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Integrated Practical Solutions

Remediation Action Plan
Proposed Waste Transfer Facility

34 – 36 McPherson Street
Banksmeadow, NSW

Prepared for
Veolia Environmental Services (Australia) Pty Ltd

Project 37278.07
February 2014

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Executive Summary

This Remediation Action Plan (RAP) details the work required to remediate the property located at 34 – 36 McPherson Street, Banksmeadow NSW (the site) for a proposed waste transfer facility. The site location and boundaries are shown on Drawing 1, Appendix A. The RAP was commissioned by Veolia Environmental Services (Australia) Pty Ltd (VES), the development proponent.

The assessment process, including approval of this RAP, is subject to a Site Audit by a EPA accredited Site Auditor under part 4 of the *Contaminated Land Management (CLM) Act* 1997. Mr Graeme Nyland of ENVIRON Australia has been appointed as the Site Auditor.

The RAP describes the works which are necessary to manage and remediate contamination identified at the site and to validate the remediated site as suitable for the proposed development (from a contamination perspective). The strategy detailed herein comprises the removal of phase separated hydrocarbons (PSH), Underground Petroleum Storage Systems (UPSS) and contaminated soil which may potentially impact groundwater; and the containment and on-site management of contaminated soil which does not pose a risk to groundwater (including asbestos). The RAP includes an unexpected finds protocol and contingency measures to manage other issues which may arise during the course of remediation and redevelopment works.

The proposed redevelopment will include the demolition of current site structures, including removal of pavements. The redeveloped site will be fully paved (with no soft landscaping). Final design levels had not been finalised at the time of preparation of this RAP, but it is understood that levels will be increased over the majority of the site, possibly in the order of 2 m in some areas. The waste compactor is expected to remain a low point at the site, with its base close to current ground level.

The scope of remediation is based on the results of previous contamination investigations and the details of the proposed development, and is not transferable to other development proposals at the site. It is noted that the previous investigations were undertaken prior to the issue of the amended *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM 1999 as amended May 2013) and its approval by the NSW Environmental Protection Authority (EPA) on 11 June 2013.

The objectives of the RAP are to:

- Establish an appropriate remedial strategy so as to render the site suitable, from a site contamination perspective, for the proposed development;
- Establish the remediation acceptance criteria to be adopted for the remediation of the site and the validation requirements to confirm the successful implementation of the remediation strategy;
- Establish appropriate environmental safeguards required to complete the remediation works in an environmentally acceptable manner; and
- Establish appropriate work health and safety (WHS) procedures required to complete the remediation works in a manner that would not pose a threat to the health of site workers or users.

The success of the remediation will need to be validated as detailed herein. An operational Environmental Management Plan (EMP) will be required to ensure that the contained contaminated fill does not present an unacceptable risk to human health or the environment in the future, and that ongoing management and/or monitoring is properly implemented.

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1. Introduction

1.1 General

This Remediation Action Plan (RAP) details the work required to remediate the property located at 34 – 36 McPherson Street, Banksmeadow NSW (the site) for a proposed waste transfer facility. The site location and boundaries are shown on Drawing 1, Appendix A. The RAP was commissioned by Veolia Environmental Services (Australia) Pty Ltd (VES), the development proponent.

The RAP describes the works which are necessary to manage and remediate contamination identified at the site. The strategy detailed herein comprises the removal of phase separated hydrocarbons (PSH), Underground Petroleum Storage Systems (UPSS) and contaminated soil which may potentially impact groundwater; and the containment and on-site management of contaminated soil which does not pose a risk to groundwater (including asbestos). The RAP includes an unexpected finds protocol and contingency measures to manage other issues which may arise during the course of remediation and redevelopment works.

The scope of remediation is based on the results of previous contamination investigations and the details of the proposed development, and is not transferable to other development proposals at the site. It is noted that the previous investigations were undertaken prior to the issue of the amended *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM 1999 as amended May 2013) and its approval by the NSW Environmental Protection Authority (EPA) on 11 June 2013. The NEPM 1999 as amended is referred to in this RAP as NEPM (2013) to avoid confusion. This RAP has been prepared with reference to NEPM (2013), including review of previous results in accordance with the NEPM (2013) criteria where appropriate results are available.

The assessment process, including approval of this RAP, is subject to a Site Audit by a EPA accredited Site Auditor under part 4 of the *Contaminated Land Management (CLM) Act* 1997. Mr Graeme Nyland of ENVIRON Australia has been appointed as the Site Auditor. The RAP will be subject to the review and approval of the Site Auditor.

1.2 Site Identification

Site details are provided in Table 1, below and a site drawing showing the site boundary and location is presented on Drawing 1, Appendix A.

Table 1: General Site Information

Item	Description
Site Owner	Keith Engineering Pty Ltd
Proposed Site Lessee/Occupier	Veolia Environmental Services (Australia) Pty Ltd
Lot and DP Number	Lots A & B, D.P. 366725 Lot 1, D.P. 435497
Site Address	34 – 36 McPherson Street, Banksmeadow
County/Parish	Parish of Botany
Local Government Authority	City of Botany Bay
Total Site Area	Approximately 9,880m^2
Current Zoning	MD – SEPP (Major Development) 2005
Current Site Use	Industrial
Proposed Future Land Use	Industrial
Adjacent Land Use	North – Pacific National Botany Yard (including railway yard) then Botany Industrial Park (including Orica) East – Botany Building Recyclers Waste and Recycling Facility South – McPherson Street then light industrial units West – railway line, then Orica "Southlands" industrial site

1.3 Proposed Development

The development comprises a waste transfer station with facilities for loading waste directly onto rail for off-site transfer. The proposed development includes the current subject site and part of the Pacific National Botany Yard (Lot 2 in D.P. 1006865) to the north.

This RAP only covers 34-36 McPherson Street, Banksmeadow, and does not cover remediation requirements for the Pacific National site.

It is understood that the proposed redevelopment will include the demolition of current site structures, including removal of pavements. The redeveloped site will be fully paved (with no soft landscaping), with access roads along the eastern and western sides of the site, car parking facilities at the southern side of the site, adjacent to McPherson Street, and heavy duty pavements at the rear northern side for container handling. In addition, a new waste transfer terminal building, a single storey office building, weighbridge, maintenance shed and waste compactor are proposed. The draft proposed development site plans are provided in Appendix A.

Final design levels had not been finalised at the time of preparation of this RAP, but it is understood that levels will be increased over the majority of the site, possibly in the order of 2 m in some areas. The waste compactor is expected to remain a low point at the site, with its base close to current ground level.

1.4 Regulatory Requirements

This RAP has been prepared to assist VES to meet regulatory requirements for the redevelopment of the site under the State Environmental Planning Guidelines SEPP 55 – *Remediation of Land* under the *Environmental Planning and Assessment Act* (1979).

This RAP does not address requirements which may apply under the *Contaminated Land Management Act* 1997 (the CLM Act) relating to Duty to Report or contamination significant enough to warrant regulation under the CLM Act.

It is noted, however, that there does appear to be a Duty to Report under the CLM Act for the contamination at the site. Under section 60 of the CLM Act, a person whose activities have contaminated land or a landowner whose land has been contaminated is required to notify DECC [now EPA] when they become aware of the contamination.

If required, this RAP should be amended as appropriate to address any requirements specified by the EPA under the CLM Act.

2. Objectives and Scope

The scope of the RAP has been established on the basis of the findings of the previous investigations, site observations and proposed development details.

In this regard, the objectives of the RAP are to:

- Establish an appropriate remedial strategy so as to render the site suitable, from a site contamination perspective, for the proposed development;
- Establish the remediation acceptance criteria to be adopted for the remediation of the site and the validation requirements to confirm the successful implementation of the remediation strategy;
- Establish appropriate environmental safeguards required to complete the remediation works in an environmentally acceptable manner; and
- Establish appropriate work health and safety (WHS) procedures required to complete the remediation works in a manner that would not pose a threat to the health of site workers or users.

This RAP was prepared in accordance with the NSW Office of Environment and Heritage (2011) [now EPA] *Guidelines for Consultants Reporting on Contaminated Sites* (OEH 2011) for consideration in remedial action plans.

3. Site Information

3.1 Site Description

A site inspection was conducted by DP in January 2013. DP is not aware of any significant changes to the site since this time. The following observations were made:

- The site is located on the northern side of McPherson Street and on the eastern side of an existing railway line that cuts through McPherson Street, separating it into two sections (i.e. an eastern and a western section). The site is essentially rectangular with a skewed northern boundary and covers an approximate area of 9,880 m^2 (approximately 1 ha). At the time of the inspection the site contained several industrial buildings of varying age, as well as temporary/portable buildings surrounded by a variety of sealed and unsealed pavements. The site boundaries are shown on Drawing 1, Appendix A;
- 34 McPherson Street has an existing building within the southern portion of the site, adjacent to the road frontage that has been constructed from steel framing with part brick cladding and probable asbestos-cement wall and roof sheeting. In addition, several smaller sheds constructed with steel frames and sheet metal cladding is present within the central part of the site, as were a few portable site office buildings and portable industrial storage bins. The ground surface is covered with reinforced concrete slab floors within the buildings, with exposed pavements of both reinforced concrete and asphalt construction;
- The adjoining 36 McPherson Street has a smaller warehouse at the southern end of the site that had been constructed from brick and sheet metal roofing. This warehouse was joined to an existing office building of similar construction on its eastern side with associated asphalt paved car parking fronting both buildings adjacent McPherson Street. A larger steel portal-framed and sheet metal clad warehouse occupied the central and northern parts of the site. The building was relatively tall, contained gantry cranes and was used for storage. The floor slab of the warehouse was reinforced concrete, as was a small area on the northern side of the building. Exposed areas to the east of the warehouse were unsealed and partly covered with unbound gravels;
- Other existing site features included a small substation and adjoining shed and concrete paving at the south eastern corner of No. 36, as well as two areas of mature tree growth along the McPherson Street frontage of No. 36 and along the central part of the eastern site boundary;
- At the time of the April 2012 investigation the large factory building on 36 McPherson Street was used for storage, and the rear of 34 McPherson Street was being used for metal soldering and fabrication work. The northern outdoor areas at both locations were being used for the storage of skip bins. The southern outdoor area of 36 McPherson Street was being used for the storage of truck trailers;
- There are understood to be two Underground Petroleum Storage Systems (UPSS) at the site comprising three underground storage tanks (USTs) and one bowser. The UPSS comprise:
    - One UST which is located in the north western corner of the site, and is identifiable by its fill point. This tank was no longer in use but is believed to have contained diesel. The UST could not be detected by the ground penetrating radar (GPR) survey used during the April 2012 investigation and no WorkCover records were found for the tank. As such, the location, size and extent of the UST are unknown;

- The remaining two USTs were located south east of the large factory along with a bowser. Both USTs were disused, and only the southern UST could be located by the GPR survey conducted during the April 2012 investigation (it was noted that a trailer was parked over the area of the second UST, restricting the use of the GPR in the area). Fill points were identified for both USTs. The original WorkCover plan sighted for the April 2012 investigation suggested that the USTs were oriented in a north-south direction, while more recent plans show them to be oriented east-west; and

- The eastern boundary of the site had a retaining wall, with the eastern neighbour elevated above the subject site. The eastern portion of the site was relatively level, whilst the western portion of the site fell approximately 0.6 m towards the south west.

3.2 Geology, Hydrogeology and Regional Groundwater

3.2.1 Geology

Reference to the Sydney 1:100,000 Geological Series Sheet indicates that the site is underlain by Quaternary sediments comprising medium to fine grained marine sands, although it is commonly known from previous investigations nearby that the area often has a thin surfacing of fill overlying the alluvial deposits. The previous fieldwork has confirmed the presence of shallow filling and deep alluvial sandy soils.

3.2.2 Hydrology and Hydrogeology

Surface water at the site is expected to infiltrate into the ground in unpaved areas with excess water entering the local stormwater drainage system. After periods of high rainfall pools of water have been observed in various areas at the site, and groundwater measurements from previous investigations have indicated that the groundwater is at or very close to the surface at the northern portion of the site after significant rainfall.

The site is located on the Botany sands aquifer. Hydraulic conductivity within the sand beds of the Botany aquifer is highly variable and is typically around 20 m/day in clean sand. This value decreases to 5 – 10 m/day in silty or peaty sands and to less than 4m/day in sandy or peaty clay. The influence of the Waterloo rock or cemented sand (otherwise known as 'coffee rock') and igneous intrusions can also significantly reduce hydraulic conductivity[1].

Merrick (1998)[2] reports groundwater level variations in the Botany Sands Aquifer of up to 2 m.

[1] McNally G.H. & Branagan D.F, 1998. An Overview of the Engineering Geology of the Botany Basin. In McNally G.H. & Jankowski J. (Eds) Environmental Geology of the Botany Basin: Conference Proceedings. EEHSG/Geological Society of Australia and Conference Publications, Springwood NSW, 1-23.

[2] Merrick N.P, 1998. Glimpses of History: The Evolution of Groundwater Levels and Usage in the Botany Basin, In McNally G.H. & Jankowski J. (Eds) Environmental Geology of the Botany Basin: Conference Proceedings. EEHSG/Geological Society of Australia and Conference Publications, Springwood NSW, 230-242.

The local gradient falls generally in a south westerly direction towards Botany Bay at Port Botany and measured groundwater levels (as discussed in previous reports), indicate that groundwater flows to the south west. Botany Bay is located approximately one kilometre to the south of the site, and is considered likely to be the receiving body of groundwater from the site. Botany Bay is an open bay, with inputs from rainfall, rivers, groundwater and tidal exchange with the Pacific Ocean. Botany Bay is predominantly a marine environment, with some freshwater at the surface layer.[3]

The site and the area between the site and Botany Bay are located within the Botany Aquifer Zone 1 (red) Groundwater Extraction Exclusion Area around the Orica site (refer to drawing and related government gazette notices provided in Appendix B)[4]. The use of groundwater in Zone 1 is banned. This Zone incorporates groundwater contamination associated with the Orica Voluntary Management Plan including remediation of contaminated groundwater.

3.2.3 Registered Groundwater Bore Search

A search of registered groundwater bores was undertaken on data supplied by the NSW Office of Water (NOW) as part of the April (2012) investigation. A review of the search was undertaken in August 2013, which confirmed the results of the 2012 search.

Eighteen bores were registered in an approximate 0.5 km radius of the site. Four of these had records of standing water levels, with results varying from 2.1 to 2.4 m bgl. Two of the bores were registered as abandoned, six for use for monitoring, eight for industrial use and one for domestic use, with the remaining bore not having a recorded use. The bore registered for domestic use was installed in 1995, and was located approximately 0.5 km to the north east (i.e. up-gradient) of the site. The industrial bores were installed between 1947 and 1997. One of the abandoned bores was located directly to the south of the site on McPherson Street.

4. Previous Reports

4.1 Relevant Reports and Previous Results

The following relevant contamination investigations have previously been conducted, and where available for review:

- DP *Report on Preliminary Contamination Assessment, 34 – 36 McPherson Street Banksmeadow* (March 1997, Project 34342) [DP (1997)];
- DP *Report on Phase 2 Contamination Assessment, 34 – 36 McPherson Street Banksmeadow* (October 2004, Project 37278) [DP (2004)];
- Environmental Investigation Service (EIS) *Report to Parrwood Pty Ltd on Additional Contamination Assessment for Proposed Industrial Development at Plan 34 – 36 McPherson*

[3] http://www.environment.nsw.gov.au/resources/water/10510towrapointecd5b.pdf.
[4] Further information is available from the NSW Office of Water, and at http://www.water.nsw.gov.au/Water-management/Water-quality/Groundwater/Botany-Sand-Beds-aquifer/Botany-Sands-Aquifer/default.aspx.

Street Banksmeadow (Ref E19781F-RPT, October 2005) [EIS (2005a)] [copy not available for review];

- Environmental Investigation Service (EIS) *Report to Parrwood Pty Ltd on Remedial Action Plan for Proposed Industrial Development at Plan 34 – 36 McPherson Street Banksmeadow* (Ref F19781F-RAP, November 2005) [EIS (2005b)];
- EIS *Site Remediation, 34 – 36 McPherson Street Banksmeadow* (DRAFT letter, Ref E19781F-LET, 23 November 2005c);
- DP *Report on Supplementary Contamination Assessment, 34 – 36 McPherson Street Banksmeadow* (April 2012, Project 37278.01) [DP (2012)];
- DP *Report on LNAPL Delineation Assessment, 34 – 36 McPherson Street Banksmeadow* (May 2013, Project 37278.03) [DP (2013)]; and
- VES additional groundwater monitoring results, report not available at time of RAP preparation.

These reports are discussed below, with previous sample locations shown on Drawing 3, Appendix A. Previous borehole logs, groundwater contours and a summary of previous results are provided in Appendix C.

4.2 Preliminary Contamination Assessment – DP (1997)

DP (1997) included the drilling of seven bores, three of which targeted the UPSS in the south east of the Site (Bores 5, 6 and 7). Given the time which has elapsed since this investigation, the results are not considered to be suitable for characterising current site conditions; however, they do provide background information. Ten primary soil samples were analysed for various suites including heavy metals (arsenic, cadmium, chromium, copper, lead, mercury and zinc), total recoverable hydrocarbons (TRH, a screening test for total petroleum hydrocarbons – TPH), benzene, ethyl benzene, toluene and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAH). Two groundwater samples were analysed for chromium, copper and zinc. It is noted that low levels of TRH C_{15}-C_{40} were detected in samples from Bores 1 and 4, and zinc was detected at concentrations between 9.6 and 2,400 mg/kg, with the highest concentration in the north and west of the site. All soil results were within the then Proposed Health Based Soil Guidelines for Industrial Sites (NEHF1996), and later re-assessment of the results by DP indicated they were also within the DEC *Guidelines for the NSW Site Auditor Scheme* (2006) for commercial/industrial use and the EPA *Contaminated Sites Guidelines for Assessing Service Station Sites* (1994), which have since been superseded by the NEPM (2013). With respect to the metals in groundwater, chromium was below the adopted laboratory practical quantitation limits in both samples, whilst copper and zinc were detected at slightly elevated concentrations (copper at 40 µg/L in one sample and zinc at 60 and 130 µg/L).

4.3 Phase 2 Contamination Assessment – DP (2004)

DP (2004) comprised a Phase 2 Contamination Assessment and included drilling 21 bores in the accessible areas of the site (note only limited access was available in the buildings, due to the operational nature of the site at the time of the investigation). Elevated zinc concentrations were detected in soil and groundwater, with the maximum zinc concentration detected in soil being 58,200

mg/kg in sample 110/0.5 (in the north west of the site), and the second highest being 21,990 mg/kg in sample 121/0.5 (in the north east of the site). Wells were installed in both of these bores, and zinc in groundwater was detected at 7,500 µg/L and 540 µg/L respectively in Wells 110 and 221. Slightly elevated levels of chromium, copper and lead were also detected in groundwater. The well installed to the south east of the site, near the UPSS did not contain sufficient water to be sampled.

With respect to organic contaminants, DP (2004) recorded one significantly elevated concentration of TRH C10-C36 in soil (16,300 mg/kg in sample 115/3.0). Slightly elevated levels in soil were also recorded for benzo(a)pyrene (6.7 mg/kg in sample 116/0.5), TRH C10-C36 (1,224 mg/kg in sample 109/0.5) and benzene (1.1 mg/kg in sample 110/0.5). TRH, benzene and phenanthrene were detected in one groundwater sample, from Well 110 near the UPSS in the north west of the site (150 µg/L TRH C6-C9; 1,520 µg/L TRH C10-C36; 9 µg/L of benzene; and 1 µg/L phenanthrene). Toluene was also detected in the groundwater sample from Well 103 in the west of the site (2 µg/L). volatile organic compound (VOC) was detected in all groundwater wells, and is assumed to be sourced from off site.

Asbestos was detected in four of the six samples analysed in DP (2004).

The results are discussed with reference to NEPM (2013) is Section 4.7.

4.4 Environmental Investigation Service Reports – EIS (2005a, 2005b, 2005c)

EIS (2005b) provided a brief summary of some of the results of EIS (2005a), although the borehole logs and full correlation of results and sampling locations are not given/clear. Based on the limited available information the following is understood to have been conducted:

- EIS analysed nine soil samples for zinc, with all results within the adopted SAC (no longer applicable). The locations and recorded concentrations were not given;
- EIS analysed nine soil samples for TRH and BTEX. An elevated concentration of 7,100 mg/kg was recorded in sample BH309/0.1-0.45, which appears to be located south west (down gradient) of the UPSS in the north west of the site. All other concentrations were recorded to be within the adopted SAC (no longer applicable), although the test locations and detected concentrations are not given;
- EIS analysed 14 soil samples for asbestos, with asbestos detected in three locations (BH301/0.2-0.5, BH303/0.2-0.5 and BH311/0.05-0.15), two of which appear to be located in the north east of the site and one in the west of the site;
- EIS installed three groundwater monitoring wells at the site and also collected samples from the wells installed as part of DP (2004). The location of the EIS wells cannot be seen on the plan provided to DP;
- EIS detected zinc in groundwater at concentrations of between 23 and 8,000 µg/L, with the second highest concentration being 100 µg/L. The 8,000 µg/L was detected in a sample from DP Well 110. Some elevated levels of arsenic, chromium, copper, lead and nickel were also highlighted by EIS;
- EIS analysed five groundwater samples for TRH and BTEX. TRH C6-C9 was detected in four samples (between 18 and 80 µg/L, including a result of 31 µg/L in DP Well 110). TRH C10-C36

was detected in one sample, 8,590 µg/L, from DP Well 110, with 2.9 µg/L of benzene detected in the same sample; and

- EIS analysed five samples for VOC, with VOC detected in some of the samples.

Based on the available laboratory results EIS prepared the remediation strategy for chemical contaminants, and their drawing shows areas requiring remediation. As not all sample locations are shown on the reviewed drawing, it is not clear how the boundaries of the remediation areas have been defined. Remediation of asbestos is not provided in EIS (2005b). Six remediation areas were defined and the following results were found:

- Area A: zinc around DP Bore 110;
- Area B: TRH C10-C36 in soil down gradient of the north eastern UPSS;
- Area C: TRH C10-C36 in soil in DP 109/0.5 (1,244 mg/kg);
- Area D: TRH C10-C36 in soil around DP Bore 115;
- Area E: the north western UPSS; and
- Area F: the two south eastern UPSS.

4.5 Supplementary Contamination Assessment – DP (2012)

DP (2012) comprised a supplementary contamination assessment and acid sulphate soil investigation with 23 soil test bores, eight of which were converted to groundwater monitoring wells.

A 150 mm layer of light non-aqueous phase liquid (LNAPL - a type of phase separated hydrocarbon, PSH) was detected on the surface of the groundwater in Well 216.

Laboratory results obtained identified the following:

- TRH C10-C36 contamination in soils, with the most elevated results in the area of/down gradient of the Well 216 (located near former DP bore 115), and the diesel UPSS (maximum detected concentration 25,950 mg/kg);
- PAH contamination in soils, with the most elevated results in bore 214, in the main factory building (maximum detected concentration of total PAH: 806 mg/kg and benzo(a)pyrene: 130 mg/kg);
- Asbestos contamination in soils;
- Zinc concentrations in groundwater were significantly lower than previously detected (maximum current concentration of 2,100 µg/L compared to up to 8,000 µg/L previously);
- Relatively low levels of dissolved phase TRH C10-C36 in groundwater (maximum concentration of 1,240 µg/L);
- Cobalt in groundwater marginally above the GIL (3 µg/L); and
- Acid sulphate soils were present.

Laboratory analysis indicated that the PSH contamination in the area of Well 216 was consistent with a product such as engine oil, and that the contamination in the area of the diesel UPSS was consistent with a mixture of diesel and engine oil, or similar.

An acid sulphate soil management plan was recommended if any excavation works were proposed for the site.

The results are discussed with reference to NEPM (2013) is Section 4.7.

4.6 LNAPL Delineation Assessment – DP (2013)

DP (2013) presented the results of further investigation of the previously identified PSH, present in the form of LNAPL, and associated soil and dissolved phase groundwater contamination. The assessment was conducted for due diligence purposes and was conducted in general accordance with the Sampling Analysis and Quality Plan (SAQP, December 2012) prepared by DP.

The objectives were to assess the extent of PSH and associated dissolved phase contamination in the vicinity of groundwater MW216. Eight groundwater monitoring wells were installed in the area of and down-gradient of MW216. Soil and groundwater samples were collected. The observations during the investigation were as follows:

- Fibre cement was observed at Bore 303;
- Ash, slag, building rubble and petroleum odours were observed near and below the water table at Bores 302 and 303;
- PSH was present at well 216;
- Oily droplets were observed during development of well 303, however, none were noted at the time of sampling. At the time of sampling black, sticky, soft, solid PSH was present at the phreatic surface;
- Soil contaminants were found to be generally low. The maximum detected TRH C10-C36 concentration was 1,270 mg/kg at Bore 303;
- Petroleum contamination was noted in three wells adjacent to well 216 – wells 301, 302 and 303. The highest results were in well 303; and
- Xylenes were detected in wells 301, 302 and 303. Toluene, ethylbenzene and PAH were also detected in well 303.

The investigation found that there were no signs of down-gradient dissolved phase plume associated with the PSH in well 216, as the contamination identified comprised of different compounds, i.e. lighter fractions of TRH. It was considered that the PSH in well 216 was not mobile (which may be due to underground structures), and has been reasonably delineated by the surrounding wells. Full delineation of the PSH in Well 303 was not undertaken, and was not practical due to the inaccessibility of adjacent building areas for drilling.

4.7 Review of Previous Results in Accordance with NEPM (2013)

4.7.1 Chemical Contaminants

A review of the previous results has been conducted in accordance with NEPM (2013), using the investigation levels detailed in Section 8 of this RAP. Tables C1 and C2, Appendix C summarise the previous laboratory results and their significance with respect to the current review.

A number of exceedances/ inferred exceedances were recorded, and are provided below along with results elevated relative to reference levels.

Borehole/ Monitoring Well 110
Groundwater samples

- Zinc of 2,100 – 8,000 µg/L in DP and EIS groundwater samples;
- TRH C6-C9 (maximum 150 µg/L) and TRH C10-C28 (maximum 1,520 µg/L) compared to reference levels for protection of waters sourced from Airport Regulations (1997)[5] of 150 µg/L C6-C10 and 600 µg/L C10-C36.

Soil sample 110/0.5

- Zinc of 58,200 mg/kg. Although this result is within the Remediation Acceptance Criteria (RAC), remediation is considered necessary based on the likelihood that this is a contributing source to the zinc contamination in groundwater at this location.

Borehole 115
Soil sample 115/3.0

- TRH C10-C36 of 16,300 mg/kg compared to the Management Limits of 1,000 mg/kg (TRH >C10-C16), 3,500 mg/kg (TRH >C16-C34), 10,000 mg/kg (TRH >C34-C40).

Monitoring Well 209
Groundwater samples

- TRH C15-C28 (maximum 660 µg/L) compared Airport Regulations (1997) of 600 µg/L C10-C36. Note this is an up-gradient well, and the result is considered to be representative of groundwater quality flowing onto the site, rather than from an on-site source.

Borehole 214
Soil sample 214/0.9-1.0

- Benzo(a)pyrene toxicity equivalent (BaP TEQ) (a weighted sum of carcinogenic PAH compounds) of 179.8 mg/kg compared to the HIL of 40 mg/kg;
- TRH C15-C36 of 16,800 mg/kg compared to the Management Limits of 1,000 mg/kg (TRH >C10-C16), 3,500 mg/kg (TRH >C16-C34), 10,000 mg/kg (TRH >C34-C40).

[5] The Australian Government Airport (Environment Protection) Regulations (1997), Schedule 2 Water Pollution Accepted Limits: Table 1.03 – Accepted limits of contamination in the absence of other Australian environmental-protection based guidelines.

Borehole 216 / Monitoring Well 216
Groundwater samples

- TRH C10-C36 (maximum 4,100 µg/L) compared Airport Regulations (1997) of 600 µg/L C10-C36.

Soil sample 216/0.7-0.8

- TRH C15-C36 of 25,900 mg/kg compared to the Management Limits of 3,500 mg/kg (TRH >C16-C34), 10,000 mg/kg (TRH >C34-C40).

Soil sample 216/0.9-1

- TRH C15-C36 of 7,900 mg/kg compared to the Management Limits of 1,000 mg/kg (TRH >C10-C16), 3,500 mg/kg (TRH >C16-C34), 10,000 mg/kg (TRH >C34-C40).

Borehole 219
Soil sample 219/0.1-0.4

- TRH C10-C36 of 18,600 mg/kg compared to the Management Limits of 1,000 mg/kg (TRH >C10-C16), 3,500 mg/kg (TRH >C16-C34), 10,000 mg/kg (TRH >C34-C40).

Soil sample 219/1-1.4

- TRH C10-C14 of 18,600 mg/kg compared to the Management Limit of 1,000 mg/kg (TRH >C10-C16).

Borehole 220
Soil sample BD2A/230112 (replicate of 220/0.2-0.4).

- TRH C10-C28 of 13,100 mg/kg compared to the Management Limits of 1,000 mg/kg (TRH >C10-C16) and 3,500 mg/kg (TRH >C16-C34).

Metals in Groundwater
The following metals exceeded the groundwater investigation levels (GILs) in one or more samples: arsenic, chromium, cobalt, lead, nickel and zinc. Other than zinc in MW110 (as discussed above), no remediation is considered necessary based on the following:

- The results being variable, and not consistently above the GILs;
- The results generally being only marginally over the GILs and/ or the expected background values for groundwater in an industrial area;
- No on-site source having been identified; and
- The non-sensitive nature of the receiving water bodies, including the Botany Aquifer Zone 1 Groundwater Extraction Exclusion Area and Botany Bay near Port Botany.

4.7.2 Asbestos

Based on the presence of significant quantities of asbestos containing materials (ACM) observed in filling over the site in the previous investigations and the proposed development, further assessment of the extent and percentage asbestos content in soils is not considered to be warranted. The

available information is considered to be sufficient to inform a remediation strategy for the site, based on the assumption that all filling materials will be managed as asbestos contaminated unless validated as clear of asbestos based on high density *ex situ* validation testing.

5. Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e. it enables an assessment of the potential source – pathway – receptor linkages.

The CSM has been prepared based on the previous assessment and has been used in determining an appropriate remediation strategy for the site.

5.1 Potential Contamination Sources

The potential contamination sources detailed in Table 2 have been identified. Sources considered to require remediation/ further assessment on the basis of the previous investigation results are detailed below the Table.

