12/2013	[NT]	[NT]	LCS-W1	04/12/2013
Date analysed	-			04/12/2013	[NT]	[NT]	LCS-W1	04/12/2013
Arsenic-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	96%
Cadmium-Dissolved	µg/L	0.1	Metals-022 ICP-MS	<0.1	[NT]	[NT]	LCS-W1	103%
Chromium-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	95%
Copper-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	94%
Lead-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	104%

Client Reference: E2008, Meadowbank

QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Mercury-Dissolved	µg/L	0.05	Metals-021 CV-AAS	<0.05	[NT]	[NT]	LCS-W1	100%
Nickel-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	96%
Zinc-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	94%

Report Comments:

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

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

Quality Control Definitions

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

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

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

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

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

Laboratory Acceptance Criteria

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

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

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

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

Sheet 1 of 1

Site: Shepards Bay Urban Meadowbank, NSW

Project ID: E2008

Laboratory: Envirolab Services
12 Ashley Street,
CHATSWOOD NSW 2067
P: 02 9910 6200 F: 02 9910 6201

Environmental Investigations Contamination Assessment Management & Geotechnical
17/1A Coulson Street,
ERSKINEVILLE NSW 2043
PO Box 215
ST PETERS NSW 2044
Ph: 9516 0722
Fx: 9516 0741
service@eiaustralia.com.au

Sample ID	Laboratory ID	Container Type	Sampling Date	Sampling Time	WATER	SOIL	COMPOSITE	OTHER	Heavy Metals A	Heavy Metals B	TPH / BTEX	PAHs	OCPs / PCBs / OPPs	TPH (C6 - C9 only)	Asbestos	VOCs	sPOCAs	pH (1:5)	EC (1:5)	Peroxid PH		
GWI-1	1	1S, 2VC, 1P	28.11.13	AM	/				/		/											

Comments:
A Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc
B Antimony, Barium, Beryllium, Cobalt, Manganese, Tin, Vanadium

ENVIROLAB Envirolab Services 12 Ashley St Chatswood NSW 2067 Ph: (02) 9910 6200
Job No: 101721
Date Received: 3/12/13
Time Received: 14:39
Received by: TT
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Laboratory Turnaround:
- [ ] Same Day
- [ ] 24 Hours
- [ ] 48 Hours
- [ ] 72 Hours
- [x] Standard
- [ ] Other ______

Investigator: I attest that these samples were collected in accordance with standard EI field sampling procedures.

Sampler Name: E. Short (Print) E. Short (Signature) Date: 3.12.13

Sampler's Comments:

Received by: (print & Signature) Tania Tan Tania Tan Date: 3/12/13 Time: 14:39

IMPORTANT:
PLEASE E-MAIL LABORATORY RESULTS TO:
service@eiaustralia.com.au

Container Type:
J= solvent washed, acid rinsed, Teflon sealed, glass jar; S= solvent washed, acid rinsed glass bottle; P= natural HDPE plastic bottle; VC= glass vial, Teflon Septum; ZLB = Zip-Lock Bag

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client:

Environmental Investigations
17/1A Coulson St
Erskineville NSW 2043

ph: 9516 0722
Fax: 9516 0741

Attention: E Short

Sample log in details:

Your reference:	**E2008, Meadowbank**
Envirolab Reference:	**101721**
Date received:	03/12/2013
Date results expected to be reported:	**10/12/13**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	1 Water
Turnaround time requested:	Standard
Temperature on receipt (°C)	16.4
Cooling Method:	Ice Pack
Sampling Date Provided:	YES

Comments:

Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au