Table 2: Potential Contamination Sources and Contaminants of Concern

Potential Source	Description of Potential Contaminating Activity	Contaminants of Concern
Imported fill of unknown origin	- Importation of potentially contaminated filling soils	Asbestos has been identified in filling at the site. Elevated PAH and TPH has been detected in filling, and whilst some of this contamination is considered to be associated with the site activities, some may have been imported onto the site in the filling.
On-Site Buildings & Structures	- Building(s) with asbestos cement present - UPSS - Substation - Potentially unidentified sources (e.g. unknown UPSS)	Elevated levels of asbestos, TPH, BTEX, PAH have been identified at the site. There is considered to be a potential for phenols, volatile organic compounds (VOC) and PCB to be detected in areas not currently accessible (beneath the UPSS and substation)
Previous land use	- Metal casting - Metal fabrication - Potentially manufacture and/ or storage of sealants	Zinc, TPH, BTEX, PAH
Current land use	- Fabrication of stage sets - Carpentry - Metal soldering and fabrication work - Storage, including of skip bins and truck trailers	None identified to be present at the site
Adjacent land uses	- Railway Line - Botany Industrial Park (including Orica) - Botany Building Recyclers Waste and Recycling facility - Orica “Southlands” industrial site - Light industrial units	TPH, PAH, VOC, metals (detected concentrations in up-gradient wells are not considered to be of concern)

The majority of the above potential sources have been investigated. The contamination sources (S) requiring remediation/ further assessment are as follows:

S1 Contaminated Filling (asbestos, zinc, PAH, TPH)

S2 Asbestos buildings (potential source of asbestos to ground surface, to be demolished pre-remediation)

S3 UPSS (potential/ confirmed petroleum contamination source to soil and groundwater)

S4 Substation (not previously assessed due to operational status, requires validation assessment following decommissioning)

S5 PSH (from previous land use)

No contamination has been identified from the current site uses.

No contamination posing an unacceptable risk to human health at the subject site has been identified from the neighbouring sites.

5.2 Potential Receptors

5.2.1 Human Health Receptors

R1 – Proposed site users (commercial/ industrial)

R2 – Construction workers

R3 – Intrusive maintenance workers

R4 – Land users in adjacent areas (commercial/ industrial)

5.2.2 Environmental Receptors

R5 – Groundwater

R6 – Surface Water (Botany Bay)

The site is located within the Botany Aquifer Zone 1 Groundwater Extraction Exclusion Area. As such groundwater is not considered to comprise a sensitive receptor. However, it is considered that off-site migration of contamination into groundwater needs to be minimised to allow the future improvement of water quality in the aquifer.

The site and the surrounding area have been under heavy industrial/ industrial and commercial land use with significant hard cover for many years. The proposed development building will extend to the site boundaries with no or minimal areas of ancillary vegetation. Therefore it is considered that ecological receptors do not require protecting at the site.

The primary surface water receptor from the site is considered to be Botany Bay with Port Botany located approximately one kilometre south of the site. Botany Bay is considered to be a highly disturbed environment. As such, surface water is not considered to comprise a sensitive receptor.

However, it is considered that off-site migration of contamination into surface water needs to be minimised to allow the future improvement of water quality.

5.2.3 Other Receptors

R7 – Buried infrastructure

R8 – Buildings

5.3 Potential Pathways

Potential pathways for contamination include the following:

P1 – Direct contact with soil or groundwater (ingestion and dermal)

P2 – Inhalation of dust and/or vapours

P3 – Leaching of contaminants and vertical mitigation into groundwater

P4 – Surface water run-off

P5 – Fire/ explosion

Off-site dermal contact with or ingestion of groundwater from the site is not considered to be a potential exposure pathway due to the site and areas down gradient of the site being located within the Botany Aquifer Zone 1 Groundwater Extraction Exclusion Area.

5.4 Summary of Preliminary CSM

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human, water or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways. The possible pathways between the above sources (S1 to S5) and receptors (R1 to R8) are provided in Table 3 below.

Table 3: Conceptual Site Model

Source	Transport Pathway	Receptor	Contaminants Relevant To Pathway	Threshold Criteria	Remediation/ Management Options
	Human Health				
S1 - Contaminated Filling S2 - Asbestos buildings S3 - UPSS S4 - substation (not investigated) S5 - PSH	P1: Direct contact with soil (ingestion and dermal)	R1 – Proposed site users (commercial/ industrial)	Soil: BaP TEQ	HIL-D HSL – D Direct Contact	- Remove exposure pathway (e.g. construct capping over soil) - Off-site disposal of contaminated soil
		R2 – Construction workers	Soil: BaP TEQ	HIL-D HSL – D Direct Contact	- Adoption of appropriate Work Health & Safety procedures
		R3 – Intrusive maintenance workers	Soil: BaP TEQ	HIL-D HSL -Intrusive Maintenance Worker - Direct Contact	- Administrative Controls (including Environmental Management Plan) - Adoption of appropriate Work Health & Safety procedures
	P1: Direct contact with PSH, groundwater (ingestion and dermal)	R2 – Construction workers	PSH	ADWG	- Adoption of appropriate Work Health & Safety procedures
		R3 – Intrusive maintenance workers	PSH	ADWG	- Off-site disposal of PSH - Adoption of appropriate Administrative Controls and Work Health & Safety procedures
	P2: Inhalation of dust and/or vapours	R1 – Proposed site users (commercial/ industrial)	Asbestos	HSL-D - Asbestos	- Remove exposure pathway (e.g. construct capping over soil/ groundwater)

Source	Transport Pathway	Receptor	Contaminants Relevant To Pathway	Threshold Criteria	Remediation/ Management Options
		R4 – Land users in adjacent areas (commercial/ industrial)			
		R2 – Construction workers	Soil: asbestos, elevated TRH	HSL-D - Vapour inhalation, Asbestos	- Adoption of appropriate Administrative Controls and Work Health & Safety procedures
		R3 – Intrusive maintenance workers	PSH	HSL-Intrusive Maintenance Worker - Vapour inhalation	
	Environment				
	P3 – Leaching of contaminants and vertical mitigation into groundwater.	R5: Groundwater	Soil: TRH, PAH, Zinc	GIL - marine Management Limits (PSH formation)	- Remove transport pathway (e.g. place contaminated soil in containment cell) - Off-site disposal of contaminated soil/PSH - On-site treatment of contaminated soil/PSH
	P4 – Surface water run-off.	R6: Surface water (Botany Bay)	Soil: TRH, PAH, Zinc	GIL - marine	Remove transport pathway (e.g. construct capping over soil) Off-site disposal of contaminated soil On-site treatment of contaminated soil

	Buildings and Structures				
	P1: Direct contact	R7 – Buried infrastructure (damage to services)	Soil: TRH PSH	Management Limits	- Placement of services in trenches with clean material/ management of potential migration of contamination into service trenches - Off-site disposal of contaminated soil/PSH - On-site treatment of contaminated soil/ PSH
	P5 - fire, explosion	R9 – Buildings	Soil: TRH PSH	Management Limits	- Off-site disposal of contaminated soil/PSH - On-site treatment of contaminated soil/ PSH

6. Remediation Extent and Options

6.1 Areas of Environmental Concern

Based on the result of the previous reports and with reference to NEPM (2013), six areas of environmental concern (AEC) requiring remediation and/ or management and/ or validation testing are detailed in Table 4, below.

In addition given the industrial history of the site, there is a risk that additional UPSS and contamination not yet identified at the site will be present. This will be addressed during remediation by a geophysical survey for ferrous objects and an unexpected finds protocol and contingency plans.

Table 4: Areas of Environmental Concern

AEC	Issue	Relevant Borehole/Well	Relevant Results
AEC 1	PSH (and potential for dissolved phase TPH, BTEX, PAH in groundwater associated with the PSH)	BH 115 BH / MW 216 BH / MW 303	- 115/3.0 m bgl: TRH C10-C36 of 16,300 mg/kg - 216/0.7-0.8 m bgl: TRH C15-C36 of 25,900 mg/kg - 216/0.9-1 m bgl: TRH C15-C36 of 7,900 mg/kg - 216 groundwater: LNAPL & TRH C10-C36 - 303 groundwater: PSH
AEC 2	UPSS (2 USTs)	N/A	- All results within RAC
AEC 3	BaP TeQ in soil TPH in soil	BH 214	- 214/0.9-1.0 m bgl: BaP TEQ of 179.8 mg/kg - 214/0.9-1.0 m bgl: TRH C15-C36 of 16,800 mg/kg
AEC 4	UPSS (1 UST) TPH in soil Zinc in soil Zinc in groundwater	BH / MW 110 BH 219 BH / MW 220	- 110/0.5 m bgl: Zinc of 58,200 mg/kg - 110 groundwater: Zinc & TRH C6-C36 - 219/0.1-0.4 m bgl: TRH C10-C36 of 18,600 mg/kg - 219/1-1.4 m bgl: TRH C10-C14 of 18,600 mg/kg - 220/0.2-0.4 m bgl: TRH C10-C28 of 13,100 mg/kg
AEC 5	Substation [a]	nil	- No previous testing due to operational status
AEC 6	Asbestos in soil	Various	- Filling over entire site

Notes:

a no contamination associated with the former substation has been identified, however targeted sampling has not previously been undertaken due to its operation status. Validation sampling beneath the substation will be required as part of its decommissioning.

6.2 Typical Remedial Options Available

A number of remedial options were reviewed. The suitability of the remedial options was examined in accordance with a number of relevant documents, including, *inter alia*, the following:

- *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* (ANZECC 1992);
- *NSW DEC, Contaminated Site: Guidelines for the NSW Site Auditor Scheme* (2006); and
- *Guidelines for the Assessment of On-site Containment of Contaminated Soil* (ANZECC, 1999).

Possible remedial options to achieve the remedial goals are identified as follows:

- No action;
- Treatment (on- or off-site)
- Off-site disposal to an approved/ licensed site/ waste facility; and
- Physical barrier systems.

The following is a summary of the review of remediation options:

6.2.1 No Action

The "No Action" option involves no remedial response to the contamination identified on the subject site. This option was not considered appropriate for the following reasons:

- The risks to human health and the environment from the contamination would be unacceptable under the proposed development;
- It does not provide any means to improve the current condition of the site. Based on the nature of the soil contamination issues currently at the site, localised remediation is considered feasible and practicable.

6.2.2 Treatment and Monitored Natural Attenuation

Soils

Applicable treatment options for soils comprise bioremediation of petroleum contaminated soils and immobilisation of zinc and PAH contaminated soil (e.g. by microencapsulation to prevent leaching). No appropriate treatment options are available for treatment of asbestos in soil.

The advantages of treatment are the reduction in the production of waste which can have cost savings.

Bioremediation of petroleum contaminants in soil generally comprises "landfarming" which involves the addition of nutrient/ hydrocarbon consuming microorganisms, mixing and aeration. Landfarming can be an effective method of treating petroleum in soils, but for more highly contaminated soils can take several months or longer. Space is required to allow spreading of the soils in thin layers for treatment. Time and available space are likely to be the biggest constraints to bioremediation for this project,

however, bioremediation may be applicable for select soils pending the progress of works and the waste classification of the material.

Treatment for zinc and PAH would require benchtop trials to determine an appropriate method for the contaminants, soils and site conditions, including likely reactions with groundwater, soil and groundwater pH etc. Given the expected, relatively limited, additional soils requiring remediation for zinc and PAH, treatment is considered unlikely to be economically feasible for the current project.

Groundwater

Based on the dissolved concentrations of contaminants (zinc and petroleum) recorded in groundwater to date, active remediation to reduce concentrations in groundwater is not considered to be necessary. The principal groundwater remediation strategy proposed for the site is the removal of contamination sources contributing to groundwater contamination.

Given the shallow depth to the PSH, removal and off-site disposal (discussed below) is considered to be the most appropriate remediation technology for the PSH. As a contingency measure, monitored natural attenuation (MNA) may be a suitable method of managing/ remediating significant residual contamination, if detected during remediation works and subsequent validation.

MNA allows the petroleum contamination to naturally attenuate. For this option to be acceptable sufficient data has to be available to show that natural attenuation (NA) is occurring in the aquifer, and ongoing monitoring is required to confirm that the NA continues to occur at an acceptable rate. MNA is not considered to be suitable for PSH.

Dissolved phase petroleum contamination has been identified at the site and the extent and degree of this contamination has been delineated as far as practicable in several areas.

MNA will not immediately remove the risks associated with the petroleum present on the site, but rather is considered to be a remediation methodology suitable for long term remediation of residual petroleum contamination.

Once the source of petroleum contamination to groundwater (i.e. contaminated soils and the LNAPL) has been remediated, and validation assessment has shown there are no unacceptable risks from petroleum vapour from the groundwater, MNA would be considered to be a suitable remediation technology, if required, for residual dissolved phase petroleum contamination.

MNA can be “enhanced” by the addition of chemicals to increase the rate of NA, generally by increasing dissolved oxygen concentrations in the aquifer.

The PSH and potential risks associated with any residual petroleum contamination would also need to be managed.

6.2.3 Off-site Disposal

Soils

Off-site disposal of contaminated material is considered a suitable option for managing human health and environmental impacts from the contaminated materials. Off-site disposal comprises the excavation of soil, classification of spoil, and disposal to a facility which can legally receive it. It is noted that soil in the area of the LNAPL contamination may require treatment prior to off-site disposal to a landfill.

Disposal of the contaminated soil off-site is relatively straightforward, however, it is expensive and can result in production of significant quantities of waste requiring transport and disposal to landfill which in itself in an undesirable environmental outcome. As such, this method is considered suitable in certain areas of the site, however, it is not suitable as an overall approach due to the extent of contamination and the potential to manage much of the contamination on site.

This method is considered most suitable in the areas where contamination in soil may potentially impact groundwater, namely, areas of contamination associated with the UPSS, and in identified areas of contamination (such as the zinc hotspot and TRH contamination in the vicinity of Bore 110, AEC 4). TRH and PAH contamination identified in AEC 2 and AEC 3 should be excavated to the extent practicable.

Groundwater

Off-site disposal of contaminated groundwater comprises pumping and removal of the groundwater and/or liquid and disposal to a facility which can legally receive it. This option is considered suitable to remove the PSH in order to remove the contaminant source.

Removal of free product and/or oily water and water with elevated petroleum hydrocarbons should be conducted during remediation works. Water may require removal from the tank pits and general excavation areas and disposed of to a suitable waste facility.

This option would adequately address the remediation goals via the removal of the contaminants and areas of environmental concern from the subject site. This option would be appropriate for PSH areas and also in the tank pits, if required.

6.2.4 Containment of Contamination

Soil

Physical barrier (or containment) systems involve the placement/installation of a layer of suitable capping/ containment system to limit the exposure of site users to contaminants and, if required, the migration of contamination in groundwater. These are suitable where intrusive remedial methods may not be feasible, practical or desirable due to safety or practical constraints. The physical barrier is also used to control the emission of odours or volatile organic compounds, to reduce erosion, infiltration and improve site aesthetics.

Physical barrier layers aimed at removing the physical exposure pathway to site users (for example, for asbestos contamination) typically include 0.5 m of validated virgin excavated natural material (VENM) or a permanent pavement or building slab. The long term management of the integrity of the capping layer will be outlined in an appropriate environmental management plan (EMP) with provisions

for regular inspection and maintenance included as necessary. The EMP will need to be legally enforceable and should have an appropriate public notification mechanism such as in the site's Section 149 (2&5) planning certificate and/or under Section 88B of the *Conveyancing Act 1919.*

The proposed redevelopment will include a concrete slab over the site. As such capping asbestos contamination and contaminants not posing a risk to groundwater is considered to be a feasible remediation method for the project.

Groundwater
On-site management of contaminated groundwater comprises mitigating potential risks to human health or the environment associated with the contamination. Risks to human health can occur through ingestion, dermal exposure and inhalation. Environmental risks generally occur when contaminated groundwater discharges into surface water bodies, potentially impacting ecosystems in the water body.

On-site management of PSH is not considered to be acceptable including by the NSW EPA, however, on-site management of dissolved phase petroleum contamination may be appropriate following assessment of all the risks and in conjunction with monitored natural attenuation (see Section 6.2.2). Given the site is within the Botany Aquifer Zone 1 Groundwater Extraction Exclusion Area, controls preventing the extraction of groundwater both at and down-gradient of the site are already in place. Petroleum contaminants can produce vapours, therefore assessing and, if required, mitigating potential impacts from vapour intrusion into newly constructed buildings may be required.

6.3 Preferred Remediation Option

The two main "driving factors" have been considered in determining the preferred remediation strategy:

- Rendering the site suitable for the proposed waste transfer facility from a health perspective. It is considered that this can be achieved by removal of contamination potentially posing a risk to site users caused by vapour, particularly vapour intrusion into the buildings, removal of the LNAPL and by capping of the remaining contamination to remove the exposure pathway;
- Managing the risk of unacceptable impacts on the environment. It is considered that this is primarily through the mitigation of migration of contamination off-site in groundwater. Given that the site is within a Groundwater Extraction Exclusion Area, it is considered that the receiving bodies are not sensitive and that the actual risk posed by the site is therefore low. As such a "clean up to the extent practicable" (CUTEP) strategy is proposed. It is considered that removal of the source of contamination to groundwater, including the UPSS, PSH and potentially leachable TPH and zinc contaminated soils is suitable to manage potential impacts on the environment.

In summary, the preferred remediation strategy for the site entails:

- Removal of asbestos from buildings and the ground surface;
- Investigation of additional, currently unidentified, UPSS at the site;
- Removal of the UPSS and associated infrastructure;

- Removal of any mobile PSH as a liquid waste;
- Removal of residual PSH through excavation and off-site disposal (or on-site treatment if necessary);
- Removal of other contaminated soils not considered suitable for on-site capping due to potential risks to groundwater or human health (related to vapour intrusion);
- Final assessment of the need for remediation of any dissolved phase contamination. This will require additional site investigation works (refer to Section 7.3 for details);
- On-site capping of contaminated soils not considered to present an ongoing risk to groundwater or human health if retained on-site, including asbestos contaminated soils; and
- Preparation and implementation of an EMP with provisions for ongoing regular inspection and maintenance of the capped contaminated soils. The EMP will be legally enforceable and have an appropriate public notification mechanism such as inclusion in the site's Section 149 (2&5) planning certificate, or under Section 88B of the *Conveyancing Act 1919*.

Under the proposed development scenario this remedial strategy is considered to be the most appropriate for practicality and cost effectiveness. The option would also result in reduction in health and environmental risks to an acceptable level.

7. Adopted Remediation Strategy

7.1 Overview and Site Management

7.1.1 Overview and Remediation Areas

The remediation works will be carried out by experienced and appropriately licensed contractors. An experienced environmental consultant will be engaged as the Validation Consultant (refer to Section 7.1.2) to inspect the progress of the works and to provide ongoing advice and recommendations as required. The success of the remediation works will be validated by the Validation Consultant.

For ease of reference the remediation actions/ areas at the site have been subdivided into six Areas of Environmental Concern (AEC). The locations of these AEC are provided on Drawing 2, Appendix A.

7.1.2 Roles and Responsibilities

Principal and Principals Representative

The Principal, VES, is responsible for the environmental performance of the proposed remediation works, including implementation of acceptable environmental controls during all Site works. The Principal will retain the overall responsibility for ensuring this RAP is appropriately implemented. The Principal is to nominate a representative (the Principal's Representative - PR), who is responsible for overseeing the implementation of this RAP. The actual implementation of the RAP will, however, be conducted by the Contractor on behalf of the Principal.

The Principal will also be responsible for acquiring all necessary approvals for the remediation works proposed, including approval from the consent authority.

Principal Contractor (the Contractor) and Site Manager

The Principal Contractor (referred to herein as the Contractor) is foreseen to be the party responsible for the day-to-day implementation of this RAP and shall fulfil the responsibilities of the Principal Contractor as defined by WorkCover. It is noted that the Contractor may appoint appropriately qualified sub-contractors or sub-consultants to assist in fulfilling the requirements of the procedures.

The Principal Contractor will nominate a Site Manager who will be responsible for day to day site management and first response to any unexpected finds encountered during works.

Asbestos Contractor

The Asbestos Contractor will be responsible for undertaking all asbestos works, and will include an employee who is a licenced removalist with a Class A or B licence (issued by WorkCover NSW) who will be the works supervisor.

The Asbestos Contractor and Principal Contractor can be the same entity.

Project Surveyor

The project surveyor will be a Registered Surveyor and will be responsible for undertaking the surveying work detailed herein at the instruction of the Principal Contractor.

Validation Environmental Consultant (the Validation Consultant)

The Validation Environmental Consultant (Validation Consultant) will provide advice on implementing this RAP and validate that the site has been appropriately remediated. In general terms, the Validation Consultant will cover items required under the CLM Act and to achieve site validation.

The Validation Consultant will be responsible for:

- Overseeing the remediation works;
- Undertake all validation assessment work, including inspections, sampling and reporting;
- Provide advice and recommendations arising from inspections/ observations;
- Notifying their client with the results of any assessments and any observed non-conformances in a timely manner;

The Validation Consultant, Environmental Consultant and Occupational Hygienist can be the same entity.

Environmental Management Consultant (the Environmental Consultant)

The Environmental Management Consultant (the Environmental Consultant) will provide advice on day to day monitoring and issues arising under the POEO Act (such as waste classification and waste disposal).

The Environmental Consultant will be responsible for:

- Undertaking the required assessments for disposal of liquid and solid wastes;
- Providing advice on issues under the POEO Act; and
- Providing any monitoring activities which may be required which do not directly relate to final site validation (e.g. for odours and air quality).

The Validation Consultant, Environmental Consultant and Occupational Hygienist can be the same entity.

Occupational Hygienist

The Occupational Hygienist will provide advice on WHS issues related to the asbestos works.

The Occupational Hygienist will be suitably qualified/ licenced as required in accordance with the WHS Regulations.

The Occupational Hygienist will be responsible for:

- Preparing any WHS plans and advice requested by the Contractor;
- Undertaking airborne asbestos monitoring (if and when required);
- Undertaking clearance inspections;
- Providing advice and recommendations arising from monitoring and/or inspections; and
- Notifying their client with the results of any assessments and any observed non-conformances in a timely manner.

The Validation Consultant, Environmental Consultant and Occupational Hygienist can be the same entity.

7.1.3 Asbestos Contaminated Soils

Based on the results available to date **all fill is assumed to be contaminated by asbestos and requires management as such**, unless further assessment indicates certain materials only have a low risk of asbestos being present.

An appropriately licensed Asbestos Contactor will be required to undertake all asbestos works and an Occupation Hygienist will be required to provide advice, air monitoring and asbestos validation as required. Further details on this are provided in Section 12.4.

7.1.4 Material Tracking and Disposal Records

The contractor will track the movement of all materials excavated from the site, all imported soil and soil disposed off site, and UPSS structures. This will include tracking of:

- stockpile locations, with corresponding source of materials;
- off-site disposal records for soils (trucking record, landfill dockets);
- sources, volumes, dates and location of any imported materials;
- estimated volume(s) of any soils imported to or exported from the site; and
- destruction records (UPSS).

7.1.5 Minimising Cross Contamination

Prevention of cross contamination of soils and groundwater during remediation works is vital to the successful remediation of the Site. The following measures must be conducted to manage the potential for cross contamination:

- Undertaking all work in accordance with the RAP, including provisions for soil tracking and management of phase separated hydrocarbon (PSH) impacted soils;
- Segregating soils with different contaminant profiles during handling works. This includes separation during excavation and loading into trucks and/or placement in clearly identified, separate, stockpiles;
- Use of suitable trucks for transport of soils within the site. For saturated soils with PSH, the trucks must be sealed to prevent leakage of liquids. Other trucks must be able to prevent spillage or leakage of soils during transport; and
- Disposal of all liquids, including surface runoff, leachate from soils excavated from beneath the water table and extracted groundwater/ PSH in accordance with the POEO Act, and as discussed herein.

7.1.6 Groundwater Management

The site is located within the Botany Aquifer Zone 1 (red) Groundwater Extraction Exclusion Area around the Orica site. All works involving or potentially impacting groundwater must be conducted in accordance with the requirements of the NSW Office of Water.

7.1.7 Programme

The detailed programme and timing of works will depend on the progress of remediation and earthworks, and is the responsibility of the Contractor.

7.2 Prior to Remediation: Borehole Location, Building Demolition and Geophysical Survey

Prior to remediation works, the following will be conducted:

- Location of the previous boreholes requiring remediation by the Project Surveyor, including Borehole: 110, 115, 214, 216, 219, 220 and 303. This should be conducted in conjunction with the Validation Consultant and based on visible signs of the previous drilling (where present);
- Removal of asbestos from the buildings and ground surface by the Asbestos Demolition Contractor as part of the demolition programme;
- Removal of visible asbestos from the ground surface by the Asbestos Demolition Contractor following demolition of the buildings and removal of hardstand;
- Systematic inspection by the Validation Consultant of the site soils following removal of the hard stand for any signs of contamination, potential contamination sources, or local variations in soil conditions which could indicate an underground structure; and
- Investigation for unknown UPSS by a Geophysical Engineer using geophysical methods following removal of concrete slabs. The geophysical survey will cover the entire accessible portion of the site. It is foreseen that the entire site will be accessible, with the possible exception of the sub-station (if retained in its current location). Exclusion of the substation from the geophysical survey is considered to be appropriate as the risk of unknown UPSS in this location is considered to be negligible.

  The actual geophysical survey method will be confirmed prior to commencement. It is anticipated, however, that the geophysical survey will be conducted using a Geometrics G858 Caesium Vapour magnetometer with two sensors configured as a vertical gradiometer, mounted 0.5 m and 1.5 m above ground on a hand-carried non-magnetic staff or on a hand-towed cart (depending on ground conditions following demolition). Each sensor will measure the Total Magnetic Intensity (TMI) of the Earth's magnetic field at intervals of 0.2 seconds (average station spacing of 0.2 m) along parallel survey lines approximately 4 m apart.

  TMI and positional data would be subsequently processed using GeoMetrics MagMap2000 magnetics software and MapInfo/Discover3D GIS software, leading to:

  - Display of the vertical magnetic gradients as a grid surface, overlain with site features to allow identification of gradient anomalies due to surface sources;
  - Identification of remaining local anomalies having amplitudes and widths in excess of background noise levels, as potentially due to buried ferrous metal hence as possible targets for follow-up investigation; and
  - Determination of target coordinates and priorities for follow-up investigation.
- Investigation of signs of concern identified by the soil surface inspection or anomalies identified by the geophysical survey by the Validation Consultant using plant provided by the Contractor.

  Signs of concern identified by the site soil inspection will be investigated by test pitting/ strip trenching as considered appropriate. Any identified contamination or structures considered to be a potential contamination source will be investigated and, if required, remediated in accordance with the Unexpected Finds Protocol (Section 13).

Anomalies identified by the geophysical investigation would be ground-truthed by test pitting to determine the source of the anomaly. Anomalies identified to be UPSS, or other potential contamination sources, would be assessed to determine the need for remediation in accordance with Section 12.

- Additional investigation for potential contamination sources in the main previous manufacturing area of location of the large warehouse building. Limited test pitting/ strip trenching will be conducted in this area to confirm the results of the above investigation works, targeting areas where no signs of concern were identified visually or by the geophysical survey. If the limited further investigation indicates that contamination sources may have been missed by the above investigations, a more comprehensive strip trenching programme will be adopted in consultation with the Site Auditor. Any identified contamination or structures considered to be a potential contamination source will be investigated and, if required, remediated in accordance with the Unexpected Finds Protocol (Section 13).

7.3 AEC 1: PSH and TPH Contaminated Soils and Groundwater

Contaminants detected in this area include TRH in soils, as well as PSH at the groundwater table, identified at Well 216 (Area 1a) and 303 (Area 1b) (refer to Drawing 2, Appendix A). The PSH in Well 216 was liquid, comprising LNAPL, whilst the PSH in Well 303 was observed to solidify on exposure to air following well development. It has not been confirmed if the PSH is continuous between Wells 216 and 303.

The remediation works will comprise:

- Further investigation of the extent of the PSH, groundwater contamination and for any underground structures by the Validation Consultant using plant provided by the Contractor. It is foreseen that this will comprise:
  - Review of geophysical survey results;
  - Investigation for underground structures, e.g. through the use of strip trenches;
  - Test pitting down-gradient of the PSH in areas not previously accessible (i.e. under the former toilet/ office areas);
  - Construction of temporary monitoring wells in the test pits by placement of slotted PVC pipes in the test pit and backfilling around the pipe. The proposed sampling frequency and distribution is provided in Section 11.2. The exact number and location of temporary monitoring wells will depend on the site observations, but is foreseen to comprise at least four locations to the south east and east of the previously identified PSH; and
  - Monitoring of the wells by the Validation Consultant for PSH over at least two rounds, conducted at least two weeks apart.
- Removal (pumping) by the Contractor of mobile PSH. It is anticipated that this will be conducted using skimming methods to minimise the removal and disturbance of groundwater. The Validation Consultant will, however, consider other methods in conjunction with the PR if proposed by the Contractor and if sufficient details are provided.

Removal of mobile PSH should be conducted as early as possible in the remediation programme, and may commence before the further investigation works have been completed. The PSH removal system will be designed by the Contractor, with the design provided to the Validation Consultant for approval prior to commencement. It is anticipated that the system will have the following features:

  - Skimming pumps in boreholes or test pits constructed in Area 1. It is anticipated that a minimum of two pump points should be allowed. Whilst the previous wells may be available for use, they may not have sufficient diameter for the required pumping equipment. The Contractor should allow for installation of new wells if required;
  - A secured above-ground collection tank into which the PSH is to be pumped;
  - A cut off system to turn off the pumps when the collection tank approaches capacity (e.g. at 90% of capacity); and
  - An agreement with an appropriately licensed liquid waste contractor to collect and dispose of the liquid waste off site.

- Assessment of soil in the area of the PSH both above the PSH and within the PSH impacted strata by the Validation Consultant using plant provided by the Contractor. The assessment will determine the suitability of the overburden materials to remain on site, and the waste classification of materials to be disposed off site.
- Stabilising the surrounding ground, as required, to allow removal of the PSH and contaminated soils (e.g. using sheet piles). The method and extent of the proposed stabilisation should be provided to the Validation Consultant for approval. The Validation Consultant will obtain advice from the Geotechnical Engineer as required.
- Excavation by the Contractor of the overburden from over the PSH and on-site stockpiling or off-site disposal as advised by the Validation Consultant based on the *in situ* assessment. This may require supervision and delineation by the Environmental Consultant during excavation.
- Excavation of the PSH impacted soils and off-site disposal in accordance with the waste classification. Contingency plans for materials exceeding the criteria for direct disposal to landfill are provided in Section 9.
- Inspection and validation/ characterisation sampling of the base of the PSH excavation by the Validation Consultant using plant provided by the Contractor in accordance with Section 9.
- Investigation by the Validation Consultant of residual levels of petroleum hydrocarbons in groundwater (TPH, BTEX) in and down-gradient of the PSH remediation area in accordance with Section 9. This may require additional temporary wells to be installed.
- Provision of advice from the Validation Consultant to the PR and Site Auditor regarding the appropriate removal of the PSH excavation, the suitability of the excavation for backfilling, and the presence of residual groundwater contamination.
- Assessment by the Validation Consultant of the requirements/ and options to remediate and/ or manage any residual groundwater contamination. It is anticipated that if significant residual contamination is identified, further removal of contaminated groundwater and/ or ongoing groundwater remediation (e.g. MNA) would be appropriate. Refer to the Contingency Plans in Section 13 for further information on these items.

- Determination of the approach to residual contamination to be agreed between the PR, Validation Consultant and with the approval of the Site Auditor. The adopted approach will take into account any requirements of the Consent Authority, NSW EPA and NOW.
- Approval from the Site Auditor for backfilling of the PSH excavation is recommended. If the backfilling occurs prior to approval from the Auditor, additional work (including re-excavation) may be required to satisfy the Site Auditor.
- Backfilling of the excavation with materials meeting the requirements of Section 8 and any geotechnical requirements.
- Provision of final advice from the Validation Consultant to the PR regarding the adopted approach for any residual groundwater contamination.

7.4 AEC 2, UPSS, including two USTs, bowser and associated pipework

AEC 2 comprises a UPSS with two USTs and a bowser (refer to Drawing 2, Appendix A). The USTs are understood to have a capacity of approximately 5,000 L each. The UPSS has been used to contain mineral spirits, leaded and unleaded petrol. The original WorkCover plan and the GPR suggest the USTs are oriented in a north-south direction, although it is noted that more recent WorkCover plans show the USTs to be oriented in an east-west direction.

The presence of base of the UPSS below the groundwater table in sand may result in some difficulties in the removal of the UPSS and associated contamination, and validation of the resultant excavation. As such, and given the “clean up to the extent practicable” (CUTEP) strategy proposed for the site, it is considered that a pragmatic approach should be adopted for remediation of these areas. This includes a focus on removal of grossly contaminated soils and groundwater.

If significant gross contamination (oiliness, strong odours) is observed, additional work may be required to remove the materials potentially presenting an ongoing source to groundwater. This could require stabilisation of the excavation (e.g. using sheet piles).

The remediation works will comprise:

- Removal of the contents of the UPSS by an appropriately licensed liquid waste contractor using equipment safe for use with flammable liquids, and disposed of to an appropriately licensed liquid waste facility. This will be organised by the Contractor who will obtain and keep all records of the removal and disposal of the liquid waste, and provide them to the PR and the Validation Consultant upon request;
- Purge the UPSS of product vapour by the Contractor in accordance with AS4976-2008;
- Removal of the evacuated UPSS and associated contamination by the Contractor under the supervision of the Validation Consultant. This will include:
  - Removal of overlying pavements and overburden, and the UPSS by an experienced contractor in accordance with AS4976-2008;
  - Excavate and stockpile soils with petroleum odours, staining or other signs of concern (based on field observations and photo-ionisation detector (PID) results) to a depth of approximately 0.5 m below the water table;

  - Excavate and stockpile any soils with gross signs of concern (oiliness, strong odours) from beneath the water table as practically achievable, and stockpile separately with appropriate controls to manage runoff and leaching from the stockpile;
  - Inspection of the excavation by the Validation Consultant;
  - Removal of any free product or oily water observed in the excavation pit during excavation works and off-site disposal by a licensed liquid waste contractor;
  - Collection of validation samples by the Validation Consultant using plant provided by the Contractor at a sample frequency in accordance with Section 11;
  - Collection of waste classification samples by the Environmental Consultant using plant provided by the Contractor at a sample frequency in accordance with Section 11; and
  - Analysis of primary samples for TRH, BTEX, PAH, phenols, VOC and lead.
- Assessment of the laboratory results by the Validation Consultant in accordance with RAC, and provision of advice to the PR and Contractor regarding the success of the remediation;
- Assessment of the laboratory results by the Environmental Consultant and provision of advice to Contractor regarding the waste classification of the stockpiled soil;
- If results are obtained above the RAC, consideration will be given the practicality of excavating the impacted soils and their potential for impact on groundwater. The need for additional excavation, methodology and requirements would be agreed between the Validation Consultant, Site Auditor, PR and Contractor based on the initial results and the field conditions being encountered;
- Further excavation and validation sampling as agreed until all results meet the RAC, or the practical extent of excavation has been reached, and the cessation of remedial excavation has been approved by the Site Auditor;
- Off-site disposal by the Contractor of the contaminated soil in accordance with the waste classification; and
- Backfilling of the excavation with materials meeting the requirements of Section 8 and any geotechnical requirements.

7.5 AEC 3: TPH and PAH Contaminated Soils at Borehole 214

Contaminants detected in this area include TRH and PAH in soils identified in filling in Borehole 214 (refer to Drawing 2, Appendix A). Sample 214/0.9-1 recorded 17,140 mg/kg of TRH C_{10}-C_{36}, 806 mg/kg of total PAH and 130 mg/kg of BaP. Natural materials were encountered at approximately 1.2 m bgl, and no TRH was detected in Sample 214/2.7-2.9.

The remediation works will comprise:

- Relocation of the borehole 214 by the Project Surveyor;
- Excavate filling soils from the former location of Borehole 214, with an initial excavation of 5 m by 5 m centred on the previous borehole, or based on signs of concern (e.g. odour). The excavation will extend to the top of natural material, estimated to be at approximately 1.2 m below the top of the slab;
- Stockpiling of the excavated soil by the Contractor for waste classification assessment;

- Collection of validation samples by the Validation Consultant using plant provided by the Contractor at a sample frequency in accordance with Section 11;
- Collection of waste classification samples by the Environmental Consultant using plant provided by the Contractor at a sample frequency in accordance with Section 11;
- Analysis of primary samples for TRH >C10 to C40 and PAH;
- Further excavation and validation of any remaining contamination in the soils using the above process as required (to be advised by the Validation Consultant);
- Provision of advice from the Validation Consultant when the contamination has been successfully removed;
- Provision of advice from the Environmental Consultant providing the waste classification of excavated soils;
- Off-site disposal of the excavated soil by the Contractor in accordance with the Waste Classification; and
- Backfilling of the excavation with materials meeting the requirements of Section 8 and any geotechnical requirements.

7.6 AEC 4: UPSS, TPH and Zinc Contaminated Soil

AEC 4 comprises the following subareas (refer to Drawing 2, Appendix A):

- Removal of UPSS (AEC 4a);
- Removal of zinc and benzene contaminated soils (AEC 4b); and
- Removal of TPH contaminated soils (AEC 4c).

It is anticipated that the zinc contaminated soils (AEC 4b) will be removed as part of the removal of TPH contaminated soils. It is not currently known if TPH contamination from the UPSS (AEC 4a) extends to AEC 4c.

As discussed in Section 7.4, the presence of base of the UPSS below the groundwater table in sand may result in some difficulties in the removal of the UPSS and associated contamination, and validation of the resultant excavation. As such, and given the “clean up to the extent practicable” (CUTEP) strategy proposed for the site, it is considered that a pragmatic approach should be adopted for remediation of these areas. This includes a focus on removal of grossly contaminated soils and groundwater.

If significant gross contamination (oiliness, strong odours) is observed, additional work may be required to remove the materials potentially presenting an ongoing source to groundwater. This could require stabilisation of the excavation (e.g. using sheet piles).

The remediation works will comprise:

- Removal of the contents of the UPSS by an appropriately licensed liquid waste contractor using equipment safe for use with flammable liquids, and disposed of to an appropriately licensed liquid

waste facility. This will be organised by the Contractor who will obtain and keep all records of the removal and disposal of the liquid waste, and provide them to the PR and the Validation Consultant upon request;

- Purge the UPSS of product vapour by the Contractor in accordance with AS4976-2008;
- Test pitting by the Contractor at AEC 4 under supervision of the Validation Consultant to determine the likely extent of contamination, and thereby extent of remediation excavation required. This will be determined by visual inspection with confirmatory sampling and analysis for TRH, BTEX and zinc as required to assess the extent and to provide an *in situ* waste classification (note material within the tank pit and under the UPSS cannot be classified *in situ*). If any signs of PSH are observed in soils or groundwater, they will be targeted for sampling;
- Removal of the evacuated UPSS and associated contamination by the under the supervision of the Validation Consultant. This will include:
  - Removal of overlying pavements and overburden, and the UPSS by an experienced contractor in accordance with AS4976-2008;
  - Excavate and stockpile soils with petroleum odours, staining or other signs of concern (based on field observations and PID results) to a depth of approximately 0.5 m below the water table;
  - Excavate and stockpile any soils with gross signs of concern (oiliness, strong odours) from beneath the water table as practically achievable, and stockpile separately with appropriate controls to manage runoff and leaching from the stockpile;
  - Inspection of the excavation by the Validation Consultant;
  - Chase out TPH contaminated soils in AEC 4a and 4c based on visual observations and dispose off-site in accordance with the in situ waste classification;
  - Removal of any free product or oily water observed in the excavation pit during excavation works and off-site disposal by a licenced liquid waste contractor;
  - Collection of validation samples by the Validation Consultant using plant provided by the Contractor at a sample frequency in accordance with Section 11;
  - Collection of waste classification samples by the Environmental Consultant using plant provided by the Contractor at a sample frequency in accordance with Section 11; and
  - Analysis of primary samples for TRH, BTEX, PAH, phenols, VOC, lead and zinc;
- Assessment of the laboratory results by the Validation Consultant in accordance with RAC, and provision of advice to the PR and Contractor regarding the success of the remediation;
- Assessment of the laboratory results by the Environmental Consultant and provision of advice to the Contractor regarding the waste classification of the stockpiles soil;
- If results are obtained above the RAC, consideration will be given the practicality of excavating the impacted soils and their potential for impact on groundwater. The need for additional excavation, methodology and requirements would be agreed between the Validation Consultant, Site Auditor, PR and Contractor based on the initial results and the field conditions being encountered;
- Further excavation and validation sampling as agreed until all results meet the RAC, or the practical extent of excavation has been reached, and the cessation of remedial excavation has been approved by the Validation Consultant and confirmed by the Site Auditor;

- Off-site disposal by the Contractor of the contamination soil in accordance with the waste classification; and
- Backfilling of the excavation with materials meeting the requirements of Section 8 and any geotechnical requirements.

7.7 AEC 5: Sub-Station (Assessment Only)

No investigation has been conducted in the area of the substation (refer to Drawing 2, Appendix A) due to its operational nature, and no remediation is proposed at this stage. The purpose of this section is to provide details of the required assessment in this area. If contamination is identified it will be managed as an unexpected find in accordance with Section 13.

Following the decommissioning and removal of the substation from site, the area will be inspected by the Validation Consultant for any signs of environmental concern.

If no signs of concern are observed, samples will be collected from the near surface (0-0.2 m) and analysed for heavy metals, TPH, BTEX and PCB at a rate in accordance with Section 11.

If signs of concern are observed, test pits will be excavated by the Contractor in the area of the substation for inspection and sampling by the Validation Consultant.

The Validation Consultant will provide advice regarding the field and laboratory results, and make recommendations for further work as considered necessary.

7.8 AEC 6: Asbestos and Residual Contamination Suitable for Capping

AEC 6 comprises filling over the entire site. All filling at the site is considered to be impacted by asbestos. In addition, some soils are impacted by chemical contaminants at concentrations considered suitable to be retained on site beneath the proposed capping layer.

The remediation works will comprise:

- Surveying of the level (AHD) of the top of the contained filling by the Project Surveyor. This can be conducted in stages as the works progress as long as all contained contaminated filling is included in the final completed survey;
- Installation of a marker layer, comprising a brightly coloured high-density polyethylene (HDPE) (or similar, suitable, product) by the Contractor over the contaminated filling;
- Inspection of the installed marker layer by the Validation Consultant;
- Construction of a capping layer by the Contractor over the marker layer. The capping layer will comprise:
    - permanent pavement; **and/ or**
    - a compacted layer of soils and/ or rock of at least 0.5 m depth. The soils/ rock will meet the requirements of Section 8 and geotechnical requirements.

If the marker layer is going to comprise more than 0.5 m of clean soils over the contaminated filling, placement of an "early warning layer" to advise intrusive workers that they are approaching the contaminated soils. This may comprise an open weave, durable plastic of similar.

- Inspection of the capping layer during construction by the Validation Consultant;
- Inspection of the capping layer after construction by the Validation Consultant;
- Survey of the elevation (AHD) of the top of the capping layer by the Project Surveyor;
- Preparation of a drawing by the Project Surveyor showing the type and thickness of the capping layer. It is foreseen that this drawing will include contours of the top of the contained contaminated filling and the top of the capping layer and spot levels;
- Review of the above survey drawing by the Validation Consultant to determine if there are any areas of the capping layer which may not meet the requirements. If the requirements do not appear to have been met based on the survey plan, the Validation Consultant will undertake further inspection/ assessment as necessary to verify the actual site conditions or if further works need to be conducted to meet the requirements of the capping layer;
- Implementation by the Contractor of any additional works required to finalise the construction of the capping layer;
- Survey of the elevation (AHD) of the top of the capping layer by the Project Surveyor in any areas of repair, and approval by the Validation Consultant as above; and
- Preparation and implementation of an operational EMP in accordance with Section 10.8.

8. Remediation and Assessment Criteria

The remediation works will be validated as meeting an acceptable standard for the proposed land use. The validation will be undertaken by visual inspection, field screening, analysis of samples and review of any available plans, as discussed below.

This section provides Remediation Acceptance Criteria (RAC), which will be used to judge the success or otherwise of the remediation, and are based on a variety of considerations, including field observations and laboratory results

This section also provides soil and groundwater assessment criteria, which will be used in characterising soils and groundwater as required to determine the RAC have been met and for off-site disposal.

8.1 Remediation Acceptance Criteria

8.1.1 RAC for Soils

For soils in areas not to be capped, the RAC are the SAC, as detailed in Section 8.2.

The RAC for on-site capping of contaminated soils will be considered to have been met when:

- The Validation Consultant has confirmed that all materials requiring off-site disposal and/ or treatment have been removed and disposed off-site (or treated on site), and the resultant excavations have been validated; and
- The capping layer has been constructed and validated in accordance with Section 7.8.

Soil forming part of the capping layer will need to meet the SAC provided in 8.2, to have been legally imported onto the site/ obtained from the site, and to meet all geotechnical requirements.

8.1.2 RAC for Groundwater

The remediation of petroleum contamination in groundwater will be considered complete when:

- Visual inspection shows that PSH has been removed to the extent practical; **and**
- Testing of soil from the PSH excavation area showing that remaining concentrations do not have an elevated risk of forming PSH; and
- All groundwater results being within the GAC; **or**
- Residual groundwater contamination considered to be suitable for management using MNA and development and implementation of a Groundwater Management Plan (GWMP).

8.2 Soil Assessment Criteria

The relevant soil assessment criteria (SAC) are based on a commercial/industrial use (the proposed waste transfer facility). The SAC are not considered to be remediation acceptance criteria, but are considered to be applicable to any materials to remain on the site without remediation/ management or further assessment showing that such management is not required.

The SAC have been derived from the revised NEPC *National Environment Protection Measure (Assessment of Site Contamination)* (1999) as amended [NEPC, 2013].

As all soils at the site are proposed to be capped, ecological criteria are not considered to be applicable. If any uncapped soils are to remain under the final development, ecological criteria may also need to be considered.

8.2.1 Health Investigation Levels

The Health Investigation Levels (HILs) are scientifically based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential risks to human health from chronic exposure to contaminants. They are intentionally conservative and are based on a reasonable worst

case scenario for four generic land use scenarios. Given the proposed continued land use, the following HIL has been adopted:

- **HIL D** – Commercial/Industrial areas.

The adopted HILs, from Table 1A(1), Schedule B1 of NEPC (2013) are shown on the following Table 5.

Table 5: Health Investigation Levels (HILs) (mg/kg)

Analyte		HIL D (mg/kg)
Heavy Metals	Arsenic	3,000
	Cadmium	900
	Chromium (VI)	3,600
	Copper	240,000
	Lead	1,500
	Mercury (inorganic)	730
	Nickel	6,000
	Zinc	400,000
PAH	Benzo(a)pyrene TEQ[a]	40
	Total PAH	4,000
Phenols	Phenol	240,000
OCP	DDT + DDD + DDE	3,600
	Aldrin + Dieldrin	45
	Chlordane	530
	Endosulfan	2,000
	Endrin	100
	Heptachlor	50
	HCB	80
	Methoxychlor	2,500
OPP	Chlorpyrifos	2,000
PCB	PCB[b]	7

Notes:
a Benzo(a)pyrene Toxicity Equivalent for carcinogenic PAHs
b non dioxin-like PCBs only

8.2.2 Health Screening Levels – Petroleum Hydrocarbons

Health Screening Levels (HSLs) are used to assess selected petroleum compounds and fractions to assess the risk to human health via inhalation and direct contact with affected soils and groundwater. The HSLs were developed by the Co-operative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) and were derived through the consideration of health effects only, with particular emphasis on the vapour exposure pathway. Other considerations such as ecological risk, aesthetics, the presence of free phase product and explosive / fire risk are not addressed by the HSLs. As such the HSLs should be used similarly to the HILs, i.e. as a screening tool.

The HSLs have been developed for a range of petroleum hydrocarbons, and for different land uses, media, pathways, soil types and depths to contamination. HSLs have also been derived by CRC CARE for direct contact with petroleum hydrocarbons for the four land use scenarios and intrusive maintenance workers.

The approach in the development of HSLs has sought to set a combination of assumptions and parameters that correspond to the reasonable exposure that can be expected for the range of scenarios. If the subject site does not fall within the range of assumed conditions the HSLs may not be protective and a more detailed consideration of the site specific situation should be carried out.

In order to determine whether the HSLs tabulated in Schedule B1 of NEPC (2013) are applicable or whether a site specific determination is required CRC CARE provide an application checklist which should be completed prior to using the HSLs. The following parameters were considered in completing the checklist:

Petroleum Hydrocarbons (potential contaminants)

- Toluene
- Ethylbenzene
- Xylenes
- Naphthalene
- Benzene
- C_6-C_{10} (F1)
- >C_{10}-C_{16} (F2)
- >C_{16}-C_{34} (F3)
- >C_{34}-C_{40} (F4)

Land Uses (as proposed)

- HSL D – commercial/industrial; and
- Intrusive maintenance worker

Potential Pathways

- Soil vapour intrusion
- Direct contact

Media

- Soil

Soil Types

- Alluvial sands (in the absence of laboratory particle analysis sand HSLs have been adopted as an initial conservative screen; sand is the dominant sub-surface profile at the site).

Depth to Contamination

- Various

Workers Engaged in Subsurface Works

- For work in shallow trenches the HSLs for vapour intrusion and direct contact for HSL D, and intrusive maintenance worker (CRC CARE technical reports) have been adopted; and
- Work in deep trenches (e.g. sewers) has not been included in the development of HSLs. These works usually require health and safety procedures to be followed for protection in confined spaces including use of personal protection equipment.

Other Considerations

- Combined pathways exposure has not been assessed. For each land use the lowest HSLs for soil vapour intrusion and/or direct contact have been adopted as an initial conservative screen;
- Cumulative cancer risk has not been assessed as the chemicals which have been recorded near to or above the HSLs are limited to TRH (non-carcinogenic) only; and
- Site specific adjustments for vapour biodegradation, soils organic carbon content, air exchange rate, soil moisture content, differing lithology or deep contamination have not been considered in this assessment. These parameters tend to reduce the conservatism of the HSL and can be considered at a later stage (e.g. once the development details have been finalised) to potential increase in the HSLs.

The adopted soil HSLs for vapour intrusion, from Table 1A(3), Schedule B1 of NEPC (2013) and Table B3, Appendix B, CRC CARE Technical Report No. 10 (Intrusive Maintenance Worker) are shown on the following Table 6.

Table 6: Soil HSLs for Vapour Intrusion and Intrusive Maintenance Worker (mg/kg)

Analyte		HSL D (mg/kg)				Intrusive Maintenance Worker (mg/kg)		
		Sand				Sand		
		0-<1m	1-<2 m	2-<4m	4+m	0-<2m	2-<4m	4+m
TRH	C_6-C_{10} (less BTEX) [F1]	260	370	630	NL	NL	NL	NL
	>C_{10}-C_{16} (less naphthalene) [F2]	NL	NL	NL	NL	NL	NL	NL
BTEX	Benzene	3	3	3	3	77	160	NL
	Toluene	NL	NL	NL	NL	NL	NL	NL
	Ethylbenzene	NL	NL	NL	NL	NL	NL	NL
	Xylene	230	NL	NL	NL	NL	NL	NL
PAH	Naphthalene	NL	NL	NL	NL	NL	NL	NL

Notes: The soil saturation concentration (Csat) is defined as the soil concentration at which the pore water phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the pore water will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for chemicals and the HSL is shown as 'not limiting' or 'NL'.

The adopted soil HSLs for direct contact, from Table B4, Appendix B, CRC CARE Technical Report No. 10 are shown on the following Table 7.

Table 7: Soil Health Screening Levels (HSLs) for Direct Contact (mg/kg)

Analyte		HSL D (mg/kg)	Intrusive Maintenance Worker (mg/kg)
TRH	C_6-C_{10} (F1)	26,000	82,000
	>C_{10}-C_{16} (F2)	20,000	62,000
	>C_{16}-C_{34} (F3)	27,000	85,000
	>C_{34}-C_{40} (F4)	28,000	120,000
BTEX	Benzene	430	1,100
	Toluene	99,000	120,000
	Ethylbenzene	27,000	85,000
	Xylene	81,000	130,000
PAH	Naphthalene	11,000	29,000

8.2.3 Management Limits – Petroleum Hydrocarbons

In addition to appropriate consideration and application of the HSLs, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards; and
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

Management limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. The adopted management limits, from Table 1B(7), Schedules B1 of NEPC (2013) are shown on the following Table 8. The following site specific data and assumptions have been used to determine the management limits:

- The management limits will apply to any depth within the soil profile; and
- The majority of soils encountered at the site comprised largely alluvial sands. In the absence of field or laboratory measurements a "coarse" soil texture has been adopted.

Table 8: Management Limits (mg/kg)

Analyte		Management Limit (mg/kg)
TRH	C_6-C_{10} (F1)	700
	>C_{10}-C_{16} (F2)	1,000
	>C_{16}-C_{34} (F3)	3,500
	>C_{34}-C_{40} (F4)	10,000

Note: Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2, i.e.

F1 C6-C10
F2 >C10-C16
F3 >C16-C34
F4 >C34-C40

8.2.4 Asbestos in Soil

Filling at the site is to be treated as asbestos contaminated and to be capped, no further asbestos assessment is required for filling to be capped.

With respect to materials not capped on site, NEPM (2013) notes that a detailed asbestos assessment is not required unless the presence of asbestos contamination has been positively detected in the soil.

Asbestos only poses a risk to human health when asbestos fibres are made airborne and inhaled. If asbestos is bound in a matrix such as cement or resin, it is not readily made airborne except through substantial physical damage. Bonded ACM in sound condition represents a low human health risk, whilst both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres. Consequently, FA and AF must be carefully managed to prevent the release of asbestos fibres into the air.

Health Screening Levels (HSLs) for asbestos in soil, which are based on likely exposure levels for different scenarios, have been adopted in NEPC (2013).

The adopted HSLs for commercial/ Industrial use are:

- 0.05% w/w of asbestos in soil in the form of bonded ACM (ACM will be assumed to contain 15% w/w asbestos unless specific results are available to show otherwise);

- 0.001% w/w friable asbestos (FA) and asbestos fines (AF), where quantifiable*; and
- No visible asbestos on the ground surface

Note: * NEPC (2013) recommends the use of AS4964-2004 for the detection of free fibres (including asbestos fibres) in a soil sample. NEPC (2013) also acknowledges the nominal detection limit of this method of 0.01%. As the Site has only a low potential for AF or FA based on its history and investigations to date (i.e. no asbestos manufacturing), this laboratory detection limit of 0.01% will be adopted as the screening criteria for FA and AF.

NEPC (2013) defines the various asbestos types referred to above as follows:

Bonded ACM: Asbestos containing material which is in sound condition, bound in a matrix of cement or resin, and cannot pass a 7mm x 7mm sieve.

FA: Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically unbonded or was previously bonded and is now significantly degraded and crumbling.

AF: Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically unbonded or was previously bonded and is now significantly degraded and crumbling.

8.3 Groundwater Assessment Criteria

The groundwater assessment criteria (GAC) are not the RAC, which are detailed in Section 8.1.2. The GAC, however, provide concentrations above which further management, remediation or monitoring of groundwater may be required in accordance with this RAP.

The GAC comprise groundwater investigation levels (GILs) and HSLs as detailed below. The PQL has also been adopted as a screening level for some contaminants.

8.3.1 Groundwater Investigation Levels and Reference Levels for Direct Contact

The GILs have been sourced from NEPM (2013), Schedule B1, Table 1C, and are provided in Table 9.

'Marine water' GILs have been adopted as a conservative approach. The receiving water body is considered to be Botany Bay, with Port Botany located approximately one kilometre to the south of the site.

Thresholds for drinking water have been adopted as an initial screen for direct contact with groundwater at the site. These have been sourced from NHMRC (2011) National Water Quality Management Strategy Australian Drinking Water Guidelines [ADWG], as referenced in NEPM (2013).

In addition reference levels have been provided to assist in assessing the significance of results where NEPM (2013) does not provide relevant criteria, these are detailed in Table 9 along with their sources.

Table 9: Groundwater Investigation Levels (µg/L)

Analyte	Human Health (µg/L)			Ecosystem Protection (µg/L)		
	ADWG	Reference Levels	Reference Source	GIL	Reference Levels	Reference Source
TPH						
C6-C9	-	-	-	-	150	b
C10-C36	-	-	-	-	600	b
BTEX						
Benzene	1	-	-	500	-	
Toluene	800	-	-	-	180	c
Ethyl benzene	300	-	-	-	5	c
o-xylene	600	-	-	-	350	c
p-xylene		-	-	-	200	c
m-xylene		-	-	-	75	-
PAH						
Naphthalene	-	-	-	50	-	-
Metals						
Arsenic (III)	10	-	-	-	4.5	c
Arsenic (V)		-	-	-	2.3	c
Cadmium	2	-	-	0.7	-	-
Chromium (III)	-	-	-	27	-	-
Chromium (VI)	50	-	-	4.4	-	-
Copper	2,000	-	-	1.3	-	-
Lead	10	-	-	4.4	-	-
Mercury	1	-	-	0.1	-	-
Nickel	20	-	-	7	-	-
Zinc	-	3,000	a	15	-	-
Phenol	-	-	-	400	-	-
PCB						
Arochlor 1242	-	-	-	-	0.3	c
Arochlor 1254	-	-	-	-	0.01	c

a NHMRC (2011) National Water Quality Management Strategy Australian Drinking Water Guidelines [ADWG], Aesthetic based threshold, no health based guideline available
b The Australian Government Airport (Environment Protection) Regulations (1997), Schedule 2 Water Pollution Accepted Limits: Table 1.03 – Accepted limits of contamination.
c ANZECC (2000). Low reliability trigger value for marine water

8.3.2 Health Screening Levels (Petroleum Hydrocarbons)

The HSLs are used to assess selected petroleum compounds and fractions to assess the risk to human health via inhalation of vapours sourced from groundwater. Groundwater levels under the building following development have not been confirmed due to limited monitoring data on groundwater level variations and the final design levels not having been determined. It is expected, however, that average depths to groundwater could range from between 0.2 m (in the area of the compactor only) to 3 m or more. As a conservative measure, an average groundwater under the building of 1 m has been adopted. On this basis generic HSLs do not apply, and site specific HSLs have been determined in accordance with NEPM (2013), using the spread sheet provided as part of Friebel, E & Nadebaum, P 2011a, *HSLs for petroleum hydrocarbons in soil and groundwater, part 1: technical development document*, Technical report no. 10, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

The calculated HSLs are provided in Table 10, below. The HSLs will need to be confirmed based on the final site data, as detailed in Section 10.6.

The inputs and outputs to the spread sheet are provided in Appendix D. Default generic parameters were generally adopted, with the exception of the following site specific data:

- Depth to groundwater: 1 m (conservative measure for average groundwater based on site data and proposed development)
- Soil type 0 - 1 m: Sand (based on site data)
- Advection depth: 0.2 m (conservative measure based on expected slab thickness)
- Capillary thickness: 0.2 m (generic value for sands)
- Floor length: 103 m (as per proposed development)
- Floor width: 47 m (as per proposed development)
- Foundation thickness: 0.2 m (as per proposed development, slab thickness)
- Enclosed space height: 13 m (as per proposed development)
- Air exchange rate: 6 m^3/hour. Based on building dimensions and a proposed air exchange of 390,000 m^3/h

Table 10: Groundwater Health Screening Levels for Vapour Intrusion (µg/L)

Contaminant	Site Specific, groundwater 1 m below building
	µg/L
Toluene	NL
Ethylbenzene	NL
Xylenes	NL
Naphthalene	NL
Benzene	NL
TRH C_6-C_{10} less BTEX [F1]	NL
TRH >C_{10}-C_{16} less naphthalene [F2]	NL

Note: NL – "Not Limiting" to human health for the proposed land use for vapour intrusion from petroleum hydrocarbons

8.4 Classification for Off-site Disposal

All soils to be disposed off site will be assessed and classified in accordance with the NSW Department of Environment and Climate Change (DECC) *Waste Classification Guidelines* (2008, revised 2009).

8.5 Contaminants with No Assessment Criteria

Where screening guidance is provided in NEPM (2013) for a specific analyte, the practical quantitation limit (PQL) will be used as the initial screening criteria.

If concentrations are recorded above the PQL, reference criteria will be sourced from other national and international guidance as relevant and used to determine the significance of the detected analyte.

Details of the reference criteria will be provided where used.

9. Soil Management

9.1 Importation of Soil

If soils are to be imported onto the Site they must meet the following requirements:

- The soils must be legally able to be imported onto the Site in accordance with the *Protection of the Environment Operations (Waste) Regulation* 2005 and any required Council approvals; and
- The soils must meet the RAC (refer Section 8); and
- The soils must meet the geotechnical requirements for their proposed use.

It is preferable for all soil materials imported onto the site to comprise Virgin Excavated Natural Material (VENM). Excavated Natural Material (ENM) may also be imported onto the site.

The process for importation of soils will comprise:

- The Contractor will obtain appropriate paperwork for the materials proposed to be imported, including any available validation report(s) by appropriately qualified environmental consultants, and/or analytical results for potential contaminants, and submitted to the Validation Consultant and the PR prior to importation of the soils;
- The Validation Consultant will review the documentation, determine if the material is suitable for importation and/or what additional confirmatory laboratory testing is required prior to or during importation to validate that the soil is suitable for use on Site. An inspection of the source site by the Validation Consultant may be required;

- The Contractor will inspect the material as it is delivered to ensure it meets the description of the material provided in the documentation. Any material not meeting the description, or with signs of environmental concern (e.g. odours, staining, building rubble inclusions asbestos-cement fragments etc) will be rejected by the Contractor, and will be returned to the source site;
- The Environmental Consultant will inspect the imported material and collect "check" validation samples with a minimum of 3 samples per source site for VENM (or 1 sample per 500 m^3 of ENM) and have them analysed at a NATA accredited laboratory for a suite of common contaminants (including heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos). The inspection and validation sampling may be conducted regularly for any source site, depending on the volume of soil being imported;
- If any signs of concern are observed in the soil or if analytical results do not meet the requirements for importation, the Environmental Consultant will inform the Contractor and Principals Representative (PR) as soon as practical. Where possible the material will be returned to the source site. If this is not possible, the material will be managed in accordance with the Contingency Plan; and
- The results will be included in the validation report.

9.2 Stockpiling of Contaminated Material

Surplus soil/filling materials with contaminant levels in excess of the RAC requiring temporary stockpiling on site shall be placed in a suitable location(s) on impermeable materials. All stockpiles of contaminated material shall be surrounded by star pickets and marking tape or other suitable material to clearly delineate their boundaries. Stockpiles shall be lightly conditioned by sprinkler or covered by geotextile or similar cover to prevent dust blow and other air quality impacts in general compliance with the requirements of the State Environmental Planning Guidelines SEPP 55 – *Remediation of Land*. Should the stockpile remain on site for over 48 hours, geotextile silt fences or hay bales should be erected around each stockpile to prevent losses by surface erosion. Any stockpile to remain on site overnight should be adequately secured in order to reduce the risk of sediment run-off.

9.3 Waste Disposal

All off-site disposal of wastes, where required, will be undertaken in accordance with the POEO Act.

Any soils removed from the Site will be classified in accordance with either:

- the DECC *Waste Classification Guidelines* 2008 Revision July 2009; or
- A General or Specific Exemption under the *Protection of the Environment Operations (Waste) Regulation* 2005.

No soils will leave the site without a formal waste classification.

9.3.1 Assessment of Soil

A waste classification/ exemption assessment will be required for any soils to be disposed off-site. Assessment works will be undertaken by the Environmental Consultant based on previous analytical data, field observation, and if required, additional testing results.

The process of assessment will comprise:

- an inspection for signs of concern (e.g. asbestos-containing materials, staining, odours);
- determination of the source of the material to determine what previous results may be relevant;
- review of previous results to determine if they are applicable to the subject soils (i.e. materials are of similar description, there are no additional signs of concern which need to be assessed) and if sufficient testing results are available;
- undertake additional testing and analysis if considered necessary based on the previous results and the material type/ condition; and
- provision of a report to the Contractor and Principal clearly stating the classification of the subject material.

Based on the results the Environmental Consultant will provide advice on the appropriate disposal/re-use options for the material.

9.3.2 Spoil Contingency Plan

This plan caters for the storage, treatment and disposal of excavated spoil which fails to meet the criteria for direct disposal to a landfill (i.e. Hazardous Waste). Any suspected Hazardous Waste materials should have their classification confirmed by the Environmental Consultant, including additional sampling and analysis as appropriate, prior to implementing this contingency plan.

Hazardous Waste (if encountered) will be handled as follows:

- Materials of the same spoil category/ contamination issue will be carefully excavated and placed as separate stockpiles at demarcated and contained locations. The categorisation would be done on the basis of on-site observations and the contaminant exceedances detected;
- Stockpiles of excavated materials will be appropriately bunded with hay bales/sandbags and covered with anchored geotextile or impermeable plastic sheeting, or alternatively placed in an appropriate container e.g. waste skip, with appropriate cover. Materials considered to have the potential to produce contaminated leachate will be stockpiled in an area with an appropriate leachate collection system;
- Sampling and analysis of segregated stockpiles will be conducted to determine the concentrations of the target parameters in the excavated materials (e.g. leachability of the contaminants of concern, treatability studies);
- Should the sampling and testing confirm the Hazardous Waste category, a treatment methodology will be determined, which may to treat the material for re-use on-site or to a suitable standard for landfill disposal;

- If the material is to be disposed off site, appropriate applications will be made to the EPA. It is foreseen that treatment and management of Hazardous Wastes to be disposed off site would be conducted by a specialised contractor. Agreement as to the appropriateness of the treatment and disposal method for materials must be obtained from the EPA, and disposal consent must be sought from the Hazardous Waste Regulation Unit of the EPA prior to the removal of such wastes from the Site; and
- An appropriately licensed Hazardous Waste remediation contractor will be appointed to manage the waste and remove from site in accordance with the methodology agreed with the EPA.

9.3.3 Loading and Transport of Spoil

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the POEO Act. All licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the Site.

Removal of waste materials from the Site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification and the corresponding requirements outlined in the DECC *Waste Classification Guidelines* (2008, revised 2009), and with the appropriate approvals obtained from the EPA, if required.

Details of all soils removed from the Site (including Virgin Excavated Natural Material - VENM) shall be documented by the Contractor with copies of weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate) provided to the Validation Consultant and the PR. A site log shall be maintained by the Contractor to track disposed loads against on-site origin.

Transport of spoil shall be via a clearly delineated, pre-defined haul route. The proposed waste transport route will be notified to the local Council and truck dispatch shall be logged and recorded by the Contractor for each load leaving the Site. A record of the truck dispatch will be provided to the PR.

9.3.4 Disposal of Material

All materials excavated and removed from the Site shall be disposed in accordance with the POEO Act to a facility/site legally able to accept the material. Copies of all necessary approvals from the receiving site shall be given to the PR prior to any contaminated material being removed from the Site. A record of the disposal of materials will be maintained.

All relevant analysis results, as part of waste classification reports, shall be made available to the Contractor and proposed receiving site/ waste facility to enable selection of a suitable disposal location. Holding arrangements, treatment and disposal requirements for excavated materials which fail to meet the landfill disposal guideline levels are discussed in Section 9.3.2.

Copies of all consignment notes for the transport, receipt and disposal of all materials (including VENM) will be maintained as part of the site log and made available to the Validation Consultant for inspection and reporting purposes upon request.

10. Validation Plan

10.1 Data Quality Objectives and Indicators

The validation assessment will be conducted in accordance with Data Quality Objectives (DQOs) and Quality Assurance/Quality Control (QA/QC) procedures to ensure the repeatability and reliability of the results.

The validation assessment will be planned in accordance with the following DQOs:

- State the Problem;
- Identify the Decision;
- Identify Inputs to the Decision;
- Define the Boundary of the Assessment;
- Develop a Decision Rule;
- Specify Acceptable Limits on Decision Errors; and
- Optimise the Design for Obtaining Data.

A checklist of Data Quality Indicators (DQI) in accordance with Appendix V of the NSW EPA *Contaminated Sites Guidelines for the NSW Site Auditor Scheme* (2nd edition) [2006] will be completed as part of the validation assessment. The DQIs are:

- Documentation completeness;
- Data completeness;
- Data comparability and representativeness; and
- Data precision and accuracy.

Based on a fulfilment of the DQOs and DQIs an assessment of the overall data quality will be presented in the validation assessment report.

10.2 Site Inspections

The Validation Consultant will conduct regular site inspections during remedial works, when any issue of concern is identified and to assess the progress of remediation. A record of the inspections and observations will be provided as part of the Validation Assessment Report. This will include a photographic record.

10.3 Survey

A survey of the residual contaminated soils and capping layer will be prepared in accordance with Section 7.8.

10.4 Soil Validation

Soil sampling and testing is expected to be required to meet the following outcomes:

- Validation samples of remediation excavations/ areas of environmental concern;
- Validation samples of the ground surface where contaminated soils are stockpiled or treated on bare soil;
- Waste classification assessment;
- Groundwater assessment; and
- If soil is imported onto the Site.

The validation sampling frequencies are set out in Section 11.

10.5 Groundwater Validation Plan

Groundwater inspection, sampling and testing is expected to be required to meet the following outcomes:

- Visual inspection at the completion of removal of PSH;
- Testing for residual contamination within and down-gradient of the PSH excavation (Area 1), and any other areas where PSH is encountered during remediation works (e.g. in the UPSS excavation pits).

10.6 Risk Assessment

Whilst it is not anticipated that vapour intrusion will present an unacceptable risk under the proposed development, this will need to be confirmed as part of the validation assessment. The assessment will be based on the final residual contaminant concentrations for soils and groundwater remaining at the site; the depth of the contaminated media below the design floor level; and the final building and ventilation design.

It is foreseen that the risk will comprise an assessment using the CRC CARE *Technical Report 10: Health screening levels for petroleum hydrocarbons in soil and groundwater,* Risk / Health-Based Criteria Model. If use of this model indicates that there is a potential risk, either further remediation or more site specific quantitative risk assessment will be required.

10.7 Other Site Documentation Requirements

The following documents will need to be reviewed as part of the validation assessment, and will need to be provided by the referenced companies and/or personnel.

10.7.1 Principal's Representative (PR)

- Any Licences and Approvals required for the Works which are not the responsibility of the Contractor to provide.

10.7.2 Contractor

- Any Licences and Approvals required for the Works which are the responsibility of the Contractor to provide;
- Records of PSH removal and disposal, including disposal dockets;
- Records of disposal/destruction documentation for the former UPSS;
- Transportation Record: this will comprise a record of all truck loads of soil entering or leaving the Site, including truck identification (e.g. registration number), date, time, load characteristics (i.e. classification, on-site source, destination);
- Disposal dockets: for any soil materials disposed off-site, the contractor will supply records of: transportation records, spoil source, spoil disposal location, receipt provided by the receiving waste facility (where available), a record of receipt from the receiving site will be supplied (i.e. the receiving sites transportation records);
- Imported materials records: records for any material imported onto the Site, including source site, classification reports, inspection records of material upon receipt at Site and transportation records;
- Records relating to any unexpected finds and contingency plans implemented; and
- Incident Reports: any WHS or Environmental Incidents which occur during the works will be documented and the PR and appropriate regulatory authority will be informed in accordance with regulatory requirements.

10.7.3 Validation Consultant

The Validation Consultant will prepare or obtain the following documents:

- Chain-of-Custody documentation;
- Progress reports/memos as required informing the Principal and Auditor of remediation progress;
- A final validation report;
- EMP; and
- If required, a GWMP.

10.7.4 Environmental Consultant

The Environmental Consultant will prepare or obtain the following documents:

- Waste classification reports, as required;
- Chain-of-Custody documentation;

- Progress reports/memos as required by the Contractor;

10.7.5 Occupational Hygienist

The Occupational Hygienist will prepare or obtain the following documents:

- Airborne asbestos monitoring records; and
- Visual clearance of asbestos removal.

10.8 Validation Reporting

A validation assessment report will be prepared for the site by the Validation Consultant in accordance with NSW Office of Environment and Heritage (OEH) *Contaminated Sites Guidelines for Consultants Reporting on Contaminated Sites* (reprinted 2011) and other appropriate guidance documentation. The validation report shall detail the methodology, results and conclusion of the assessment and make a clear statement regarding the suitability of the Site for the proposed land use.

The validation reports shall include a photographic record, details of the contaminated materials contained on site, present detailed analytical results, confirm that any imported fill is appropriately validated, and a drawing showing the extent of the capping layer and final surveyed surface levels of both the contaminated fill materials and capping layer.

10.9 Environmental Management Plan

Following the successful implementation of the RAP, a operational Environmental Management Plan (EMP) will need to be prepared which will detail how the capping system is to be managed in the long term. The EMP will also include restrictions on the extraction of groundwater as considered necessary.

The EMP will need to be legally enforceable and should have an appropriate public notification mechanism such as in the site's Section 149 (2&5) certificate and/or under Section 88B of the *Conveyancing Act 1919.*

10.10 Groundwater Management Plan

If required, a groundwater management plan (GWMP) will be prepared in accordance with Section 13.5.

11. Sample Collection and Analysis Requirements

11.1 Soil Sampling Frequencies

The sampling frequency will depend on the volume or area to be assessed and the previous results. The following sampling frequencies will be used. These frequencies may be reduced for large volumes or areas.

Visual Inspections and Signs of Environmental Concern

All areas to be assessed and validated will first be subject to a visual inspection.

If any signs of environmental concern (e.g. odours, staining) are observed in the area/material being tested, targeted sampling will be conducted as required to assess the contamination potentially associated with the observed sign of concern. This may require additional samples to those required by the testing frequencies given below.

Validation of excavation:

Small to medium excavations (base <500 m^2):

- Base of excavation: 1 sample per 25-50 m^2 or part thereof. Where high local variation is expected, a minimum of 3 samples will be collected.
- Sides of excavation: 1 sample per 10 m length or part thereof. Additional samples will be collected at depths of concern where there is more than one depth of concern, with a minimum of 1 sample per 1.5 m depth.

Large excavations (base ≥500 m^2):

- Base of excavation: sampling on a grid at a density in accordance with the EPA *Contaminated Sites: Sampling Design Guidelines* (1995) or a minimum of 10 samples. In sub-areas with any specific signs of concern, a higher sampling density may be required.
- Sides of excavation: 1 sample per 20 m length or part thereof. Additional samples will be collected at depths of concern where there is more than one depth of concern.

Stockpiles

Samples will be collected from stockpiles at various depths to characterise the full depth of the stockpile.

Validation/ assessment of stockpiled soils (note actual frequency will be determined based on volume, contamination risk and homogeneity of the material):

- Stockpiles ≤250 m^3: 1 sample per 25 m^3 or a minimum of 3 samples;
- Stockpiles 250 – 1,000 m^3: 1 sample per 50-100 m^3, or a minimum of 10 samples; and
- Stockpiles >1,000 m^3: 1 sample per 100-250 m^3.

A sampling regime will be determined by the Environmental Consultant/Validation Consultant in the event that a stockpile has a volume significantly greater than 1,000 m^3.

Where contaminated soils are stored or treated on bare soils, the footprint of the stockpile requires validation following removal of the contaminated soils.

11.2 Groundwater Sampling Frequencies

Collection of groundwater samples from excavation pits or wells in and down-gradient of the PSH excavation area(s) will be undertaken at locations determined based on the extent of PSH and visual observations. It is anticipated an approximate density of 1 sample per 100 m^2 within the PSH area and samples at 10-20 m intervals along (or 5-10 m down-gradient of) the down-gradient boundary of the PSH excavation area.

11.3 Field Methods

11.3.1 Soils

The following general sampling methodology is to be implemented for all sampling:

- Preparing record of samples, including sample date, location, description, signs of concern, and any field results;
- Sampling from surface or from the utilised plant using disposable sampling equipment or stainless steel hand tools;
- Decontaminating all re-useable sampling equipment prior to collecting each sample using a 3% solution of phosphate free detergent (Decon 90) and distilled water;
- Transferring samples into a sealable plastic bag, and then placement in a second plastic bag (i.e. double bagging) (for asbestos analysis);
- Transferring samples into laboratory-prepared glass jars with Teflon-lined lid, and capping immediately (for chemical analytes);
- Labelling sample containers with individual and unique identification, including project number and sample number;
- Placing the plastic bags for asbestos into a sealed container for transport to the laboratory;
- Placing the glass jars for chemical analysis into a cooled, insulated and sealed container for transport to the laboratory; and
- Use of chain-of-custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

11.3.2 Water

The following general sampling methodology is to be implemented for all sampling:

- Preparing record of samples, including sample date, location, description, signs of concern, and any field results;
- Decontaminating all re-useable sampling equipment prior to collecting each sample using a 3% solution of phosphate free detergent (Decon 90) and distilled water;
- Immediate placement of sample in laboratory prepared sample containers and capping;
- Labelling sample containers with individual and unique identification, including project number and sample number;
- Placing the samples into a cooled, insulated and sealed container for transport to the laboratory; and
- Use of chain-of-custody documentation to ensure that sample tracking and custody can be cross checked at any point in the transfer of samples from the field to hand-over to the laboratory.

For 'grab' groundwater samples (e.g. from an excavation pit), the following additional sampling methodology is to be implemented for all sampling:

- Collection of sample from the depth of concern, which will be the water surface for petroleum contaminants; and
- Collection of samples directly into sampling containers, or sampling using disposable or decontaminated glass sampling equipment.

For samples from groundwater wells, the following additional sampling methodology is to be implemented for all sampling:

- Collection of sample from depth of concern, which will be the water surface for petroleum contaminants;
- Micro-purging of well using a low flow pump until field parameters (pH, temperature, dissolved oxygen, EC and redox) have stabilised; and
- Once field parameters had stabilised the samples were collected using a low flow pump. Use of new disposable equipment (bladders and tubing) for each sample.

11.4 Laboratory Analysis

Laboratory analysis of samples will be undertaken by laboratories with NATA accreditation for the analyte being tested and with appropriate QA/QC assessment to meet the requirements of Section 11.5.

It is anticipated that at least two laboratories will be employed to undertake the testing, a primary laboratory and secondary laboratory, which will analyse inter-laboratory replicate samples.

Samples will be analysed for the contaminants of concern identified for the sampling purpose. These contaminants will be identified based on available laboratory results from previous testing, field observations and the objective of the analysis.

11.5 Quality Control and Quality Assurance

QA/QC procedures will be adopted to ensure the repeatability and reliability of the results.

Field QA/QC testing will include the following:

- 5% sample inter-laboratory analysis, analysed for the same suite as primary sample;
- 5% sample intra-laboratory analysis, analysed for the same suite as primary sample;
- Rinsate samples (where re-useable sampling equipment is used), analysed for the suite of analytes analysed by the majority of the primary samples;
- Trip spike samples (one per batch of samples tested for BTEX where volatile contaminants are of concern); and
- Trip blank samples (one per batch of samples tested for BTEX where volatile contaminants are of concern).

The laboratory will undertake analysis in accordance with its accreditation, including in-house QA/QC procedures. These may include:

- Reagent blanks;
- Spike recovery analysis;
- Laboratory duplicate analysis;
- Analysis of control standards;
- Calibration standards and blanks; and
- Statistical analysis of QC data including control standards and recovery plots.

The quality control analytical results will be assessed using the following criteria:

- Sampling location rationale met the sampling objective;
- Standard operating procedures are followed;
- Appropriate QA/QC samples are collected/prepared and analysed;
- Samples are stored under secure, temperature controlled conditions;
- Chain of custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory;
- Conformance with specified holding times;
- Accuracy of spiked samples within the laboratory's acceptable range (typically 70-130% for inorganic contaminants and greater for some organic contaminants);

- Field and laboratory duplicates and replicate samples will have a precision average of +/- 30% relative percentage difference (RPD) for inorganic analytes and +/- 50% RPD for organic analytes; and
- Rinsate samples will show that the sampling equipment is free of introduced contaminants, i.e. the analytes show that the rinsate is within the normal range for deionised water.

12. Site Management Plan

12.1 Standard Site Management Plan Requirements

It is the responsibility of the Contractor to develop a Site Management Plan (SMP) detailing site management, environmental management and work health and safety (WHS) (including site emergency response) plans for the site. It is noted that at this stage, the design plans and relevant approvals for the project have not been finalised. Therefore, prior to commencement of any remedial works, the SMP that is developed by the contractor, must include the details of the remediation scheduling, contact details of relevant personnel for the project (including contact details for community liaison) and management plans for construction and implementation of the project.

Works will comply with all legislative requirements including, but not limited to, those set out under the following Acts (and their subsequent amendments and regulations):

- Environmentally Hazardous Chemicals Act, 1985;
- Hazardous Chemicals Act, 1985;
- Environmental Offences and Penalties Act, 1989;
- Agricultural and Veterinary Chemicals Act, 1994;
- Protection of the Environment Operations Act, 1997 (POEO Act);
- Contaminated Land Management Act, 1997 (CLM Act);
- Pesticide Act, 1999;
- Work Health and Safety Act, 2011 (WHS Act);
- OHS Amendment (Dangerous Goods) Act, 2003 (including OHS Amendment (Dangerous Goods) Regulation 2005); and
- POEO Amendment Act, 2005 (including POEO Amendment (Scheduled Activities and Waste) Regulation 2008).

12.2 Site Operations

Remediation works will be restricted to the hours as may be set in the Consent Conditions.

It is the site owner's/project proponent's responsibility to ensure appropriate personnel are appointed to manage and conduct the remediation and validation works. This will include:

- the Principal's Representative, who is responsible for overseeing the implementation of this RAP;
- the Contractor, who will be responsible for conducting the remedial works and managing the site; and
- an Validation Consultant, who will be responsible for providing advice as required for the remedial works and undertaking the validation works in accordance with this RAP.

The PR will be responsible for preparing a list of contacts for the works. The Contractor will be responsible for preparing a list of contacts, including emergency contacts for the site operations and provision of signage at the site to allow the public to contact nominated site personnel out of hours.

Prior to the commencement of site remediation works, the following interim controls will be in place:

- The construction of permanent fences around the subject area meeting appropriate specifications to prevent unauthorised entry; and
- Any pits or unstable areas on site that may generate potential WHS or operational risk will be demarcated and taped off, with appropriate rectification action undertaken (e.g. backfilling of pits as soon as practicable to prevent undue injuries to workers etc.).

12.3 Environmental Management

The work will be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements. The contractor will have in place a Construction Environmental Management Plan (CEMP) for the work which includes, as necessary, the following items:

- Site stormwater management plan
- Soil management plan
- Noise control plan
- Dust control plan
- Odour control plan
- Contingency measures for environmental incidents

The contractor will also be responsible to ensure that the site works comply with the following conditions:

- fugitive dust leaving the confines of the site is minimised;
- no water containing suspended matter or contaminants leaves the site in a manner which could pollute the environment;
- vehicles will be cleaned and secured so that no mud, soil or water are deposited on any public roadways or adjacent areas;
- spoil is managed in accordance with this RAP, including Section 9; and
- noise and vibration levels at the site boundaries comply with the legislative requirements.

12.4 Specific Requirements for Asbestos

In addition to the above, the WHS Act and associated Regulation has specific requirements for asbestos works. The Occupational Hygienist is responsible for providing advice on all regulatory requirements related to asbestos works and the Asbestos Contractor is responsible for implementing these requirements. A summary of the WHS requirements related to asbestos is provided below.

12.4.1 Notification

WorkCover NSW must be notified 5 days in advance of any asbestos works.

The Asbestos Contractor must, before commencing the licensed asbestos removal work, inform the following people that asbestos removal works are to be conducted and the date the work will commence:

- The person with management or control of the workplace and any adjacent occupied buildings; and
- The entity/person who commissioned the asbestos removal work.

The person with management of control of the workplace must inform workers ad any other persons in the workplace.

12.4.2 Occupational hygienist

An Occupational Hygienist is to be engaged by the Contractor to provide advice, air monitoring, asbestos clearances and other items as required to appropriately conduct all asbestos works at the site.

12.4.3 WHS Plans

The Asbestos Contractor will prepare the following plans complying with regulatory requirements, including the WHS Regulation and WorkCover NSW requirements:

- Safe Work Method Statements (SWMS); and
- Asbestos Removal Control Plan (ARCP). The ARCP must:
    - Be provided to the person who commissioned the work;
    - Include details of how the asbestos removal will be carried out, including the method to be used and the tools, equipment and personal protective equipment to be used;
    - Include details of the asbestos to be removed, including the location, type and condition of the asbestos; and
    - Be kept by the licensed asbestos contractor in accordance with the WHS Regulations.

12.4.4 Licensed Contractor and Training

All asbestos works must be undertaken by an Asbestos Contractor with a Class A or B license issued by WorkCover NSW. The licensed removalist must nominate an asbestos removal supervisor who must be readily available to a worker carrying out asbestos removal work whenever the work is being carried out.

All asbestos workers at the site must be appropriately trained in asbestos works and in the Asbestos Removal Control Plan. The training must include information on health risks associated with asbestos, and the rights of asbestos workers under the WHS Regulation.

The licensed asbestos removalist must keep records of all training works.

12.4.5 Fencing and Signage

Prior to the commencement of the asbestos works, the area will be closed off with the use of secure fencing and enclosure (e.g. shade cloth installed on fencing) and warning signs.

Warning signs shall be specific to Asbestos Hazards.

12.4.6 Restriction of Access

Access to the asbestos works area will be restricted to:

- Workers engaged in asbestos removal work;
- Other persons associated with the asbestos removal work; and
- Anyone allowed under the WHS Regulation or another law to be in the asbestos removal area.

12.4.7 Airborne Asbestos Monitoring

Monitoring for airborne asbestos fibres is to be carried out by the independent Occupational Hygienist during the asbestos works as required to meet WHS (2011) regulation and WorkCover requirements. The Occupational Hygienist will be responsible for determining when air monitoring is required, and an appropriate scope of monitoring for the works.

It is recommended that air monitoring be undertaken prior to commencement of works to identify any background asbestos concentrations in air at the site. Air monitoring will also be required during excavations works.

The Occupational Hygienist is to provide prompt results to the Asbestos Contractor to allow appropriate action to be taken if any respirable asbestos is detected.

If respirable asbestos fibre levels are recorded at 0.01 fibres/ml or more, but not more than 0.02 fibres/ml the following must be implemented immediately:

A. Investigate the cause of the respirable asbestos fibre level; and
B. Implement controls to prevent exposure of anyone to asbestos; and
C. Prevent further release of respirable asbestos fibres.

If respirable asbestos fibre levels are recorded at more than 0.02 fibres/ml the following must be implemented immediately:

A. Order the asbestos removal work to stop; and
B. Notify the regulator; and
C. Investigate the cause of the respirable asbestos fibre level; and
D. Implement controls to prevent exposure of anyone to asbestos; and
E. Prevent the further release of respirable asbestos fibre.

12.4.8 Personal Protective Equipment

The following personal protective equipment (PPE), in addition to standard construction PPE, should be worn during works involving the handling and/or removal of soils impacted by asbestos:

- Half-face P1/P2 respirator;
- Disposable coveralls (Tyvek suit or equivalent);
- Gloves; and
- Safety glasses or safety goggles.

12.4.9 Decontamination

At the direction of the Occupational Hygienist, facilities must be provided to decontaminate:

- The asbestos removal area;
- Any plant used in the asbestos removal area;
- Workers carrying out asbestos removal work; and
- Other persons who have access to the asbestos removal area.

12.4.10 Clearance Inspection and Certificate

The Occupational Hygienist is to undertake a clearance inspection and provide a certificate as required at the end of all asbestos removal works.

12.5 Requirements for Entering Excavations

Where excavations are to be entered, the following must be conducted:

- All works must be conducted in accordance with Confined Space requirements (where applicable);
- Monitoring for volatile organic compounds (VOC) (as discussed below) as a minimum should be undertaken prior to anyone entering an excavation without appropriate PPE (including face respirator) for volatile compounds as considered necessary based on the excavation size and initial monitoring results, ongoing monitoring (continuing to weekly) may be required during works; and
- If VOC is identified, the Validation Consultant will provide recommendations on appropriate management procedures and/or PPE. The Contractor will implement the recommended measures.

Monitoring for Potential Volatile Organic Compounds (VOC)
Where required, a pre-calibrated photo-ionisation detector (PID) is to be used to provide initial indications on VOC vapour levels in the impacted area. Readings should be taken every minute for 10 minutes duration. Where no reading exceeds 50 ppm (50% of the trigger value published by Calebrese & Kostecki, 1993) no further action will be deemed necessary, however, if any measurement in air exceeds 50 ppm for periods in excess of 5 minutes (i.e. 5 consecutive 1-minute readings) then works in the affected areas should cease, and samples of soil and/or vapours should be obtained and analysed to determine the nature and concentration of the volatile compounds. The Environmental Consultant/ Occupational Hygienist will provide advice on WHS management measures, if considered necessary, which may include sampling for specific contaminants of concern.

12.6 Disposal of Waters

Any water requiring disposal will be assessed and managed as follows:

- Assessment of water quality by the Environmental Consultant. This will include a review of potential for the water to be impacted by various contaminants, possible disposal options, and determination of a suitable sampling and analysis program. Analysis may include total suspended solids (TSS) and/or turbidity, pH, filterable iron, TPH, PAH, BTEX, VOC and metals. The Environmental Consultant will provide written advice of the results to the PR and Contractor, including comments on potential disposal options;
- Determination of the appropriate disposal method by the PR based on the above results. Treatment may be required prior to disposal. In general, disposal options for liquids include:
    - On-site absorption. This option is generally suitable for water with contaminants levels at background quality for the site, and comprises discharge of water onto the ground surface in an area where it will be absorbed into the underlying soils and groundwater. TSS would not be an issue of concern for this method of disposal;
    - Disposal to stormwater. This option is suitable for uncontaminated waters, with low turbidity. All water to be disposed to stormwater needs to meet the requirements of the owner of the stormwater system, which is Botany Council;

- Disposal to sewer under a Trade Waste Agreement. This method of disposal would require a Trade Waste Agreement with Sydney Water;
- Disposal as a liquid waste to a licensed liquid waste contractor in accordance with the POEO Act, 1997. This method is likely to be costly, however, it allows for off-site treatment and is therefore suitable for wastes with high levels of contaminants; and
- On-site treatment followed by disposal by one of the above methods. If direct disposal by one of the above methods is considered unsuitable due to the water quality or cost, on-site treatment could be conducted prior to disposal. On-site treatment may include for example removal of suspended solids and pH adjustment which are standard requirements for construction sites water prior to disposal to stormwater or sewer;

- Disposal of the water in accordance with the POEO Act. Record of the disposal will be kept by the Contractor and provided to the PR and Environmental Consultant.

12.7 Specific Requirements for Chemical Contaminants

The risk to workers during construction works from the chemical contaminants is considered to be generally low. However as with all contaminated soils, measures should be undertaken to minimise the potential exposure of workers to contamination. These include:

- Minimising dermal contact with contaminated soil/ water; and
- Minimising ingestion with contaminated soil/ water, including of dust.

The above can be achieved by the use of appropriate PPE and good hygiene (e.g. washing hands prior to eating/ upon completion of work).

13. Unexpected Finds Protocol and Contingency Plans

13.1 Unexpected Finds Protocol

All site personnel will be inducted into their responsibilities under this Unexpected Finds Protocol (UFP), which should be included in the Contractors Site Management Plan.

All site personnel are required to report the following to the Site Manager if observed during the course of their works:

- Signs of unexpected environmental concern, e.g. presence of unexpected fibre cement, petroleum, or other chemical odours, unnatural staining, potential contamination sources (such as buried drums or tanks) or chemical spills.

Should signs of concern be observed, the Contractor will, as soon as practical:

- Place barricades around the affected area (the potential area of environmental concern – PAEC) and cease work in that area;

- Notify authorities needed to obtain emergency response for any health or environmental concerns (e.g. fire brigade);
- Notify the PR of the occurrence;
- Notify any of the authorities that the Contractor is legally required to notify (e.g. EPA, Council); and
- Notify the Validation Consultant.

The PR will notify any of the authorities which the Principal is legally required to notify (e.g. EPA, Council).

Following the immediate response in the UFP, one of the following contingency plans may be implemented.

13.2 General Contingency Plan

The general contingency plan for the site is as follows:

- The Validation Consultant will inspect the PAEC and determine the nature of the issue, whether it comprises an AEC, and the appropriate approach to assessing or (if appropriate) managing the issue;
- The Site Auditor will be informed, if considered necessary, of the PAEC/AEC and the proposed assessment and/or management approach;
- The Validation Consultant will undertake an assessment considered necessary to determine the management strategy for the AEC;
- If contamination is found and remediation action is considered necessary, a remediation strategy for the AEC will be prepared as an addendum to this RAP by the Validation Consultant and provided to the Site Auditor for approval; and
- If the AEC or proposed remediation strategy is significantly different than that detailed in the RAP, the Consent Authority or Private Certifier (as applicable) will be provided notification of the proposed works.

13.3 Contingency Plan for Unexpected UPSS

In the event that an UPSS is encountered during site works, the UPSS should be managed/ removed as follows:

- Visual identification of the tank and associated pipework;
- Decommissioning, removal and validation using the methodology for AEC 2, Section 7.4; and
- Inclusion of the documentation, including tank and pipe work destruction certificates and analytical results in the validation assessment report.

13.4 Bioremediation (Landfarming) Contingency Plan

If petroleum contaminated soils are not suitable for direct disposal to landfill, or if it becomes more economical to treat petroleum contaminated materials on site than to dispose of them, on-site treatment will be conducted. This contingency plan is NOT suitable for asbestos contaminated soils.

Bioremediation ('landfarming') of petroleum impacted soils will be adopted as detailed follows:

- Designation of a petroleum treatment area(s) (PTA) for the *ex situ* stockpiling and bioremediation of the petroleum impacted soil;
- Construction of an impermeable or low permeability pad if materials with visible PSH (including oiliness) are to be treated;
- Bunding of the PTA with a drainage system diverting surface water runoff around the PTA, and a collection system for any run-off water from within the PTA which will be collected for assessment prior to re-use or disposal. The water assessment will comprise a visual inspection for any signs of concern (e.g. oily film) with laboratory analysis for TRH, BTEX and oil and grease (as a minimum) prior to discharge/ disposal;
- Placement of contaminated soil in the PTA. Spoil with different properties and/or chemical profiles will be kept separate for more efficient treatment;
- Addition of nutrient (e.g. blood and bone, urea or other approved product) or proprietary bioremediation product as approved by the Validation Consultant;
- Spreading of contaminated soils into windrows (preferably) or stockpiles (if insufficient space for windrows). The windrows or stockpiles will preferably be less than 0.5 m in height;
- Light conditioning of the windrows or stockpiles to keep them moist and minimise dust and vapour generation;
- Management of potential vapours will be required. Suitable control methods should include conditioning of soil with water. Additional measures will need to be implemented if significant odours are detectable outside the PTA. This may include covering of the material and/ or use of an odour suppressant;
- Turning of windrows or stockpiles by the Contractor on a regular basis to aerate the soils and assist in break-down of the petroleum hydrocarbons. Turning will be undertaken during non-windy periods. Windrows/stockpiles will be turned every 2-3 days for the first two weeks, and weekly thereafter. The turning frequency will be reviewed by the Validation Consultant after the first month and as required thereafter;
- The Contractor will monitor for any detectable odours at the boundary of the PTA before and after soil turning events. The Contractor should seek advice from the Environmental Consultant if required to assist in the management of odour issues;
- Regular inspection by the Environmental Consultant to record any odours or vapours detectable in the ambient air using a photoionisation detector (PID);
- Inspection by the Validation Consultant of the materials being treated for signs of concern (based on visual and olfactory observations) after two weeks of turning and then as required based on the material being treated and progress. The Contractor will liaise with the Validation Consultant regarding the progress of the remediation and appropriate timing of further inspections;

- If considered appropriate to speed up the landfarming process, additional nutrient, organic matter or a proprietary bioremediation product may be added;
- If signs of petroleum contamination are observed in any materials, the materials will continue to be turned;
- If no signs of concern are noted by the Validation Consultant, validation samples will be collected by the Validation Consultant in accordance at a rate of 1 sample per 25 m^3 or a minimum of three samples per windrow/ stockpile. Samples will be collected from various locations and depths over the windrow/stockpile to allow characterisation of the material;
- All validation samples will be tested at a NATA accredited laboratory TRH and BTEX, and for other analytes if considered necessary based on the source of the material;
- If a validation sample(s) exceeds the RAC, than all materials represented by the sample(s) will undergo continued bioremediation as detailed above or be disposed off-site;
- If all validation samples meet the RAC the material will be considered to be validated for re-use on site in an appropriate location; and
- Validation of the surface of the PTA by the Validation Consultant following remediation. The PTA validation will comprise sampling in accordance with Section 11 and analysis of all samples for TRH, BTEX and any other contaminants of concern. If any samples fail, the extent of the material represented by those samples will need to be chased out and the resulting excavation validated by additional validation sampling. The contaminated material can either be remediated in the PTA or disposed off-site. If materials are remediated in the PTA, the area will need to be revalidated following their remediation.

As a contingency, any soils failing the RAC after an exhaustive period of land farming will be waste classified and disposed off site in accordance with the POEO Act, 1997.

13.5 Groundwater Contingency Plans

If the groundwater validation indicates that further groundwater remediation is required, one of the below methods will be adopted:

- Remove (pump out) oily water/water with elevated petroleum hydrocarbons detected during remediation works to the extent practical/allowable under any consent conditions or agreements with the Site Auditor and/ or regulatory authorities; and/or
- Monitored natural attenuation (MNA) of residual dissolve-phase petroleum contaminants. MNA is only a suitable option where PSH has been removed to the extent practical and no unacceptable vapour risk to future site users and present.

Based on monitoring results to date MNA is considered to be suitable for remediation of residual petroleum contamination at the site.

If MNA is to be adopted a Groundwater Management Plan (GWMP) will be prepared detailing the methodology of the MNA. This will include:

- Entity responsible for ensuring the GWMP is implemented;
- Locations and frequency of monitoring;

- Analytes to be assessed;
- Requirements to allow MNA to be discontinued; and
- Triggers and contingency plans for additional monitoring/ remediation.

The GWMP will be provided to the Site Auditor for approval.

14. Conclusions

It is considered that the site can be rendered suitable for the proposed development subject to appropriate remediation in accordance with this RAP.

The success of the remediation will need to be validated as detailed herein. An operational Environmental Management Plan (EMP) will be required to ensure that the contained contaminated fill does not present an unacceptable risk to human health or the environment in the future, and that ongoing management and/or monitoring is properly implemented.

15. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at 34 – 36 McPherson Street, Banksmeadow in accordance with DP's proposal SYD130031 dated 25 January 2013 and acceptance received from Ms Elena Ivanova of Veolia Environmental Services (Australia) Pty Ltd dated 28 June 2013. The work was carried out as a variation to the Consultancy Agreement for DP Project 37278.03. This report is provided for the exclusive use of Veolia Environmental Services (Australia) Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The assumptions made are based on a previous sampling program and sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the

hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the applicable components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

This report has been produced with reference to the *National Environmental Protection (Assessment of Site Contamination) Measure* 1999 as amended (amended 16 May 2013 and approved by the NSW EPA on 11 June 2013) (ASC NEPM 1999). The report is, however, based on investigation undertaken prior to the amendment of ASC NEPM 19996. Further investigation in accordance with the amended ASC NEPM 1999 has not been undertaken and is not considered necessary due to: the investigation process being substantially completed prior to 16 May 2013; and significant additional works and/or cost would be necessary to meet the amended ASC NEPM; and the information available to DP to date indicates that any possible risks associated with applying the original ASC NEPM are likely to be relatively low.

Douglas Partners Pty Ltd

Appendix A

About this Report

Site Drawings

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

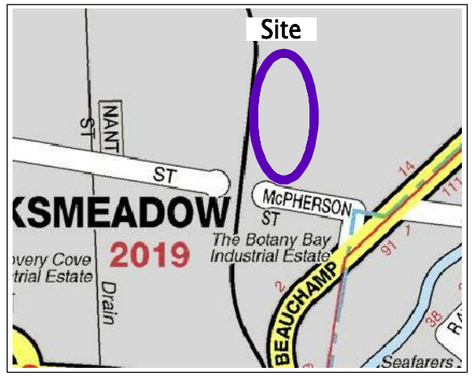
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Locality Plan

0 5 10 15 20 30 40 60m

1:600 @ A3

NOTE: Base drawing from Meadows Consulting Pty Ltd
(Drawing 4623-04, dated 21.1.2013)

LEGEND

Site Boundary

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Veolia Environmetal Services (Australia)	TITLE: **Site Location and Boundary Remediation Action Plan 34-36 McPherson Street, BANKSMEADOW**	PROJECT No: 37278.07
	OFFICE: Sydney / DRAWN BY: PSCH		DRAWING No: 1
	SCALE: As shown / DATE: 30.8.2013		REVISION: 0

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NOTE: Base drawing from Meadows Consulting Pty Ltd
(Drawing 4623-04, dated 21.1.2013)

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Veolia Environmetal Services (Australia)	TITLE: **Areas of Environmental Concern** **Remediation Action Plan** **34-36 McPherson Street, BANKSMEADOW**	PROJECT No: 37278.07
	OFFICE: Sydney / DRAWN BY: PSCH		DRAWING No: 2
	SCALE: As shown / DATE: 30.8.2013		REVISION: 0

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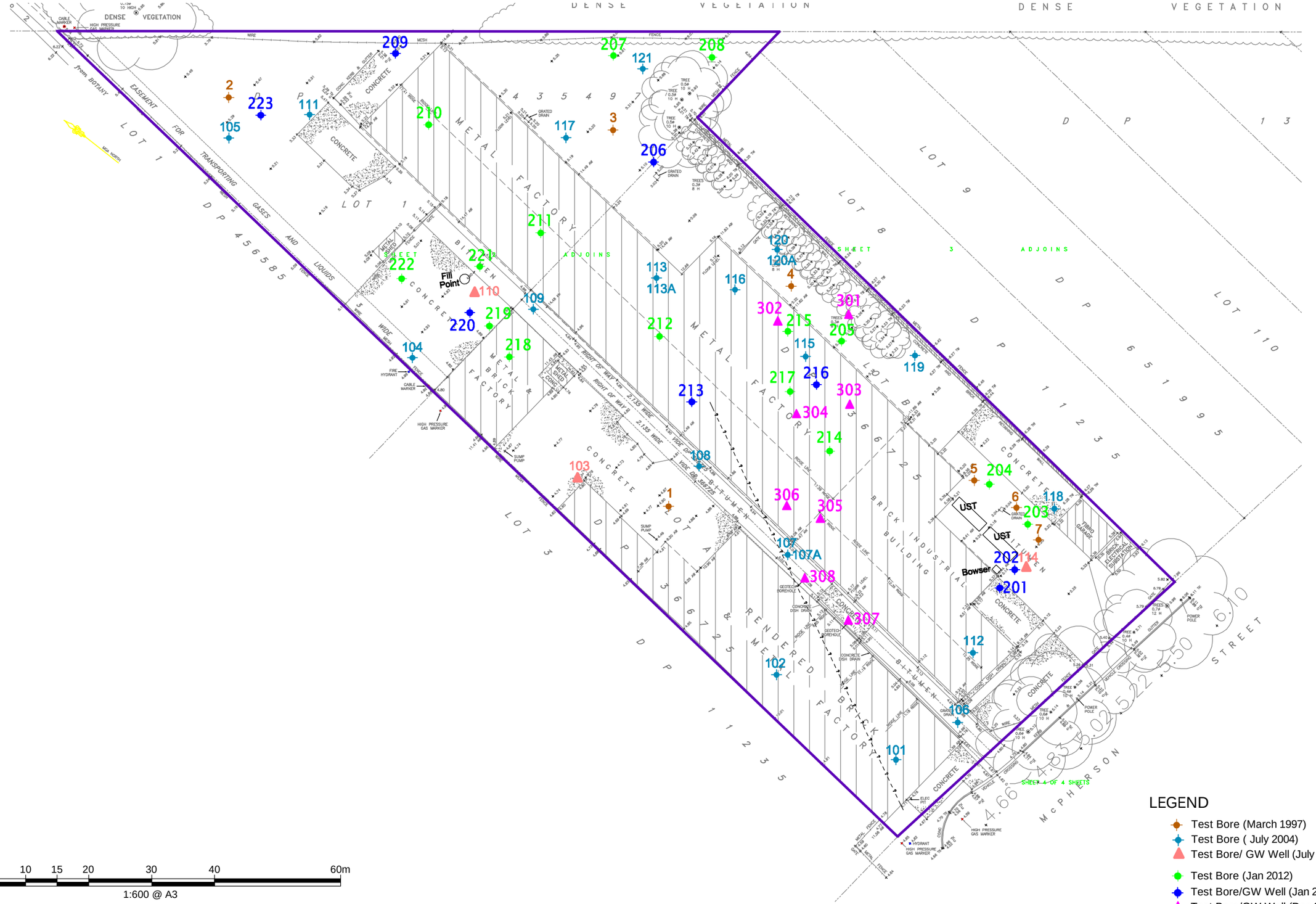

0 5 10 15 20 30 40 60m

1:600 @ A3

NOTE: Base drawing from Meadows Consulting Pty Ltd
(Drawing 4623-04, dated 21.1.2013)

LEGEND

- Test Bore (March 1997)
- Test Bore (July 2004)
- Test Bore/ GW Well (July 2004)
- Test Bore (Jan 2012)
- Test Bore/GW Well (Jan 2012)
- Test Bore/GW Well (Dec 2012)
- Site Boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Veolia Environmetal Services (Australia)		TITLE: **Previous Test Locations** **Remediation Action Plan** **34-36 McPherson Street, BANKSMEADOW**
OFFICE: Sydney	DRAWN BY: PSCH	
SCALE: As shown	DATE: 30.8.2013	

PROJECT No:	37278.07
DRAWING No:	3
REVISION:	0

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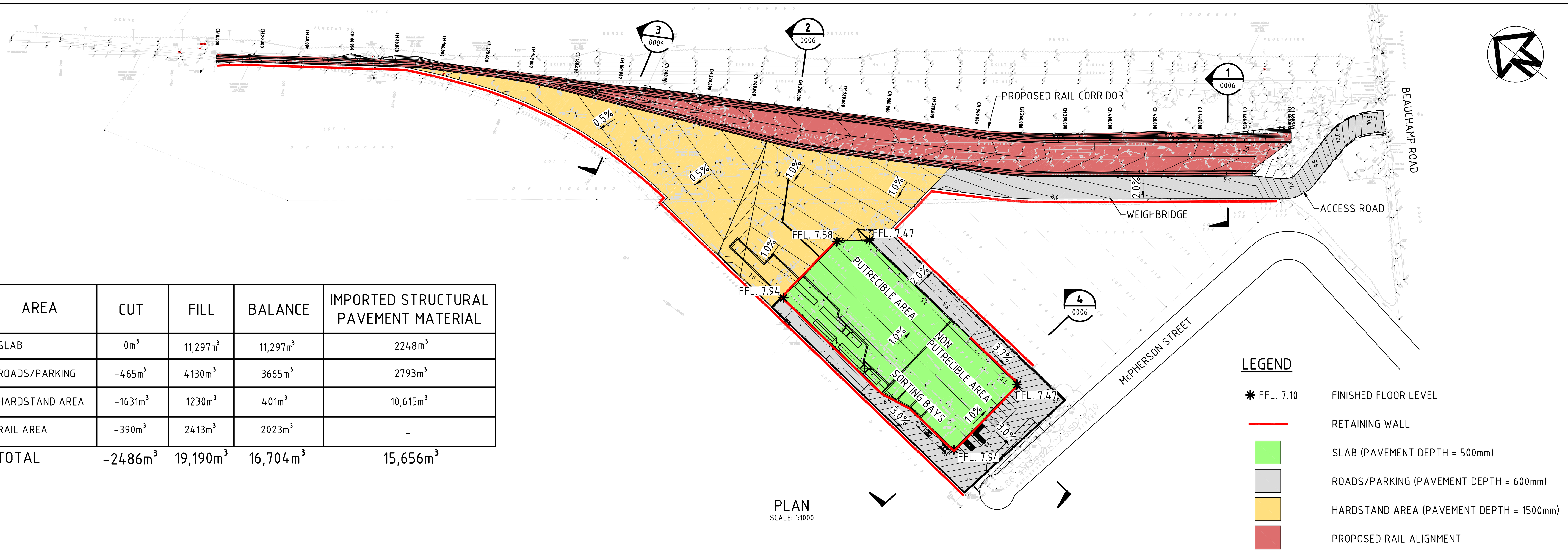
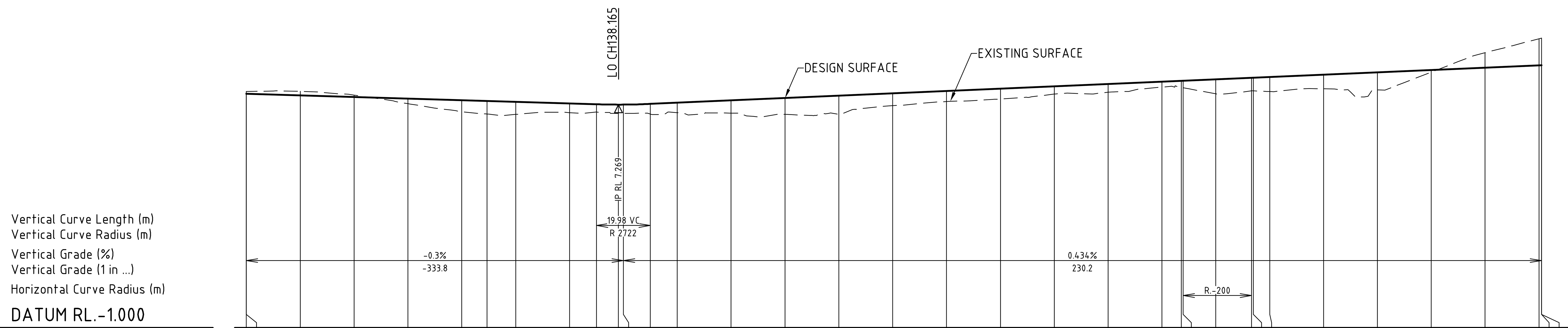


AREA	CUT	FILL	BALANCE	IMPORTED STRUCTURAL PAVEMENT MATERIAL
SLAB	$0m^3$	$11,297m^3$	$11,297m^3$	$2248m^3$
ROADS/PARKING	$-465m^3$	$4130m^3$	$3665m^3$	$2793m^3$
HARDSTAND AREA	$-1631m^3$	$1230m^3$	$401m^3$	$10,615m^3$
RAIL AREA	$-390m^3$	$2413m^3$	$2023m^3$	-
TOTAL	$-2486m^3$	$19,190m^3$	$16,704m^3$	$15,656m^3$

PLAN
SCALE: 1:1000



PEGGED CHAINAGE	DESIGN LEVELS ON ROAD CENTRELINE	EXISTING SURFACE ON ROAD CENTRELINE	CUT / FILL DEPTH
-0.000	7.688		
0.000	7.688	7.771	-0.082
20.000	7.628	7.781	-0.152
40.000	7.569	7.640	-0.071
60.000	7.509	7.323	0.186
80.000	7.449	7.021	0.428
89.396	7.421	6.938	0.482
100.000	7.389	6.924	0.465
120.000	7.329	6.990	0.339
130.010	7.299	7.009	0.290
138.165	7.287	6.965	0.322
140.000	7.287	6.964	0.323
149.990	7.312	6.937	0.375
160.000	7.356	6.990	0.366
180.000	7.443	6.973	0.470
200.000	7.530	6.925	0.605
220.000	7.617	6.925	0.692
240.000	7.703	7.248	0.455
260.000	7.790	7.400	0.391
280.000	7.877	7.497	0.380
300.000	7.964	7.676	0.288
320.000	8.051	7.745	0.306
340.000	8.138	7.935	0.203
347.165	8.169	7.927	0.242
347.877	8.172	7.913	0.259
360.000	8.225	7.687	0.538
373.244	8.282	7.795	0.487
373.956	8.285	7.797	0.489
380.000	8.312	7.771	0.541
400.000	8.398	7.874	0.524
420.000	8.485	7.837	0.648
440.000	8.572	8.494	0.078
460.000	8.659	9.214	-0.555
480.000	8.746	9.728	-0.983
480.938	8.750	9.753	-1.003
480.941	8.750		

RAIL ALIGNMENT OPTION 3 - LONGITUDINAL SECTION
SCALE: HORIZONTAL - 1:1000
VERTICAL - 1:100

100mm On Original A1

Issue	Description	Drwn	Ckd.	Appd.	Date

0 20 40 60 80 100m — 1 : 1000

0 2 4 6 8 10m — 1 : 100

Status: PRELIMINARY ONLY
NOT TO BE USED FOR CONSTRUCTION

Client: VEOLIA ENVIRONMENTAL SERVICES

Scale (A1): AS NOTED | Datum: AHD
Drawn: G.MOLLOY | Designed: F.PANETTA

Project: VEOLIA BANKSMEADOW TRANSFER TERMINAL INTERMODAL

Title: EARTHWORKS SITE LAYOUT OPTION 3 - RAIL GRADE 1 in 230

Hyder Consulting
HYDER CONSULTING PTY LTD
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141 Walker St
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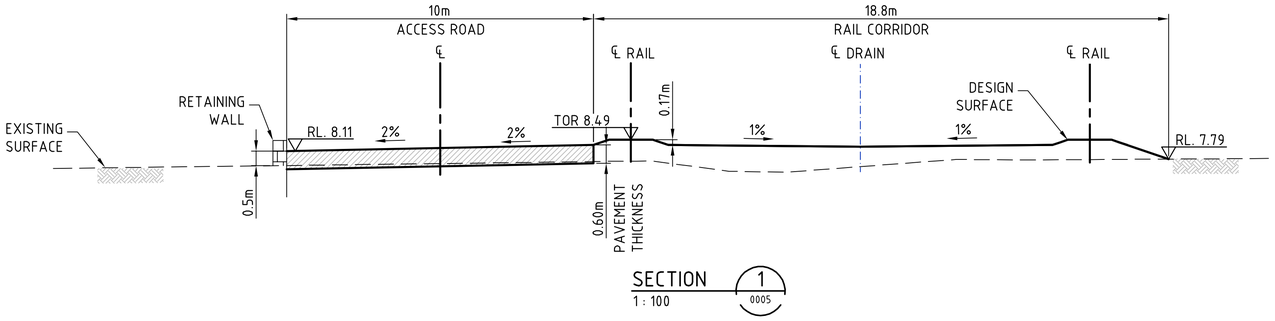
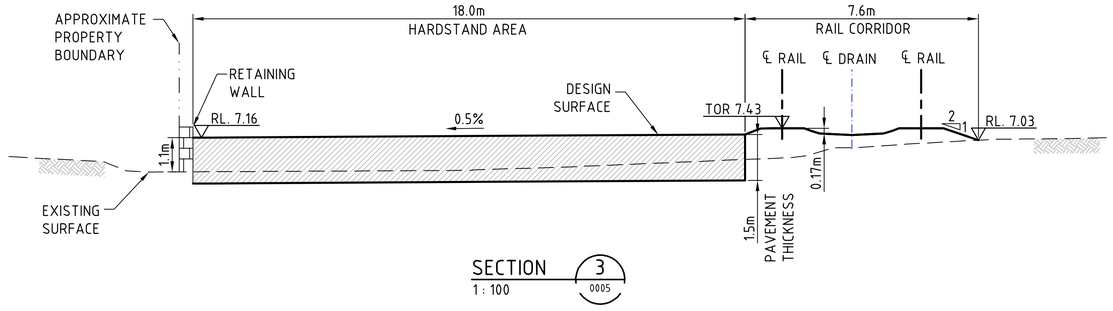
Tel: +61 (0)2 8907 9000
Fax: +61 (0)2 8907 9001

Project Code: AA005622 | Drawing No.: 0005 | Issue: A



SECTION 1 — 1 : 100 — 0005



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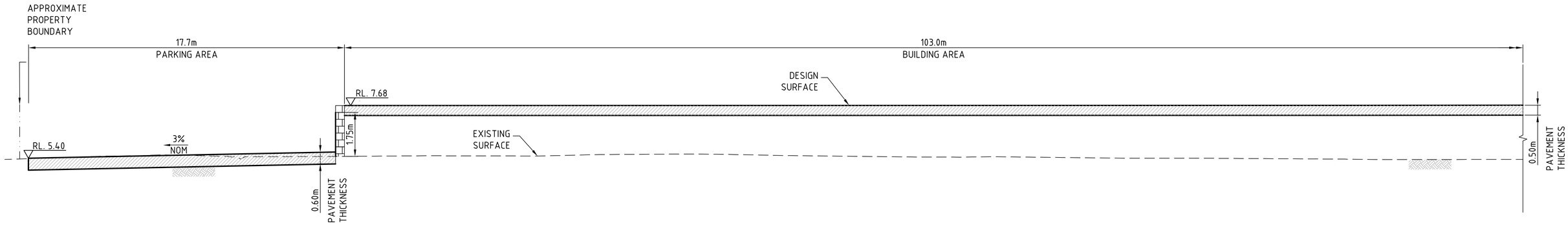

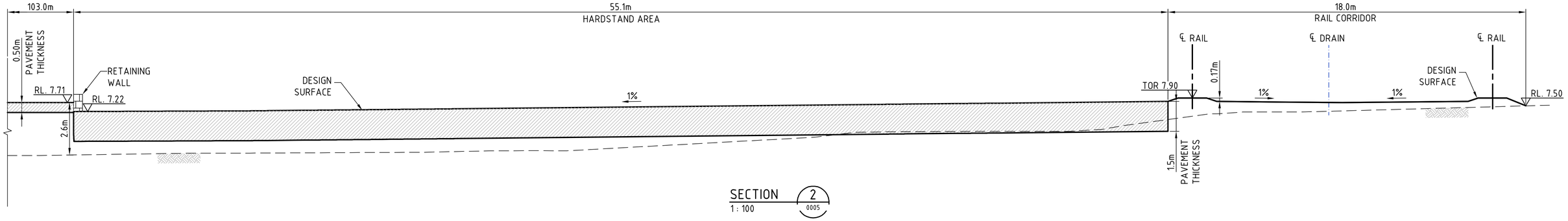

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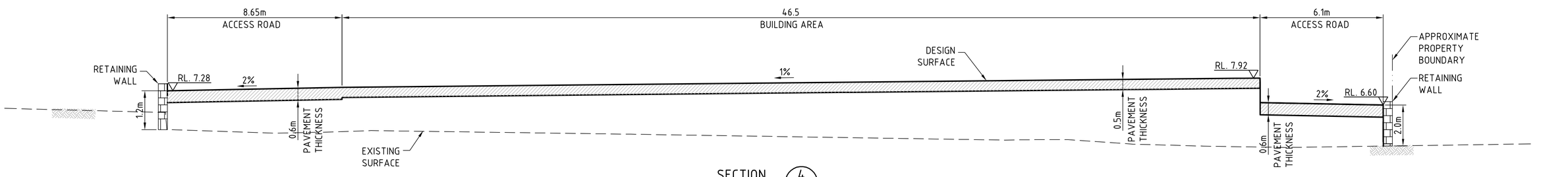

SECTION 4 — 1 : 100 — 0005

100mm On Original A1

Issue	Description	Drwn	Ckd.	Appd.	Date

Status: PRELIMINARY ONLY
NOT TO BE USED FOR CONSTRUCTION

Client: VEOLIA ENVIRONMENTAL SERVICES

Project: VEOLIA BANKSMEADOW TRANSFER TERMINAL INTERMODAL

Title: EARTHWORKS CROSS SECTIONS OPTION 3

Scale (A1): AS NOTED
Datum: AHD
Drawn: G.MOLLOY
Designed: F.PANETTA

HYDER CONSULTING PTY LTD
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141 Walker St
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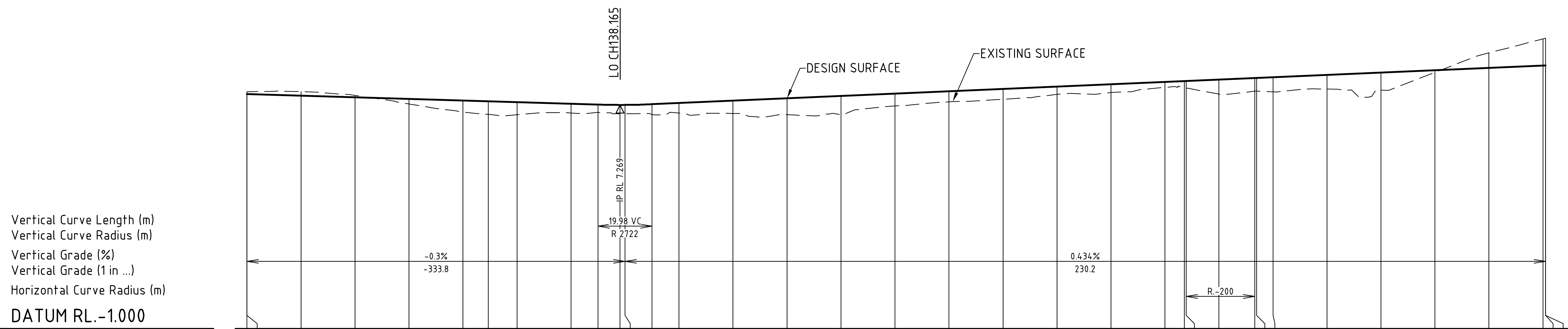
Fax: +61 (0)2 8907 9001

Project Code	Drawing No.	Issue
AA005622	0006	A

AREA	CUT	FILL	BALANCE	IMPORTED STRUCTURAL PAVEMENT MATERIAL
SLAB	0m³	11,659m³	11,659m³	2248m³
ROADS/PARKING	-460m³	1593m³	1133m³	2793m³
HARDSTAND AREA	0m³	417m³	417m³	10,615m³
RAIL AREA	-390m³	2413m³	2023m³	-
TOTAL	-850m³	16,082m³	15,232m³	15,656m³

PLAN
SCALE: 1:1000



PEGGED CHAINAGE	DESIGN LEVELS ON ROAD CENTRELINE	EXISTING SURFACE ON ROAD CENTRELINE	CUT / FILL DEPTH
-0.000	7.688		
0.000	7.688	7.771	-0.082
20.000	7.628	7.781	-0.152
40.000	7.569	7.640	-0.071
60.000	7.509	7.323	0.186
80.000	7.449	7.021	0.428
89.396	7.421	6.938	0.482
100.000	7.389	6.924	0.465
120.000	7.329	6.990	0.339
130.010	7.299	7.009	0.290
138.165	7.287	6.965	0.322
140.000	7.287	6.964	0.323
149.990	7.312	6.937	0.375
160.000	7.356	6.990	0.366
180.000	7.443	6.973	0.470
200.000	7.530	6.925	0.605
220.000	7.617	6.925	0.692
240.000	7.703	7.248	0.455
260.000	7.790	7.400	0.391
280.000	7.877	7.497	0.380
300.000	7.964	7.676	0.288
320.000	8.051	7.745	0.306
340.000	8.138	7.935	0.203
347.165	8.169	7.927	0.242
347.877	8.172	7.913	0.259
360.000	8.225	7.687	0.538
373.244	8.282	7.795	0.487
373.956	8.285	7.797	0.489
380.000	8.312	7.771	0.541
400.000	8.398	7.874	0.524
420.000	8.485	7.837	0.648
440.000	8.572	8.494	0.078
460.000	8.659	9.214	-0.555
480.000	8.746	9.728	-0.983
480.938	8.750	9.753	-1.003
480.941	8.750		

RAIL ALIGNMENT OPTION 3 - LONGITUDINAL SECTION
SCALE: HORIZONTAL - 1:1000
VERTICAL - 1:100

100mm On Original A1

Issue	Description	Drwn	Ckd.	Appd.	Date

0 20 40 60 80 100m — 1 : 1000
0 2 4 6 8 10m — 1 : 100

Status: PRELIMINARY ONLY
NOT TO BE USED FOR CONSTRUCTION

Client: VEOLIA ENVIRONMENTAL SERVICES

Project: VEOLIA BANKSMEADOW TRANSFER TERMINAL INTERMODAL

Title: EARTHWORKS SITE LAYOUT OPTION 4 - RAIL GRADE 1 in 230

Scale (A1): AS NOTED | Datum: AHD
Drawn: G.MOLLOY | Designed: F.PANETTA

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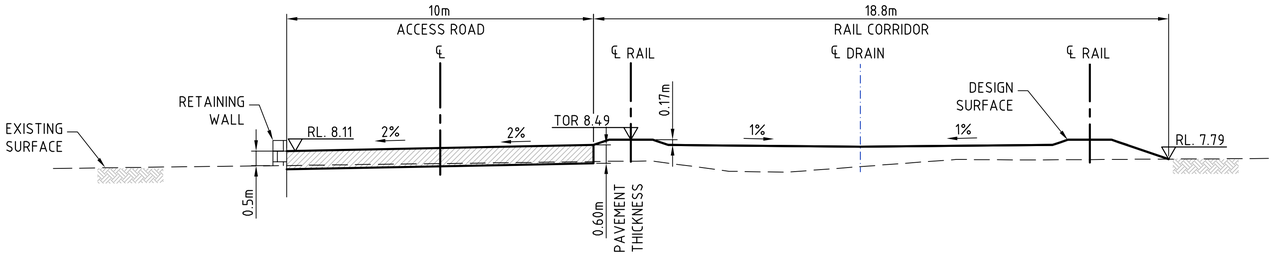
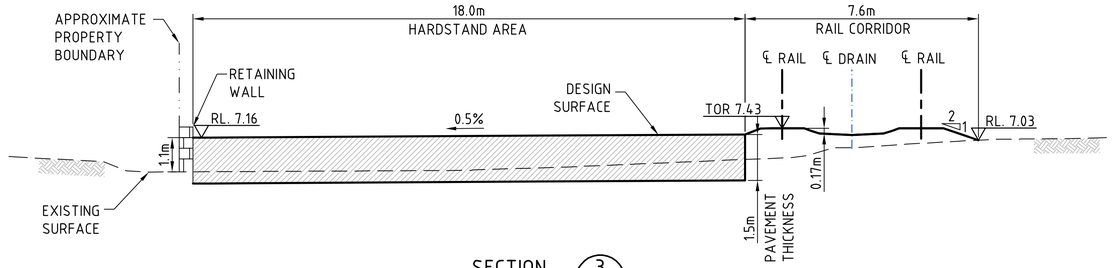
ABN 76 104 485 289
Tel: +61 (0)2 8907 9000
Fax: +61 (0)2 8907 9001

Project Code: AA005622 | Drawing No.: 0007 | Issue: A



SECTION 1 — 1 : 100 — 0007



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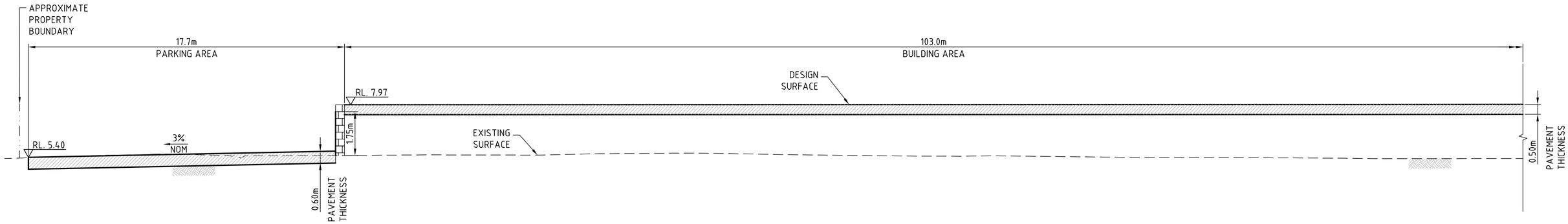

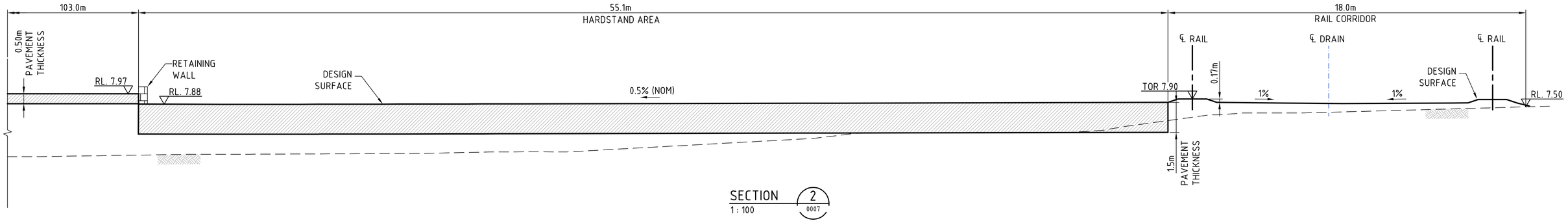

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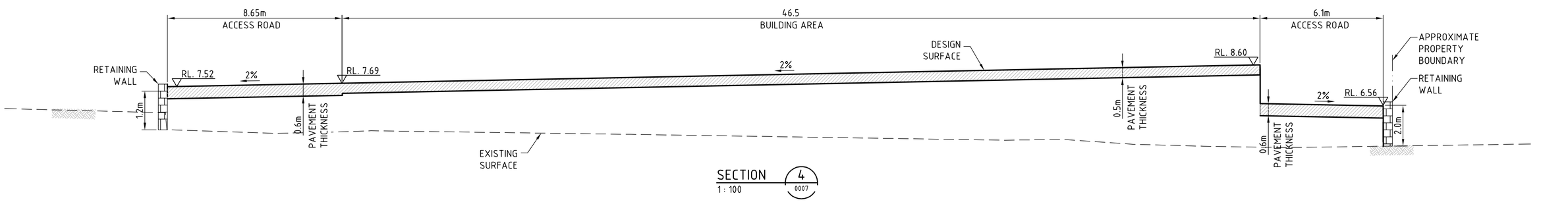

SECTION 4 — 1 : 100 — 0007

Issue	Description	Drwn	Ckd.	Appd.	Date

100mm On Original A1

Status: PRELIMINARY ONLY
NOT TO BE USED FOR CONSTRUCTION

Client: VEOLIA ENVIRONMENTAL SERVICES

Project: VEOLIA BANKSMEADOW TRANSFER TERMINAL INTERMODAL

Title: EARTHWORKS CROSS SECTIONS OPTION 4

Scale (A1): AS NOTED | Datum: AHD
Drawn: G.MOLLOY | Designed: F.PANETTA

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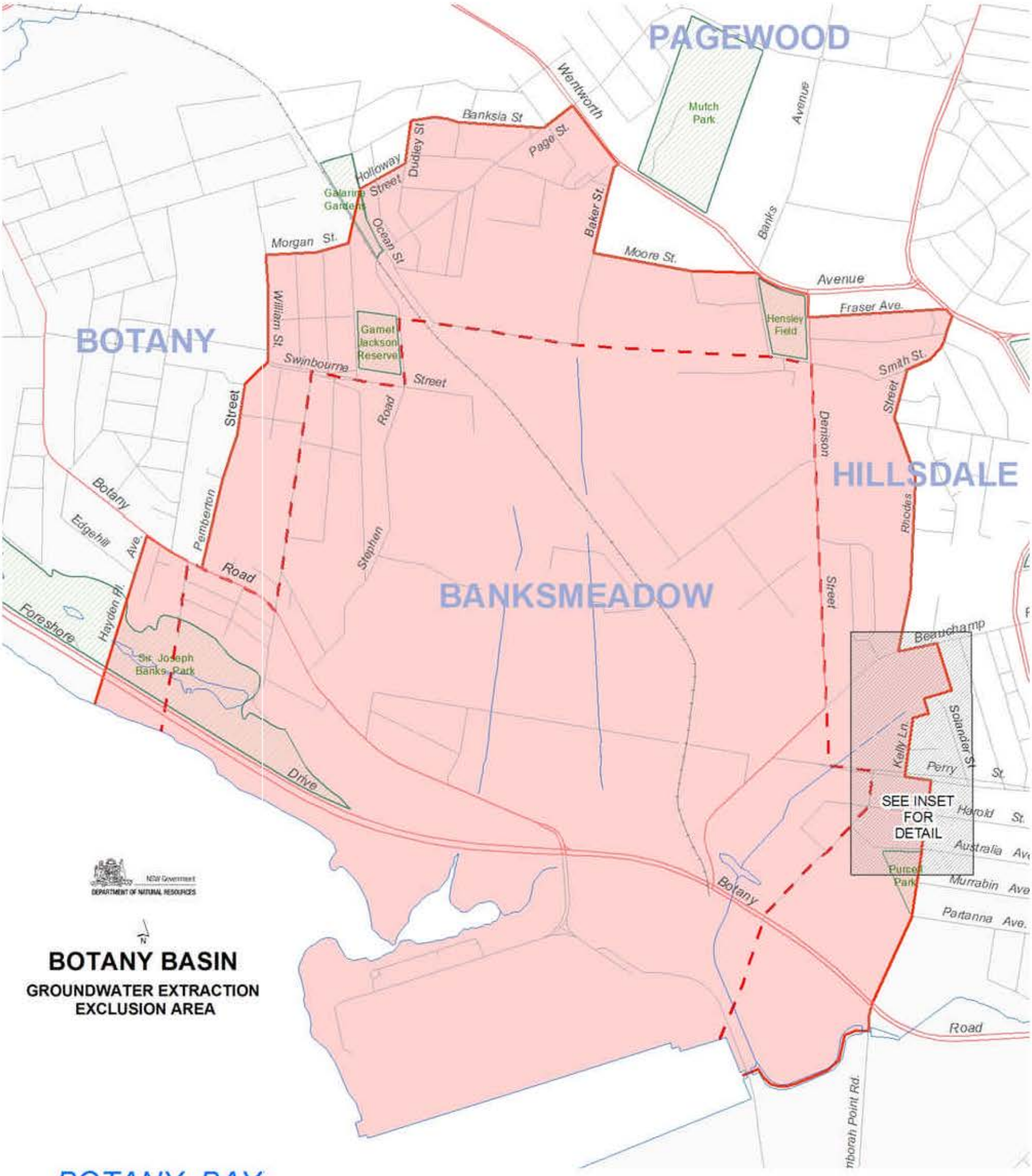
Fax: +61 (0)2 8907 9001

Project Code	Drawing No.	Issue
AA005622	0008	A

Appendix B

Information on the Groundwater Extraction Exclusion Area


PAGEWOOD
BOTANY
BANKSMEADOW
HILLSDALE
Wentworth
Avenue
Mutch Park
Banksia St
Dudley St
Page St
Holloway Street
Galarina Gardens
Morgan St.
Ocean St
Baker St.
Moore St.
Banks
Avenue
Fraser Ave.
Hensley Field
William St
Garnet Jackson Reserve
Swinbourne
Street
Road
Smith St.
Street
Botany
Pemberton
Edgehill Ave.
Hayden Pl.
Foreshore
Road
Stephen
Street
Rhodes
St. Joseph Banks Park
Drive
Botany
Beauchamp
Kelly Ln
Spiander St
Perry St.
SEE INSET FOR DETAIL
Harold St.
Australia Ave
Purcell Park
Murrabin Ave
Partanna Ave.
Road
Point Rd.
NSW Government
DEPARTMENT OF NATURAL RESOURCES
BOTANY BASIN
GROUNDWATER EXTRACTION EXCLUSION AREA
BOTANY BAY
EXCLUSION AREAS
EXTRACTION EXCLUSION AREA
PREVIOUS EXTRACTION EXCLUSION AREA
In the Groundwater Extraction Exclusion Area, the Department of Natural Resources has instructed bore licensees under the Water Act (1912) not to extract groundwater. Owners of unlicensed bores are also advised not to extract groundwater within this area.

WATER ACT 1912

Order Under Section 113A

Embargo on any further Applications for Sub Surface Water Licences.

Botany Sandbeds Water Shortage Zone GWMA 018

PURSUANT to Section 113A of the Water Act 1912, the Water Administration Ministerial Corporation, being satisfied that the Water Shortage Zone, as shown in the Schedule, is unlikely to have more water available than is sufficient to meet requirements of the licensees of bores situated within the Water Shortage Zone and such other possible requirements from the Water Shortage Zone as are determined by the Ministerial Corporation, now declares that on and from the date of publication of this Order in the *Government Gazette*, no further applications for a licence under Part 5 of the Water Act, 1912 relating to the Water Shortage Zone may be made, except as specified below until this Order is revoked by a subsequent Notice published in the *Government Gazette*.

This Order relates to all applications for licences made under Part 5 of the Water Act 1912, other than applications for licences for:

1. Water supply for private domestic purposes;
2. Water supply for urban water supply purposes;
3. Works for the de-watering of construction sites;
4. Monitoring and test bores for groundwater investigation and/or environmental management purposes;
5. Works used for groundwater remediation purposes;
6. Bores on a property which are the subject of a development consent that was granted prior to the date of this order and which are consistent with the General Terms of Approval included in that consent;
7. Conversion to a production bore where a test bore licence already existed prior to 1 May 2007, provided the application is lodged within six months of this order being made.

Note: Notwithstanding paragraphs 1 to 7, this order does not apply to:

(a) an application for a renewal of a licence, or

(b) an application for a licence for a bore to replace some other licensed bore that the applicant has ceased to use, or

(c) an application for a licence for a bore to produce water to satisfy a water allocation arising from the transfer of a water allocation under s. 117J.

Signed for the Water Administration Ministerial Corporation.

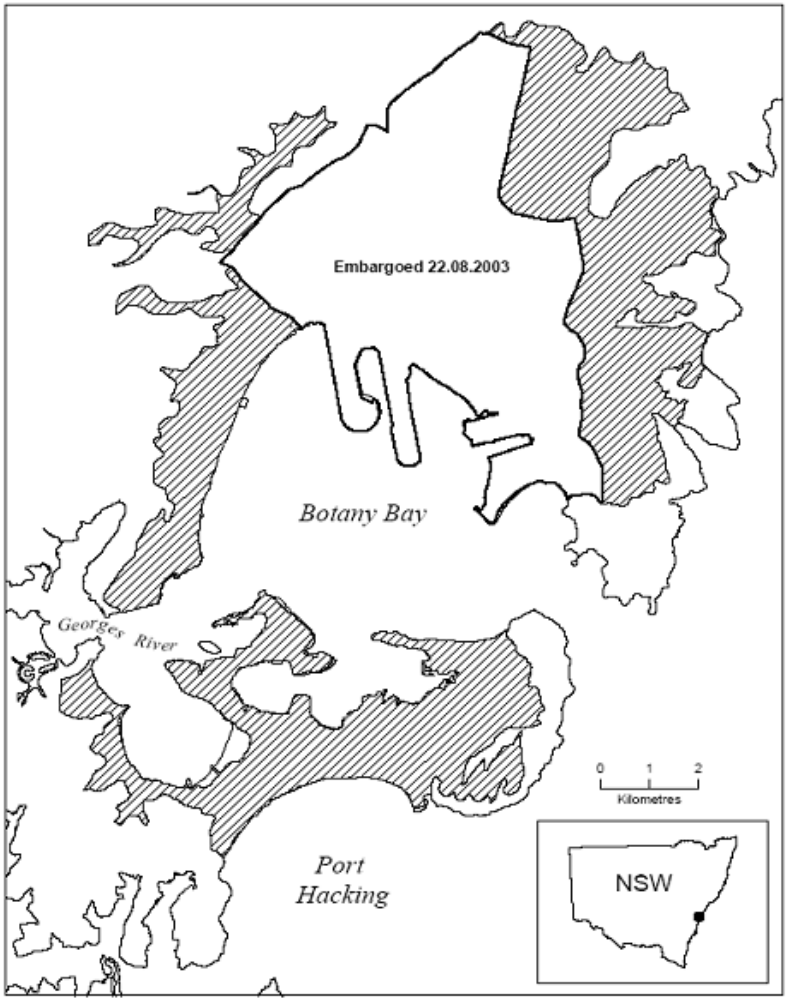
Dated this 23 May 2007.

PHIL KOPERBERG, M.P.,
Minister for Climate Change, Environment and Water

Schedule

All of the land within the Botany Sandbeds Water Shortage Zone GWMA 018, excluding the area that was embargoed on 22 August 2003, as shown in the hatched area of the map.

Botany Sandbeds Water Shortage Zone GWMA 018



WATER ACT 1912

AN application under Part 2, being within a proclaimed (declared) local area under section 20 of the Water Act 1912, as amended.

An application for an Authority for a Joint Water Supply Scheme within a proclaimed local area as generally described hereunder has been received as follows:

Gwydir River Valley

Lindsay Keith SMITH and Rhonda Joan SMITH for two pumps on Carole Creek on Lot 18, DP 750365, Parish of Goocalla, County of Benarba, for water supply for stock and domestic purposes and irrigation of 486 hectares (cotton, fodder, cereals, pulses and beans) (this application is for a replacement Authority due to the inclusion of an existing stand-by pump — no increase in entitlement) (LO Papers: 90SA11702) (GA2:345897).

Written objections to the application specifying the grounds thereof may be made by any statutory authority or local occupier within the proclaimed (declared) area, whose interest may be affected and must be lodged with the Department's Manager, Resource Access, Tamworth, within 28 days as specified in the Act.

GEOFF CAMERON,
Manager,
Resource Access.

Department of Infrastructure, Planning and
Natural Resources,
PO Box 550, Tamworth, NSW 2340.

WATER ACT 1912

Order Under Section 113A

Embargo on any Further Applications for Sub-Surface Water Licences

Botany Basin (Northern Area)

THE Water Administration Ministerial Corporation, pursuant to section 113A of the Water Act 1912, being satisfied that the water source in the attached SCHEDULE is unlikely to be able to supply water sufficient and suitable to meet the requirements of those already entitled by law to take water from the water source (and such other requirements for water from the sources as have been determined by the Ministerial Corporation), now declares that on and from the date of publication of this Order in the *Government Gazette*, no further applications for a licence under Part 5 of the Water Act 1912 may be made, except as specified below, until this Order is revoked by a subsequent Notice published in the *Government Gazette*.

This Order relates to all applications for licences issued under Part 5 of the Water Act 1912, other than applications for licences for:

1. Works for the de-watering of construction sites;
2. Monitoring and testing;
3. Works used for groundwater remediation purposes.

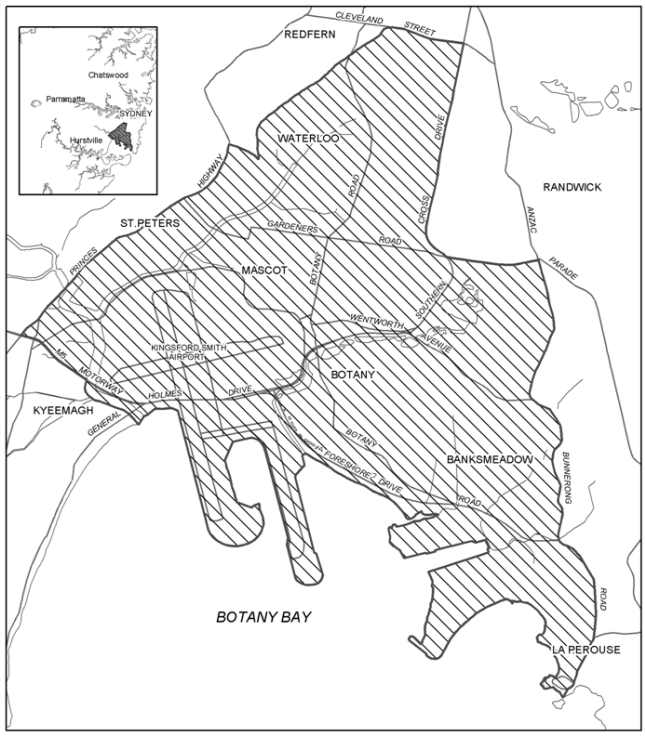
Signed for the Water Administration Ministerial Corporation.

CHRIS GUEST,
Deputy Director-General,
Department of Infrastructure,
Planning and Natural Resources.

Dated: 22 August 2003.

SCHEDULE

All the groundwater zones in the hatched area as shown on the diagram hereunder:

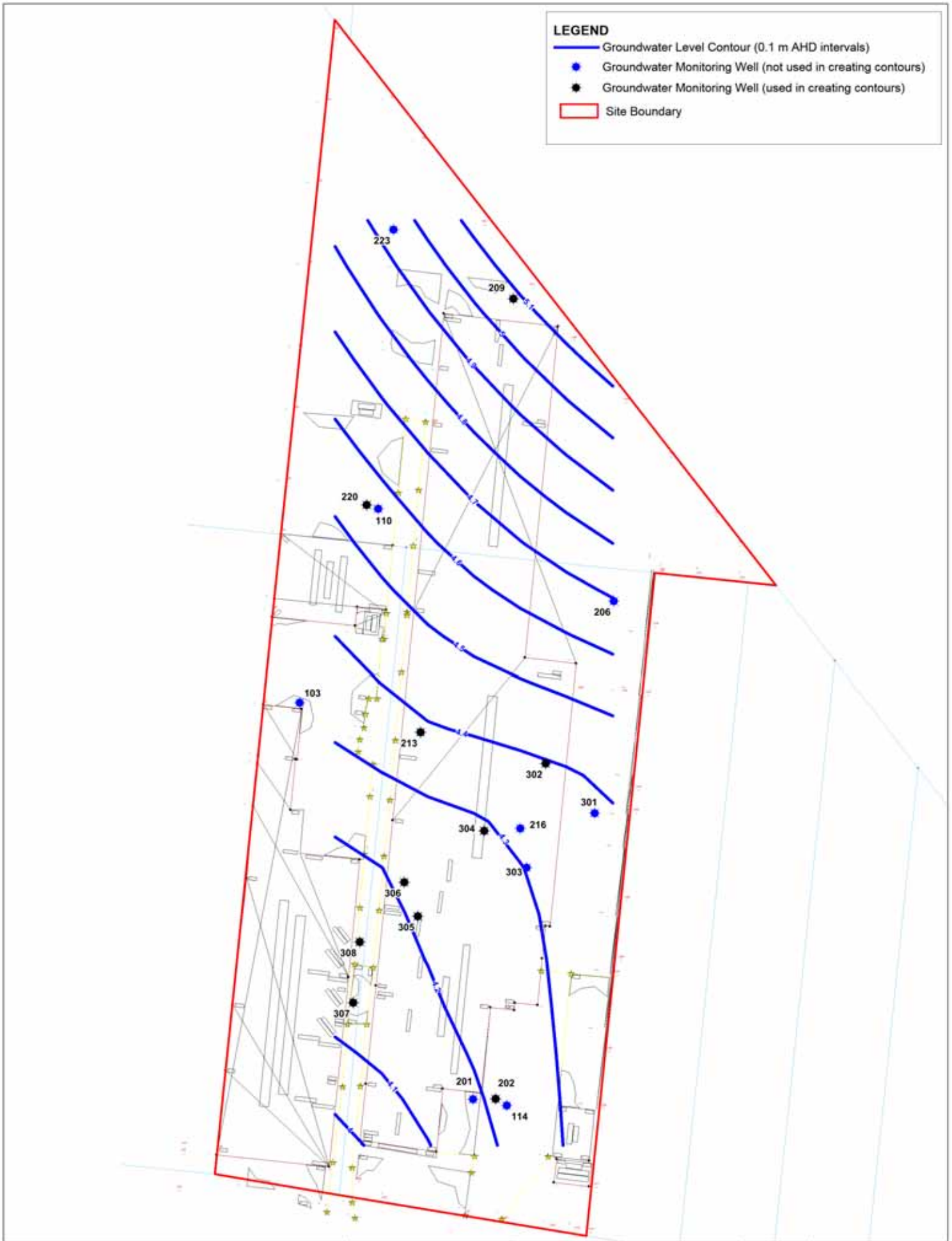


Appendix C

Groundwater Contours from Previous Assessments

Borehole Logs from Previous Assessments

Summary of Analytical Results from Previous Investigations



Douglas Partners *Geotechnics / Environment / Groundwater*	TITLE: Groundwater Contours 15.02.2013 LNAPL Delineation Assessment 34-36 McPherson St Banksmeadow			MGA	OFFICE: Sydney DRAWN BY: NLE DATE: 14.05.2013
CLIENT: Veolia Environmental Services (Australia)	PROJECT No: 37278.03	DRAWING No: 2	REVISION: A		SCALE: As shown

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

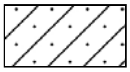
Soils


Topsoil

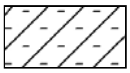

Peat


Clay

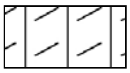

Silty clay

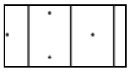

Sandy clay

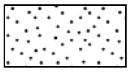

Gravelly clay

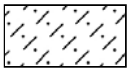

Shaly clay

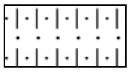

Silt


Clayey silt


Sandy silt

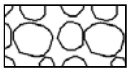

Sand

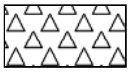

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

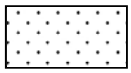

Talus

Sedimentary Rocks

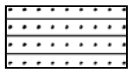

Boulder conglomerate

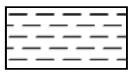

Conglomerate


Conglomeratic sandstone

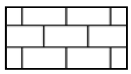

Sandstone


Siltstone


Laminite

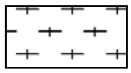

Mudstone, claystone, shale

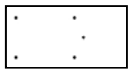

Coal


Limestone

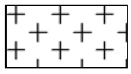
Metamorphic Rocks

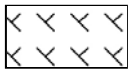

Slate, phyllite, schist

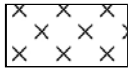

Gneiss

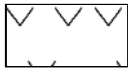

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

TEST PIT REPORT

CLIENT: KEITH ENGINEERING **DATE:** 24 FEB 97 **PIT No.** 1
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24342 **SHEET** 1 **OF** 1
LOCATION: 34-36 McPHERSON STREET, BANKSMEADOW **SURFACE LEVEL:**

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results Headspace PID (ppm)
0	FILLING - dark brown to black gravelly sand with gravel pieces up to 55mm, bricks, metal slag and some concrete pieces - oily sheen observed on wet soil	A	0.5	16
1		A	1.0	17
1.1	ORGANIC CLAY - black organic clayey silt			
2		A	2.0	17
2.1	SAND - brown grey fine grained sand			
3		A	3.0	11
3.0	TEST BORE DISCONTINUED AT 3.0 METRES			
4				
5				

RIG: BOBCAT **LOGGED:** FERNANDEZ
GROUND WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 0.35m
REMARKS: GROUND WATER SAMPLE TAKEN GW1

SAMPLING & IN SITU TESTING LEGEND

D Disturbed sample
B Bulk sample
pp Pocket Penetration (kPa)
Ux x mm dia. tube

CHECKED:
Initials: JMF
Date: 4/3/97

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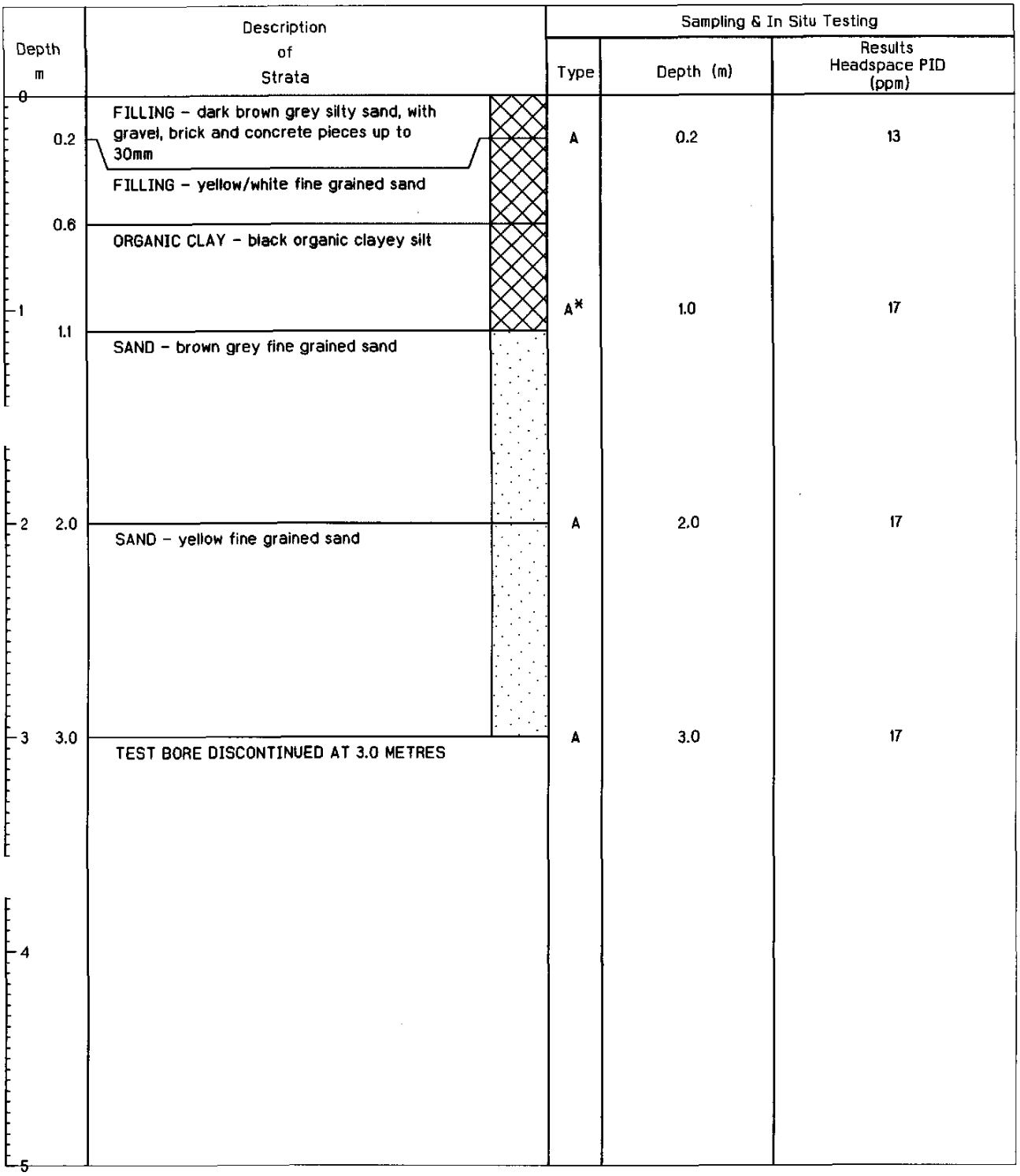
TEST PIT REPORT

CLIENT: KEITH ENGINEERING **DATE:** 24 FEB 97 **PIT No.** 2
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24342 **SHEET** 1 **OF** 1
LOCATION: 34-36 McPHERSON STREET, BANKSMEADOW **SURFACE LEVEL:**



RIG: BOBCAT **LOGGED:** FERNANDEZ
GROUND WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 0.9m
REMARKS: * DUPLICATE TAKEN Z1

SAMPLING & IN SITU TESTING LEGEND

D Disturbed sample
B Bulk sample
pp Pocket Penetration (kPa)
Ux x mm dia. tube

CHECKED:
Initials: JNF
Date: 14/3/97

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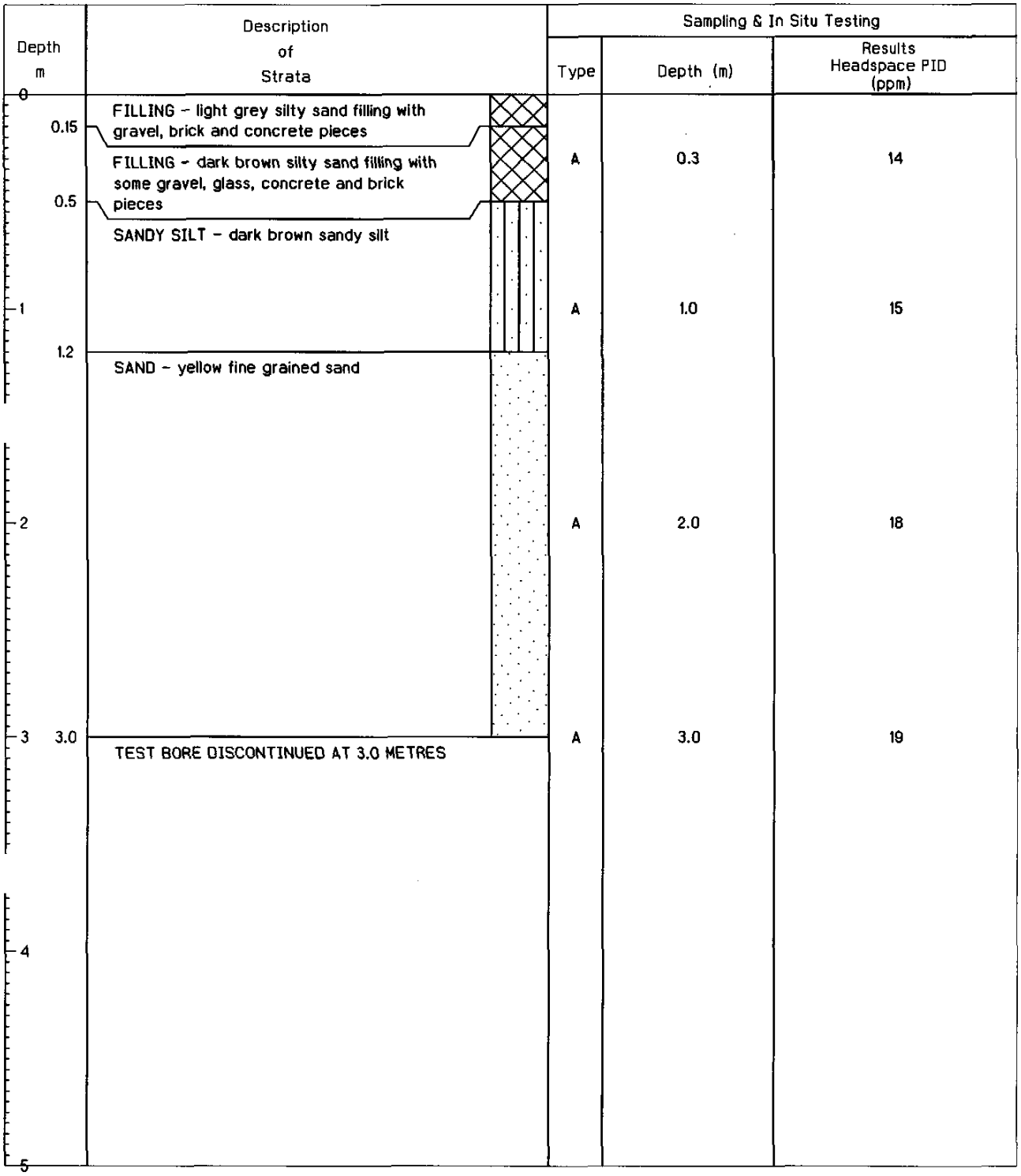
TEST PIT REPORT

CLIENT: KEITH ENGINEERING **DATE:** 24 FEB 97 **PIT No.** 3

PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24342 **SHEET** 1 **OF** 1

LOCATION: 34-36 McPHERSON STREET, BANKSMEADOW **SURFACE LEVEL:**



RIG: BOBCAT **LOGGED:** FERNANDEZ

GROUND WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 0.5m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND	
D Disturbed sample	pp Pocket Penetration (kPa)
B Bulk sample	Ux x mm dia. tube

CHECKED:
Initials: JMF
Date: 14/3/97

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TEST PIT REPORT

CLIENT: KEITH ENGINEERING **DATE:** 24 FEB 97 **PIT No.** 4
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24342 **SHEET** 1 OF 1
LOCATION: 34–36 McPHERSON STREET, BANKSMEADOW **SURFACE LEVEL:**

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results Headspace PID (ppm)
0	FILLING – brown silty sand with gravel, concrete and brick pieces up to 50mm			
0.3	FILLING – dark brown silty sand filling with gravel brick and concrete pieces	A	0.5	20
0.6	ORGANIC CLAY – black organic clayey silt			
1		A	1.0	19
1.1	SILTY SAND – dark brown silty sand			
1.3	SAND – light brown fine grained sand			
2		A*	2.0	20
2.1	SAND – yellow fine grained sand			
3 3.0	TEST BORE DISCONTINUED AT 3.0 METRES	A	3.0	20
4				
5				

RIG: BOBCAT **LOGGED:** FERNANDEZ
GROUND WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 0.4m
REMARKS: * DUPLICATE TAKEN Z2

SAMPLING & IN SITU TESTING LEGEND

D Disturbed sample
B Bulk sample
pp Pocket Penetration (kPa)
Ux x mm dia. tube

CHECKED:
Initials: JMF
Date: 14/3/97

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TEST PIT REPORT

CLIENT: KEITH ENGINEERING **DATE:** 24 FEB 97 **PIT No.** 5
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24342 **SHEET** 1 **OF** 1
LOCATION: 34-36 McPHERSON STREET, BANKSMEADOW **SURFACE LEVEL:**

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results Headspace PID (ppm)
0				
0.05	ASPHALT – dark grey black asphalt			
0.1	FILLING – dark grey silty sand filling			
	FILLING – yellow brown grey fine grained sand filling	A	0.5	17
0.7	SAND – grey brown fine grained sand			
1		A	1.0	21
1.6	SAND – yellow fine grained sand			
2		A	2.0	23
3		A	3.0	23
3.0	TEST BORE DISCONTINUED AT 3.0 METRES			
4				
5				

RIG: BOBCAT **LOGGED:** FERNANDEZ
GROUND WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 0.85m
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

D Disturbed sample — pp Pocket Penetration (kPa)
B Bulk sample — Ux x mm dia. tube

CHECKED:
Initials: JMF
Date: 14/3/97

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TEST PIT REPORT

CLIENT: KEITH ENGINEERING **DATE:** 24 FEB 97 **PIT No.** 6
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24342 **SHEET** 1 **OF** 1
LOCATION: 34-36 McPHERSON STREET, BANKSMEADOW **SURFACE LEVEL:**

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results Headspace PID (ppm)
0				
0.05	ASPHALT - dark grey black asphalt			
0.3	FILLING - brown grey silty sand with subangular gravel pieces up to 40mm			
	SAND - grey brown fine grained sand	A	0.5	22
1		A	1.0	25
	- very slight hydrocarbon odour at 1.5m			
2		A*	2.0	17
3 3.0	TEST BORE DISCONTINUED AT 3.0 METRES	A	3.0	23
4				
5				

RIG: BOBCAT **LOGGED:** FERNANDEZ
GROUND WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 0.8m
REMARKS: * DUPLICATE TAKEN Z3, GROUND WATER SAMPLE TAKEN GW2

SAMPLING & IN SITU TESTING LEGEND

D Disturbed sample
B Bulk sample
pp Pocket Penetration (kPa)
Ux x mm dia. tube

CHECKED:
Initials: JMF
Date: 14/3/97

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TEST PIT REPORT

CLIENT: KEITH ENGINEERING **DATE:** 24 FEB 97 **PIT No.** 7
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24342 **SHEET** 1 **OF** 1
LOCATION: 34-36 McPHERSON STREET, BANKSMEADOW **SURFACE LEVEL:**

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results Headspace PID (ppm)
0				
0.05	ASPHALT - dark grey black asphalt			
	FILLING - dark brown silty sand with gravel, brick and concrete filling	A	0.5	21
0.6	SAND - light grey brown sand			
1		A	1.0	22
	- slight hydrocarbon odour at 1.3m			
2		A	2.0	22
2.1	SAND - yellow fine grained sand			
3		A	3.0	22
3.0	TEST BORE DISCONTINUED AT 3.0 METRES			
4				
5				

RIG: BOBCAT **LOGGED:** FERNANDEZ
GROUND WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 1.0m
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

D Disturbed sample
B Bulk sample
pp Pocket Penetration (kPa)
Ux x mm dia. tube

CHECKED:
Initials: JMF
Date: 14/3/97

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TEST BORE REPORT

BORE No: 101
DATE: 19 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 4.8 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.1	CONCRETE				
0.2	FILLING - yellow sand filling, with trace gravel				
	FILLING - grey gravel and sand filling	A*	0.5		<1
0.7	FILLING - grey clayey sand filling, with some gravel				
1.0	FILLING - grey brown sand filling	A	1.5		<1
1.7	FILLING - brown sandy clay filling				
1.9	FILLING - grey silty sand filling				
2.7	SAND - white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.7m

REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Y4 TAKEN

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 102
DATE: 19 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 4.8 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.1	CONCRETE				
0.2	FILLING - grey sand filling, with trace clay				
	FILLING - light brown sand filling	A	0.5		<1
0.6	FILLING - grey clayey sand filling (possibly natural) - dark brown from 0.8m				
1.5	FILLING - grey sand filling	A	1.5		<1
2.0	FILLING - grey sand filling				
2.6	SAND - white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED
TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m
WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.6m
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 104
DATE: 19 Jul 04
SHEET 1 OF 1

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 4.9 AHD
DIP OF HOLE: 90°
AZIMUTH: --

Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0.08	CONCRETE				
0.2	FILLING - dark grey/black gravelly sand filling				
	FILLING - red brown silty clay filling, with trace ironstone and brown sandy filling, with trace gravel				
0.5	FILLING - grey clayey sand filling, with trace scrap metal	A*	0.5		<1
1.3	FILLING - pink brown sandy clay filling, with trace gravel				
1.5	FILLING - grey clayey sand filling, with trace scrap metal	A	1.5		<1
2.7	SAND - grey white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0	no recovery	

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.6m

REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Y3 TAKEN

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED	
Initials:	
Date:	

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TEST BORE REPORT

BORE No: 105

CLIENT: KEITH ENGINEERING PTY LTD **PROJECT No:** 37278 **DATE:** 19 Jul 04

PROJECT: PHASE 2 CONTAMINATION ASSESSMENT **SURFACE LEVEL:** 5.2 AHD **SHEET** 1 OF 1

LOCATION: 34-36 McPHERSON ST, BANKSMEADOW **DIP OF HOLE:** 90° **AZIMUTH:** --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.05	GRASS				
0.2	FILLING - light grey sand filling, with some gravel				
	FILLING - grey sand filling, with trace organic material, moist to wet	A	0.5		<1
0.6	FILLING - dark brown black, silty clay/clayey sand filling, with trace organic matter				
1		A	1.5		<1
1.8	FILLING - grey sand filling				
2					
2.7	SAND - grey white sand				
3 3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0	low recovery	<1
4					

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.6m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED	
Initials:	
Date:	

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TEST BORE REPORT

BORE No: 106
DATE: 19 Jul 04
SHEET 1 OF 1

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.1 AHD
DIP OF HOLE: 90°
AZIMUTH: --

Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0.01	ASPHALT				
0.2	FILLING - grey brown sand filling, with some gravel, humid				
	FILLING - black silty sand filling, with trace gravel, slag and ash, moist	A	0.5		<1
0.6	FILLING - grey sand filling, saturated				
1.5	FILLING - interbedded dark grey brown silty sand and sandy clay filling	A*	1.5		<1
2.8	SAND - white grey sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.7m

REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Y1 TAKEN

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED	
Initials:	
Date:	

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TEST BORE REPORT

BORE No: 107
DATE: 19 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.1 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0.01	ASPHALT				
0.05	FILLING				
	TEST BORE DISCONTINUED AT 0.05m - refusal				
1					
2					
3					
4					

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED
TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 0.05m
WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 108

CLIENT: KEITH ENGINEERING PTY LTD | **PROJECT No:** 37278 | **DATE:** 19 Jul 04

PROJECT: PHASE 2 CONTAMINATION ASSESSMENT | **SURFACE LEVEL:** 4.9 AHD | **SHEET** 1 OF 1

LOCATION: 34-36 McPHERSON ST, BANKSMEADOW | **DIP OF HOLE:** 90° | **AZIMUTH:** --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.01	ASPHALT	A	0.1		<1
0.2	FILLING - grey sand and crushed brick filling, with trace gravel, damp				
	FILLING - grey sand filling, with some gravel and trace crushed brick, moist to wet				
0.5	FILLING - dark grey brown gravelly silty clay filling, saturated	A	0.5		<1
	- gravel decreasing with depth				
1.3	FILLING - dark grey/black silty clay/clayey silt filling, with slight sulphur odour	A	1.5		<1
2.1	FILLING - grey silty sand filling				
2.5	SAND - white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.6m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 109
DATE: 19 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.0 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0.07	ASPHALT				
0.2	FILLING - grey sand and crushed brick filling				
0.4	FILLING - grey gravelly sand filling, trace slag and organic matter, slight organic odour, damp to moist				
	FILLING - brown sand filling, with trace gravel, moist	A	0.5		<1
0.7	FILLING - brown sand filling				
1.5	FILLING - dark brown/black silty clay/clayey silt filling, slight sulphur odour	A*	1.5		<1
1.7	FILLING - grey sand filling				
2.7	SAND - white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.7m

REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Y2 TAKEN

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 111

CLIENT: KEITH ENGINEERING PTY LTD **PROJECT No:** 37278 **DATE:** 19 Jul 04

PROJECT: PHASE 2 CONTAMINATION ASSESSMENT **SURFACE LEVEL:** 5.4 AHD **SHEET** 1 OF 1

LOCATION: 34-36 McPHERSON ST, BANKSMEADOW **DIP OF HOLE:** 90° **AZIMUTH:** --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.16	CONCRETE				
0.3	FILLING - light grey clayey sand filling, with trace gravel				
	FILLING - dark grey sand filling, with some clay and gravel, wet to saturated	A	0.5		<1
0.9	FILLING - grey clayey sand filling				
1.3	FILLING - dark grey clayey sand filling, with trace gravel and scrap metal	A	1.5		<1
1.8	FILLING - grey sand filling, with trace gravel				
2.7	SAND - grey white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.7m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED	
Initials:	
Date:	

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TEST BORE REPORT

BORE No: 112
DATE: 14 Jul 04
SHEET 1 OF 1

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.2 AHD
DIP OF HOLE: 90°
AZIMUTH: --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.11	CONCRETE				
	FILLING - light brown sand filling, with some gravel				
0.3	FILLING - grey sand filling, with some gravel to 0.5m, wet	A	0.5		<1
	- saturated from 0.6m				
1.6	FILLING - dark brown clayey sand filling, slight sulphur odour (possibly natural)	A*	1.5		<1
		A	2.5		<1
2.7	SAND - white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.9m

REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Z4 TAKEN

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 113

CLIENT: KEITH ENGINEERING PTY LTD | **PROJECT No:** 37278 | **DATE:** 14 Jul 04

PROJECT: PHASE 2 CONTAMINATION ASSESSMENT | **SURFACE LEVEL:** 5.2 AHD | **SHEET** 1 OF 1

LOCATION: 34-36 McPHERSON ST, BANKSMEADOW | **DIP OF HOLE:** 90° | **AZIMUTH:** --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.1	CONCRETE				
	FILLING - dark grey sand filling, witih some gravel and trace slag, ash, scrap metal, moist				
0.5	TEST BORE DISCONTINUED AT 0.5m - refusal	A	0.5		<1
1					
2					
3					
4					

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 0.5m

WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED

Initials:

Date:

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TEST BORE REPORT

BORE No: 115
DATE: 19 Jul 04
SHEET 1 OF 1

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW

PROJECT No: 37278
SURFACE LEVEL: 5.2 AHD
DIP OF HOLE: 90°

AZIMUTH: --

Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0.16	CONCRETE				
	FILLING - grey gravelly sand filling, with some clay				
0.5	FILLING - grey sand clay filling	A*	0.5		<1
1.6	FILLING - grey sand filling	A	1.5		<1
2.9	SAND - white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.5m

REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Y5 TAKEN

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 116
DATE: 19 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.2 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.14	CONCRETE				
	FILLING - grey gravel and clayey sand filling, wet				
0.5	TEST BORE DISCONTINUED AT 0.5m - refusal	A	0.5		<1
1					
2					
3					
4					

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED
TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 0.5m
WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 117
DATE: 19 Jul 04
SHEET 1 OF 1

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.2 AHD
DIP OF HOLE: 90°
AZIMUTH: --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.0	FILLING - brown sand filling				
0.2	FILLING - grey sand filling, with trace clay and glass				
0.3	FILLING - grey gravel and sand filling				
0.5	FILLING - dark grey-black sandy clay filling, with some clay and sulphur odour	A	0.5		<1
1.3	FILLING - light brown sand filling	A	1.5		<1
1.7	FILLING - grey sand filling				
2.7	SAND - white sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.6m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 118
DATE: 14 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.2 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.15	CONCRETE				
0.3	FILLING - dark brown sand filling, with some clay and trace gravel				
	FILLING - brown sand filling	A	0.5		<1
0.6	FILLING - grey sand filling				
1		A	1.0		<1
		A	1.5		<1
1.8	SAND - white sand				
2					
3					
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1
4					

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 1.0m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 119

CLIENT: KEITH ENGINEERING PTY LTD | **PROJECT No:** 37278 | **DATE:** 14 Jul 04

PROJECT: PHASE 2 CONTAMINATION ASSESSMENT | **SURFACE LEVEL:** 5.3 AHD | **SHEET** 1 OF 1

LOCATION: 34-36 McPHERSON ST, BANKSMEADOW | **DIP OF HOLE:** 90° | **AZIMUTH:** --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.05	GRASS				
	FILLING - brown clayey sand filling, with some gravel, slag, ash and trace glass and plastic tile, humid	A	0.5		<1
		A	0.7		<1
0.8	FILLING - dark brown sand filling with trace clay, gravel and slag, saturated				
1					
		A	1.5		<1
2					
2.9	SAND - white sand				
3 3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1
4					

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.6m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 120

CLIENT: KEITH ENGINEERING PTY LTD **PROJECT No:** 37278 **DATE:** 14 Jul 04

PROJECT: PHASE 2 CONTAMINATION ASSESSMENT **SURFACE LEVEL:** 5.2 AHD **SHEET** 1 OF 1

LOCATION: 34-36 McPHERSON ST, BANKSMEADOW **DIP OF HOLE:** 90° **AZIMUTH:** --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.2	FILLING - grey sand and gravel filling, with trace slag and ash				
0.4	FILLING - brown sand and gravel filling, with slag and ash	A	0.4		<1
	TEST BORE DISCONTINUED AT 0.4m - refusal				

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 0.4m

WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED	
Initials:	
Date:	

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TEST BORE REPORT

BORE No: 107A
DATE: 19 Jul 04
SHEET 1 OF 1

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.1 AHD
DIP OF HOLE: 90°
AZIMUTH: --

Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0.01	ASPHALT				
	FILLING - grey and brown sand filling, with some gravel and trace clay, brick and glass, damp				
0.5	FILLING - black silty sand filling, moist to wet	A	0.5		<1
		A	0.7		<1
0.8	FILLING - grey silty sand filling, with some clay, saturated				
1.6		A	1.5		<1
	FILLING - interbedded silty sand and sandy clay filling				
2.7	SAND - white grey sand				
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.7m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 113A
DATE: 14 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.2 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.11	CONCRETE				
	FILLING - grey sand filling, with trace gravel, glass, material (rags), slag, ash				
0.5	TEST BORE DISCONTINUED AT 0.5m - refusal	A	0.5		<1
1					
2					
3					
4					

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 0.5m

WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 120A
CLIENT: KEITH ENGINEERING PTY LTD **PROJECT No:** 37278 **DATE:** 14 Jul 04
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT **SURFACE LEVEL:** 5.2 AHD **SHEET** 1 OF 1
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW **DIP OF HOLE:** 90° **AZIMUTH:** --

Depth (m)	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0.2	FILLING - grey sand filling, with trace gravel, slag and ash				
0.6	FILLING - brown sand filling, with some gravel and trace slag and ash	A*	0.5		<1
	FILLING - dark brown clayey sand filling, with some gravel	A	1.5		<1
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached	A	3.0		<1

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED
TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m
WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.7m
REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Z1 TAKEN

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
B	Bulk sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 103
DATE: 14 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 4.79 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Results	Contamination Observations	Water	Well Construction Details
0.14	CONCRETE SLAB							Gatic cover
0.23	CONCRETE SLAB							Bentonite
0.3	FILLING - dark brown/black gravelly sand filling, with some clay, slag and ash							
	FILLING - black gravel and sand filling, with some slag and ash		A	0.5	PID=<1ppm		▽	
1.1	FILLING - dark brown/black sandy clay filling, with trace organic matter and sulphur odour - trace gravel to 1.3m		A	1.5	PID=<1ppm			Backfilled with gravel Machine Slotted PVC Screen
1.7	FILLING - grey sand filling, with trace gravel and slag							End cap
2.9	SAND - white sand		A	3.0	PID=<1ppm			
			A	4.0	PID=<1ppm			
4.3	SANDY CLAY - grey brown sandy clay							
4.5	TEST BORE DISCONTINUED AT 4.5m - target depth reached		A	4.5	PID=<1ppm			

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 4.5m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.6m DURING DRILLING*

REMARKS: * STANDING WATER LEVEL OBSERVED AT 0.56m ON 10/8/04

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
W	Water sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED	
Initials:	
Date:	

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TEST BORE REPORT

BORE No: 110
DATE: 14 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.47 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Results	Contamination Observations	Water	Well Construction Details
0.12	CONCRETE							GATIC COVER
0.2	FILLING - black/dark grey sand and gravel filling							BENTONITE
	FILLING - grey gravelly sand filling, with trace slag, wet to saturated		A*	0.5	PID<1ppm		▽	
1.2	FILLING - brown clayey sand filling, with trace gravel and slag		A	1.5	PID<1ppm			BACKFILLED WITH GRAVEL
								MACHINE SLOTTED PVC SCREEN
1.7	FILLING - grey sand filling, with trace gravel and slag							END CAP
2.6	SAND - white sand							
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached		A	3.0	PID<1ppm			

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.6m DURING DRILLING*

REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Y7 TAKEN
*STANDING WATER LEVEL OBSERVED AT 0.48m ON 10/8/04

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
W	Water sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 114
DATE: 14 Jul 04
SHEET 1 OF 1
AZIMUTH: --

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW
PROJECT No: 37278
SURFACE LEVEL: 5.24 AHD
DIP OF HOLE: 90°

Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Results	Contamination Observations	Water	Well Construction Details
	ASPHALT							GATIC COVER; BENTONITE
0.2	FILLING - green/brown sand filling, with some blue metal							
0.3	FILLING - brown sand filling, with trace clay and sand, moist to wet							
0.5	FILLING - grey sand filling, saturated		A	0.5	PID<1ppm			
1							▽ 1	BACKFILLED WITH GRAVEL; MACHINE SLOTTED PVC SCREEN; END CAP
1.2	FILLING - brown grey sand filling, with trace slag							
			A*	1.5	PID<1ppm			
2							2	
2.5	SAND - white sand							
3			A	3.0	PID<1ppm		3	
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached							
4							4	

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.5m DURING DRILLING*

REMARKS: A* DENOTES FIELD REPLICATE SAMPLE Z3 TAKEN
*STANDING WATER LEVEL OBSERVED AT 1.09m ON 10/8/04

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
W	Water sample	S	Standard penetration test
C	Core drilling	U_x	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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TEST BORE REPORT

BORE No: 121
DATE: 14 Jul 04
SHEET 1 OF 1

CLIENT: KEITH ENGINEERING PTY LTD
PROJECT: PHASE 2 CONTAMINATION ASSESSMENT
LOCATION: 34-36 McPHERSON ST, BANKSMEADOW

PROJECT No: 37278
SURFACE LEVEL: 5.38 AHD
DIP OF HOLE: 90°

AZIMUTH: --

Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Results	Contamination Observations	Water	Well Construction Details
0.2	FILLING - grey sand filling, with some gravel and trace scrap metal							GATIC COVER; BENTONITE
	FILLING - dark brown sand filling, with some gravel and trace brick, metal wire and slag, moist		A	0.5	PID<1ppm		▽	
	- saturated from 0.7m							BACKFILLED WITH GRAVEL; MACHINE SLOTTED PVC SCREEN
1.1	FILLING - dark brown sand filling, with trace gravel							
1.4	SAND - white sand		A	1.4	PID<1ppm			END CAP
3.0	TEST BORE DISCONTINUED AT 3.0m - target depth reached		A	3.0	PID<1ppm			

RIG: BOBCAT **DRILLER:** B ELLIS **LOGGED:** NLE **CASING:** UNCASED

TYPE OF BORING: 100mm DIAMETER SPIRAL FLIGHT AUGER TO 3.0m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 0.7m DURING DRILLING*

REMARKS: *STANDING WATER LEVEL OBSERVED AT 0.53m ON 10/8/04

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	PL	Point load strength Is(50) MPa
W	Water sample	S	Standard penetration test
C	Core drilling	U,	Tube sample (x mm dia.)
pp	Pocket penetrometer (kPa)	PID	Photo Ionisation Detector

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.19 AHD^
EASTING: 335490
NORTHING: 6240996
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 37278.01
DATE: 25/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE SLAB			0.1				Gatic cover
		FILLING - grey/dark grey, sand and gravel filling with trace silt and slag		A	0.3				Bentonite
	0.35	FILLING - grey and brown, silty sand filling			0.4				
				A	0.5		0.5-0.6m: ASS		
					0.9		0.9-1.0m: ASS	▼ 08-02-12	
1	0.95	FILLING - dark brown/black, clayey and silty sand filling		A	1.0				1 Backfilled with gravel
	1.1	SILTY SAND - dark brown, silty sand with moderate to strong petroleum odour (possibly filling)		A	1.1				
					1.3				
					1.4		1.4-1.5m: ASS		
				U_{85}	1.7				
					1.8				
2					1.9		1.9-2.0m: ASS		2 Machine slotted PVC screen
	2.1	SILTY SAND - grey/dark grey, silty sand with moderate to strong petroleum odour (possibly filling)		U_{75}	2.1				
	2.3	SAND - light brown, sand with trace silt with moderate to strong petroleum odour (possibly filling)		U_{75}	2.2				
	2.5	SILTY SAND - dark brown/grey, silty sand with moderate to strong petroleum odour (possibly filling)		U_{65}	2.3				
	2.75	SAND - brown, sand with trace silt with moderate to strong petroleum odour (possible filling)		U	2.4		2.4-2.5m: ASS		
	2.9	SAND - light grey sand with faint organic (possibly natural) odour decreasing with depth			2.5				
					2.7				
					2.9		2.9-3.0m: ASS		
3					3.0				3
				U^*_{55}	3.4		3.4-3.5m: ASS		End cap
					3.5				
					3.8		3.8-4.0m: ASS		
4	4.0	Bore discontinued at 4.0m							4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Hand auger to 1.6m then Push tube

WATER OBSERVATIONS: Free groundwater observed at 0.5m during drilling. Measured at 0.89m on 8/2/12

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. *Field replicate samples BD6A/2050112 & BD6B/250112. ASS = Acid sulphate soil sample

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.19 AHD^
EASTING: 335493
NORTHING: 6240999
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 37278.01
DATE: 23/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALT PAVEMENT							Gatic cover
		FILLING - grey/brown, gravel and fine sand filling with trace silt		U_{100}	0.1 0.3				Backfill Bentonite
	0.4	FILLING - dark brown to grey, silty sand filling		U_{100}	0.4 0.5				
	0.6	FILLING - brown and grey, silty sand filling							
	0.7	FILLING - medium grey, silty sand filling							
	0.8	FILLING - light grey, silty sand filling		U_{100} U_{90}	0.9 1.0 1.1			08-02-12	Backfilled with gravel
	1.5	SILTY SAND - dark brown, silty sand (possibly filling)		U_{90} U_{85}	1.4 1.5 1.9 2.0				Machine slotted PVC screen
	2.5	SAND - light grey, fine grained sand with natural organic odour		U_{85} U_{65}	2.8 3.0 3.4 3.5				End cap
				U_{65}	3.9 4.0				
				U_{55}	4.8				
	5.0	Bore discontinued at 5.0m			5.0				

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m during drilling. Measured at 0.91m on 8/2/12

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING: 335497
NORTHING: 6240995
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 37278.01
DATE: 23/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5	0.05	ASPHALT PAVEMENT							
		FILLING - grey brown, gravel and fine sand filling with trace silt		U_{100}	0.1				
	0.3	FILLING - dark brown/grey, silty sand filling		U_{100}	0.3				
	0.5	FILLING - light to dark grey, fine sand filling with natural organic and sulphur odour			0.5		0.5-1.0m: Bulk sample		
				U_{100}	0.9			▼	
4	1				1.0				1
				U_{90}	1.1				
					1.3				
	1.4	SAND - light grey, fine grained sand with natural and organic odour with possible faint petroleum odour (possibly filling)							
	1.7	SAND/SILT- medium to dark grey, fine grained sand and silt with natural organic odour with possible faint petroleum odour (possibly filling)		U_{90}	1.7				
3	2	2.0	SAND - light grey, fine grained sand (possible filling)		U_{90}	2.0			2
					2.3				
	2.4	SAND - yellow brown, fine grained sand with trace of silt - faint petroleum odour to 3.8m							
					2.7				
				*U_{85}					
2	3				3.0				3
					3.3				
				U_{75}					
					3.6				
1	4								4
					4.6				
				U_{65}					
	4.8	Bore discontinued at 4.8m - target depth reached			4.8				

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 0.9m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. *Field replicate samples BD1A/230112 & BD1B/230112

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.1 AHD^
EASTING: 335503
NORTHING: 6241006
DIP/AZIMUTH: 90°/--

BORE No: 204
PROJECT No: 37278.01
DATE: 25/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5	0.05	ASPHALT PAVEMENT							
		BASECOURSE - green grey, sandy, fine to medium gravel basecourse (filling)		U_{100}	0.1				
	0.3	FILLING - mottled light grey and light brown, fine grained sand filling			0.3				
				U_{100}	0.5				
					0.7				
		0.8m: becoming medium grey silty sand		U_{100}	0.8				
4	1.0	FILLING - light grey, fine to medium grained sand filling with trace gravel (possibly natural)		U_{75}	1.0			▼	1
	1.2	SAND - dark grey, fine grained sand with natural organic odour (possibly filling)			1.2				
				U_{75}	1.3				
					1.5				
				U_{75}	1.8				
3	2.0	SAND - light grey-white, fine grained sand		U_{65}	2.0				2
					2.2				
		- faint petroleum odour from 2.5m			2.5				
				A					
2	3				3.0				3
					3.7				
				A					
1	4.0	Bore discontinued at 4.0m - target depth reached			4.0				4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube to 2.5m then auger (due to refusal of push tube)

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING: 335507
NORTHING: 6241041
DIP/AZIMUTH: 90°/--

BORE No: 205
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown, gravelly sand filling with trace ceramic, wood, brick, metal and clay		U_{100}	0.0				
		- becoming grey from 0.2m		U_{100}	0.1				
		- dark green fibrous inclusions at 0.4m			0.2				
	0.4	FILLING - dark grey to black, gravelly sand filling with some ash and slag and trace silt, moist		F	0.3		F205/0.4: sample of green fibrous inclusions		
	0.6	FILLING - dark grey to black, sandy, medium to coarse gravel filling with some slag and trace silt		U_{100}	0.4				
	0.7	FILLING - dark grey to black, clayey silt filling with trace fine grained sand and rounded gravel		U_{100}	0.5				
	1.0	FILLING - light brown, gravelly sand filling (possibly cave in material)		U_{100}	0.6				
	1.2	FILLING - dark grey to black, clayey silt filling with some gravel (possibly natural)		U_{100}	0.7			▼	
	1.3	SAND - medium grey sand with trace silt and rootlets (possible filling)		U_{90}	1.0				
				U_{90}	1.2				
	1.7	SAND - light yellow brown sand with rootlets			1.3				
				U_{90}	1.6				
	2.1	SAND - light brown sand			1.7				
		- becoming light grey from 2.4m			2.0				
				U_{50}	2.6				
	3.0	Bore discontinued at 3.0m - target depth reached			2.9				

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.2m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.16 AHD^
EASTING: 335509
NORTHING: 6241077
DIP/AZIMUTH: 90°/--

BORE No: 206
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0				0.0				Gatic cover
	0.05	FILLING - red brown sand and fibre cement fragment filling		U_{100}	0.05				Bentonite
	0.25	FILLING - gravelly clayey sand filling with fibre cement fragments							
	0.3	FILLING - orange pink sandstone filling			0.4				
		FILLING - black silt filling with trace fine sand and rootlets (possible natural)		ASS U^*_{100}	0.5		0.5m: ASS	09-02-12	
	0.7	FILLING - dark grey, silty, fine grained sand			0.7				
		0.85m: grading to light grey with gravel and fibre cement (possible cave in material)			0.8				
	1			U_{100}	1.0		0.8-1.0m: ASS		1 Backfilled with gravel
	1.2	SAND - yellow brown, fine grained sand							
					1.4				
				U_{90}			1.4-1.6m: ASS		Machine slotted PVC screen
					1.6				
	1.8	SAND - light grey, fine grained sand			1.8				
				U_{90}			1.8-2.0m: ASS		
	2				2.0				2
					2.4		2.4-2.6m: ASS		
					2.8		2.8-3.0m: ASS		
	3								3 End cap
					3.5		3.5m: ASS		
	4	4.0 Bore discontinued at 4.0m			4.0		4.0m: ASS		4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube to 3.0m then auger (due to push tube refusal)

WATER OBSERVATIONS: Free groundwater observed at 0.7m; at 0.3m in hole during well installation and at 0.05m on 9/2/12

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. *Field replicate samples BD3A/24912 & BD3B/240112. ASS = Acid sulphate soil sample

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.5 AHD^
EASTING: 335514
NORTHING: 6241091
DIP/AZIMUTH: 90°/--

BORE No: 207
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - light to medium grey brown, gravelly sand filling		U_{100}	0.0				
		0.35m to 0.4m: white orange crushed sandstone layer			0.3				
	0.4	FILLING - medium grey, lightly cemented, silty sand filling with some gravel and trace foam and brick		U_{100}	0.4 0.5				
	0.6	FILLING - medium grey brown, silty sand filling with some metal wire, organic matter and trace glass and foam		U_{100}	0.6 0.7				
	0.7 0.75	FILLING - medium to dark grey sand filling							
	0.95	FILLING - yellow orange and light grey, sandstone filling		U_{100}	0.95			▼	
	1.0	FILLING - dark and light grey, silty clay and trace gravel, moist to wet		U_{75}	1.0				
	1.2	FILLING - dark grey to black, silty, fine grained sand filling with trace gravel (possible natural)			1.2				
		SAND - light grey sand with natural organic odour to 1.8m							
				U_{75}	1.8				
		- trace sandstone gravel at 2.0 to 2.1m (possible cave in material)			2.0				
		- becoming light grey to white from 2.8m - trace coffee rock		U_{55}	2.8				
	3.0	Bore discontinued at 3.0m - target depth reached			3.0				

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 6.2 AHD^
EASTING: 335529
NORTHING: 6241085
DIP/AZIMUTH: 90°/--

BORE No: 208
PROJECT No: 37278.01
DATE: 25/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0				0.0				
	0.1	FILLING - brown organic silt and sand filling (topsoil)		U_{100}	0.1				
	0.2	FILLING - brown silty sand filling with trace gravel and organic matter		U_{100}	0.2		0.2-1.0m: Bulk sample		
		FILLING - brown and grey, sand and gravel filling with trace cobble, silt, brick fragments, concrete, woven geosynthetic and sandstone			0.3				
				U_{100}					
					0.8				
	1								1
	1.6	SAND - brown sand with trace silt (possible filling)		U_{90}	1.6			▼	
	1.8	SAND - light brown sand with trace silt			1.8				
	2								2
					2.4				
				U_{90}					
					2.6				
	2.8	SAND - light brown sand with trace silt		U_{85}	2.8				
	3 3.0	Bore discontinued at 3.0m			3.0				3
	4								4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.6m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.25 AHD^
EASTING: 335500
NORTHING: 6241136
DIP/AZIMUTH: 90°/--

BORE No: 209
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	CONCRETE SLAB							Gatic cover
		FILLING - dark grey sand filling with some silt, natural organic odour		U_{100}	0.1			08-02-12	Backfill Bentonite
	0.3	FILLING - black/dark grey, coarse grained sand filling with some gravel (slag)			0.3				
				U_{100}	0.4				
	0.6	SAND - light brown, fine grained sand with trace silt			0.6				
				U_{100}	0.7				
					0.9				1 Backfilled with gravel
				U_{90}	1.4				
					1.6				Machine slotted PVC screen
	4.0	Bore discontinued at 4.0m							End cap

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 0.3m during drilling. Observed at 0.08m on 8/2/12

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 210
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	CONCRETE SLAB							
		FILLING - dark grey, slightly gravelly, fine grained sand filling		U_{100}	0.1				
	0.5	FILLING - very dark grey to black, gravelly sand filling		U_{100}	0.5				
	0.7	FILLING - orange, slightly sandy, silty gravel filling. Gravel mostly sandstone with some glass and slag			0.7			▼	
	0.85								
	0.9	FILLING - grey brown, lightly cemented, sandy silty gravel filling. Gravel mostly slag with some fibrous material		U_{100}	0.9				
1	1.0				1.0				1
	1.1	FILLING - black sandy silt filling. Natural organic odour (possibly natural)							
	1.35	FILLING - grey to black, slightly gravelly sand and sandy silt (possible cave in material)							
		SANDY SILT - black to dark grey sandy silt with natural organic odour							
		SAND - yellow brown, fine grained sand							
				U_{90}	1.8				
2					2.0				2
		2.25-2.3m: black silty lens							
				U_{90}	2.5				
					2.7				
3	3.0	Bore discontinued at 3.0m							3
4									4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** JP **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 0.7m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 211
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.14	CONCRETE SLAB							
		FILLING - light brown, fine grained sand filling		U_{100}	0.2				
		0.3m: grading to dark grey/black			0.3				
		0.45m: wood and small cobble (65mm) (possibly railway sleeper & ballast?)		U_{100}					
	0.5	- trace concrete at 0.5m			0.5				
		Bore discontinued at 0.5m - refusal							

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 212
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	CONCRETE SLAB			0.1				
		FILLING - light grey, fine grained sand filling with trace gravel		U_{100}					
	0.4				0.4				
	0.5	FILLING - light grey to black, gravelly silty sand filling with trace glass. Gravel mostly slag							
		FILLING - yellow, brown and white, gravelly sand/sandy gravel filling. Gravel mostly slag and sandstone		U_{100}	0.6				
					0.75				
	0.9				0.9			▼	
	1	SANDY SILT - black sandy silt with natural organic odour (possibly filling)		U_{100}	1.0				1
		0.9-1.3m: grading to silty sand		U_{90}					
	1.3	SAND - yellow brown, fine grained sand			1.3				
				U_{90}					
					1.6				
				U_{90}					
	2				2.0				2
					2.8				
				U_{85}					
	3	3.0 Bore discontinued at 3.0m - target depth reached			3.0				3
	4								4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** JP **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 0.9m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 213
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	CONCRETE SLAB			0.1				Gatic cover
		FILLING - grey, slightly silty, fine grained sand filling. Trace clasts/lenses of reworked black silt 3-4cm diameter		U_{100}	0.5				Bentonite
	0.55	FILLING - yellow/yellow grey, fine grained sand filling							
	0.75	FILLING - black sandy gravel filling		U_{100}	0.8 0.9			09-02-12	Backfilled with gravel
	1.4	SILT - black silt with natural organic odour (possibly filling)		U_{90}	1.5 1.6				Machine slotted PVC screen
		1.85m: becoming sandy silt							
	1.9	SAND - yellow to yellow grey, fine grained sand		U_{90}	1.9 2.0				End cap
				U_{85}	2.5 2.6				
	3.0	Bore discontinued at 3.0m							

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** JP **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 0.77m during drilling and measured at 0.78m on 9/2/12

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.3 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 214
PROJECT No: 37278.01
DATE: 25/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.12	CONCRETE SLAB							
		FILLING - light to medium grey, fine grained sand filling with some silt and trace glass and gravel		U_{100}	0.2				
					0.3				
				U_{100}	0.4				
	0.5				0.5				
	0.55	FILLING - orange sand and slag filling		U_{100}	0.6				
	0.65	FILLING - dark grey to black, silty, fine grained sand filling with some fine to coarse gravel and slag			0.7			▼	
		FILLING - medium grey, fine grained sand filling with some silt, sandstone gravel and clay clasts, wet		U_{100}					
	0.9				0.9				
1		FILLING - black silt filling with some fine grained sand and trace organic matter. Strong organic chemical (cigarette-like) odour (possibly natural)		U_{100}	1.0				1
				U_{75}	1.1				
	1.2	1.0m: becoming clayey silt with some fine grained sand							
		1.15m: becoming silty sand			1.3				
		SILTY SAND - dark grey, silty sand with faint organic odour and trace organic matter (possibly filling)		U_{75}					
		1.6m: becoming dark grey to black clayey silty sand			1.5				
					1.7				
				U_{75}					
	1.8	SAND - dark grey sand with trace silt and organic matter (possible filling)			1.8				
2				U_{75}					2
					2.1				
	2.3	SAND - light brown, fine grained sand							
					2.7				
		2.7m: grading to light yellow brown fine grained sand		U_{55}					
					2.9				
3	3.0	Bore discontinued at 3.0m - target depth reached							3
4									4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 0.7m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 215
PROJECT No: 37278.01
DATE: 25/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE SLAB							
		FILLING - grey/brown, sand and gravel filling with trace silt (slag)		U_{100}	0.2		ASS collected		
	0.45				0.4				
		FILLING - dark brown grey, silty sand and gravel filling with some brick, slag and fibre cement fragments		U_{100}	0.5				
	0.6	FILLING - grey sand and gravel filling with trace silt. Gravel mostly concrete and slag		U_{100}	0.6				
	0.9				0.8				
	1.0	SILTY SAND - grey black, silty sand, petroleum (diesel) odour (possibly filling)		U^*_{100}	0.9			▼	
	1.2	CLAYEY SILTY SAND - black clayey silty sand, petroleum (diesel) odour (possibly filling)		U_{75}	1.0				
		SAND - light grey brown, sand with trace silt (possibly filling)		U_{75}	1.2				
	1.55				1.3				
		SAND - grey brown sand with trace silt with natural organic odour		U_{75}	1.5				
					1.7				
				U_{55}	1.9				
					2.1				
				U_{55}	2.3				
					2.4				
					2.6				
	2.8	SAND - light brown sand with trace silt		U_{55}	2.8				
					3.0				
					3.4		3.4-3.6m: ASS		
					3.8		3.8-4.0m: ASS		
	4.0	Bore discontinued at 4.0m - target depth reached							

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. *Field replicate samples BD3A/250112 & BD3B/250117. ASS = Acid sulphate soil sample

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 216
PROJECT No: 37278.01
DATE: 25/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE							Gatic cover
		FILLING - grey brown, sand and gravel filling with trace silt (slag)		U_{100}	0.2				Bentonite
	0.45				0.4				
		FILLING - dark grey black, silty sand filling with slight gravel (slag)		U^*_{100}	0.5				
	0.6				0.6				
		FILLING - grey black, sand and gravel filling with trace silt (slag), organic chemical odour		U_{100}	0.7				
	0.85				0.8				
		FILLING - grey black, silty sand filling, petroleum (diesel) odour (possibly natural)		U_{100}	0.9				
	1				1.0				1 Backfilled with gravel
	1.15				1.15				
		SANDY SILT - grey, slightly sandy silt, slight petroleum (diesel) odour (possibly filling)		U_{85}	1.25			▼	
	1.25			U_{85}					
	1.35	SILTY SAND - brown grey, silty sand (possibly filling)		U_{85}	1.35				
	1.45	CLAYEY SILTY SAND - grey black, clayey silty sand (possibly filling)			1.45				
					1.5				
		SAND - light brown grey, sand with trace silt (possibly filling)		U_{75}					
					1.7				Machine slotted PVC screen
	2								2
	2.15	SAND - light grey sand with trace silt							
					2.4				
				U_{75}					
					2.6				
	3								3
	3.0	Bore discontinued at 3.0m							End cap
	4								4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free (oily) groundwater observed at 1.2m during drilling. Measured at 0.8m bgl on 31/1/12

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. *Field replicate samples BD2A/250112 & BD2B/250112

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.2 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 217
PROJECT No: 37278.01
DATE: 25/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5	0.1	CONCRETE SLAB							
		FILLING - light brown and grey, sand filling			0.2				
		0.2m: becoming medium to dark grey sand filling with trace slag and coarse gravel		U_{100}	0.3				
	0.35				0.4				
	0.4	0.3m: becoming light grey							
		FILLING - orange crushed sandstone filling		U_{100}					
	0.6	FILLING - dark grey to black, slightly sandy, silt filling with trace gravel and slag. Natural organic odour			0.6				
					0.7				
		FILLING - light grey, silty sand filling with trace fine gravel, clay and organic matter		U_{100}					
	0.9				0.9				
4	1	CLAYEY SILTY SAND - black clayey sandy silt with organic and petroleum (diesel) odour (possibly filling)		U_{100}	1.0			▼	1
				U_{90}					
	1.3	SILTY SAND - dark grey to black, silty sand with trace clay. Faint organic odour and possible petroleum (diesel) odour (possibly filling)		U_{90}	1.3				
					1.4				
		1.4m: becoming dark grey to black, silty sand with trace organic matter and organic (possibly diesel or oil) odour							
					1.7				
				U_{90}					
	1.9	SAND - medium to dark brown, fine grained sand filling with some silt. Faint (possibly natural) organic odour (possibly filling)		U_{90}	1.9				
3	2				2.0				2
	2.3	SAND - light grey, fine grained sand, becoming lighter grey with depth							
					2.4				
				U_{75}	2.5				
					2.8				
				U_{75}	2.9				
2	3								3
	3.0	Bore discontinued at 3.0m - target depth reached							
	4								4
1									

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. *Field replicate samples BD4A/4B/250112

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.0 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 218
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5	0.1	CONCRETE SLAB							
	0.22	CONCRETE SLAB			0.2				
	0.4	FILLING - dark and light brown, fine grained sand filling		U_{100}	0.4				
		FILLING - grey/black, gravel and sand filling with some clay		U_{100}	0.5				
4	1				0.7			▼	1
	1.2	FILLING - dark brown, sand and gravel filling		U_{90}	1.2				
	1.4	SAND - light brown, fine grained sand with trace silt		U_{90}	1.4				
3	2				1.6				2
		2.6m: slight natural organic odour		U_{85}	2.6				
2	3				2.8				3
	3.0	Bore discontinued at 3.0m - target depth reached							
1	4								4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 4.9 AHD^
EASTING: 335470
NORTHING: 6241088
DIP/AZIMUTH: 90°/--

BORE No: 219
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	CONCRETE SLAB			0.1				
		FILLING - black gravel and sand filling with some slag. Petroleum (diesel) odour		U_{100}			0.1-0.4m: ASS		
	0.4	FILLING - brown gravel and sand filling with trace coffee rock and crushed sandstone. Moderate petroleum odour		U_{100}	0.4		0.4-0.6m: ASS		
	0.6	FILLING - black/grey, sandy silt filling with trace glass and gravel. Moderate petroleum odour			0.6				
4	1				1.0			▼	1
				U_{100}			1.0-1.4m: ASS		
	1.4	SAND - light to dark brown, sand with trace gravel. Faint natural organic odour (possibly filling)		U_{100}	1.4		1.4-1.6m: ASS		
3	2				1.6				2
	2.5	SAND - light brown, fine grained sand with trace silt		U_{85}	2.5		2.5-2.7m: ASS		
2	3				2.7				3
					3.4				
				U_{75}			3.4-3.6m: ASS		
					3.6				
	3.8	Bore discontinued at 3.8m - target depth reached							
1	4								4
0									

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. ASS = Acid sulphate soil sample

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 4.91 AHD^
EASTING: 335472
NORTHING: 6241096
DIP/AZIMUTH: 90°/--

BORE No: 220
PROJECT No: 37278.01
DATE: 23/1/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	CONCRETE SLAB							Gatic cover
	0.14	CONCRETE SLAB							End cap space
		FILLING - dark grey to black, sandy gravel filling with petroleum (diesel) odour. Gravel mainly comprises slag and ash		U_{100}	0.2 0.4				Bentonite
	0.5	FILLING - dark grey, organic (rootlets) sandy clay filling with some terracotta and ceramic tile and trace glass		U_{100}	0.6 0.7		0.6-0.7m: ASS		
	0.7	FILLING - black organic clayey silt filling with rootlets (possible natural)		U_{100}	0.9 1.0		0.9-1.0m: ASS	▼	Backfilled with gravel
	1.1	SANDY CLAYEY SILT - dark grey to black, sandy clayey silt with some organic matter (possibly filling)		U_{90}	1.1 1.3		1.1-1.3m: ASS		
	1.6	SAND - light brown, sand with trace organic matter (possibly filling)		U_{90}	1.6 2.0		1.6-2.0m: ASS		Machine slotted PVC screen
	2.4	SAND - light brown, fine grained sand		U_{90}	2.4 2.6		2.4-2.6m: ASS		
				U_{75}	3.4 3.6		3.4-3.6m: ASS		End cap
				A	4.8 5.0				

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE/MW **CASING:** Uncased

TYPE OF BORING: Push tube to 4.0m then auger (for well installation)

WATER OBSERVATIONS: Free groundwater observed at 1.0m in soil, rose to 0.7 in hole

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. ASS = Acid sulphate soil sample. *Field replicate samples BD2A/23012 & BD2B/230112

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 4.91 AHD^
EASTING: 335472
NORTHING: 6241096
DIP/AZIMUTH: 90°/--

BORE No: 220
PROJECT No: 37278.01
DATE: 23/1/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-1	6	SAND - light brown, fine grained sand *(continued)*							6
	6.0	Bore discontinued at 6.0m - target depth reached							
-2	7								7
-3	8								8
-4	9								9
-5									

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE/MW **CASING:** Uncased

TYPE OF BORING: Push tube to 4.0m then auger (for well installation)

WATER OBSERVATIONS: Free groundwater observed at 1.0m in soil, rose to 0.7 in hole

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. ASS = Acid sulphate soil sample. *Field replicate samples BD2A/23012 & BD2B/230112

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.0 AHD^
EASTING: 335483
NORTHING: 6241095
DIP/AZIMUTH: 90°/--

BORE No: 221
PROJECT No: 37278.01
DATE: 23/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5	0.02	ASPHALT PAVEMENT							
		FILLING - dark grey, gravelly sand filling with trace concrete and shale		U_{90}	0.1				
		- with terracotta fragments from 0.3m		U_{90}	0.3				
	0.5	FILLING - dark grey brown, clay filling with some organic matter, glass, slag, concrete and fibre cement fragments			0.5				
				U_{90}	0.6				
				F	0.7				
	0.8	FILLING - black clayey silt filling with trace rootlets and natural organic odour (possibly natural)		U_{75}	0.8				
4	1				1.0			▼	1
	1.2	SILTY SAND - black silty sand with trace rootlets and natural organic odour (possibly filling)							
	1.5	SAND - grey brown, sand with natural organic odour (possibly filling)		U_{75}	1.5				
3	2				1.9				2
				U_{55}					
					2.5				
					2.6				
2	3	3.0		U_{55}	3.0				3
		Bore discontinued at 3.0m - target depth reached							
1	4								4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.1 AHD^
EASTING: 335477
NORTHING: 6241099
DIP/AZIMUTH: 90°/--

BORE No: 222
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5	0.1	CONCRETE SLAB			0.1				
		FILLING - black and grey, gravel and sand filling with some slag and silt		U_{100}	0.3				
	0.5	FILLING - mottled white, grey and red, clay filling with trace ironstone gravel		U_{100}	0.5				
	0.6	FILLING - black/dark brown, organic sandy silt filling with gravel (topsoil). Natural organic odour			0.6				
	0.9	FILLING - grey brown, slightly gravelly sand filling		U_{100}	0.9				
4	1 1.0	FILLING - grey clayey sand filling with some gravel. Gravel comprises red brick fragments		U_{90}	1.0			▼	1
	1.4	FILLING - brown sand filling		U_{90}	1.2				
	1.6	FILLING - black and grey, gravel and silt filling with some slag and natural organic matter			1.4				
	1.95	FILLING - black and grey, gravel and silt filling with some slag and natural organic matter			1.6				
3	2 2.1	FILLING - brown sand filling with some gravel, glass and fibre cement		U_{90}	2.0				2
	2.3	SAND - brown, fine grained sand with some silt			2.2				
				U_{85}	2.8				
2	3 3.0	Bore discontinued at 3.0m - target depth reached			3.0				3
1	4								4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** MW **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd
PROJECT: Supplementary Contamination Assessment
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.37 AHD^
EASTING: 335479
NORTHING: 6241137
DIP/AZIMUTH: 90°/--

BORE No: 223
PROJECT No: 37278.01
DATE: 23/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
					0.0				Gatic end cap
	0.2	FILLING - grey gravel and sand filling with trace brick fragment		U_{100}	0.2				
	0.35	CONCRETE (slab?)			0.4				Bentonite
		FILLING - light and dark grey, sandy silt filling with trace gravel, slag and coffee rock, moist		U_{100}	0.6		0.5-0.6m: ASS		
	0.7	FILLING - dark grey/black, sandy silt filling with some glass, gravel, plaster, rootlets, concrete and metal - layer of light grey sand 0.8m to 0.9m		U_{100}	0.7		0.7-1.0m: ASS		
	1				1.0			▼	1 Backfilled with gravel
	1.3	FILLING - light grey, sand filling with trace rubber, gravel and metal with faint natural organic odour		U_{90}	1.3		1.3-1.4m: ASS		
	1.4	FILLING - dark grey to black, clayey silt filling with some sand and trace rootlets (possibly natural)		U_{90}	1.4		1.4-1.6m: ASS		
	1.6	FILLING - dark grey, clayey sandy silt filling with faint natural organic odour (possibly natural)			1.6				
	1.7	SAND - medium grey sand with faint natural organic odour (possible filling)		U_{90}	1.7		1.7-2.0m: ASS		Machine slotted PVC screen
	2				2.0				2
	2.4	SAND - light yellow brown sand with trace rootlets and faint natural organic odour		A	2.4		2.4-2.6m: ASS		
					2.6				
				U_{75}	2.7		2.7-3.0m: ASS		
	3			A	3.0				3
									End cap
				A	3.5		3.5m: ASS		
	4	4.0 Bore discontinued at 4.0m - target depth reached		A	4.0		4.0m: ASS		4

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Push tube

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: Location coordinates are in MGA94 Zone 56. ^Coordinates from hand held GPS. ASS = Acid sulphate soil sample

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia) Pty Ltd **SURFACE LEVEL:** --
PROJECT: Supplementary Contamination Assessment **EASTING:**
LOCATION: 34-36 McPherson Street, Banksmeadow **NORTHING:**
DIP/AZIMUTH: 90°/--

BORE No: CPT4/CBR4
PROJECT No: 37278.01
DATE: 24/1/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	FILLING - orange brown, clayey sand filling			0.1				
		FILLING - medium to dark grey sand filling		A					
	0.4	FILLING - light orange brown, clay filling			0.4				
	0.5	FILLING - grey sandy gravel (slag) filling							
	0.7	FILLING - dark grey to black, clayey silt filling with trace sand and natural organic odour		A/B	0.7				
	1.0	Bore discontinued at 1.0m - target depth reached			1.0				

RIG: Dando terrier **DRILLER:** I Drever **LOGGED:** NLE **CASING:** Uncased

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia)
PROJECT: Delineation of LNAPL
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.11 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 301
PROJECT No: 37278.03
DATE: 14/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
					0.0				Flush gatic cover
	0.2	FILLING - grey brown gravelly fine to coarse sand filling		U90	0.2				Bentonite
	0.5	FILLING - brown, ashy, gravelly sand filling, some clinker, slag, metal and brick fragments							Casing
		FILLING - black brown organic sand filling with trace ceramic fragments (possible re-worked natural)		*U90	0.6				
	1.0				0.8				
		ORGANIC SAND - black brown, peaty sand with some plant matter		U90	1.0			18-01-13	Machine slotted PVC screen
	1.6				1.2				Gravel
		SAND - brown, fine to medium sand							
				U90	1.7				End cap
					1.9				
	4.0	Bore discontinued at 4.0m target depth reached							

RIG: Dando Terrier **DRILLER:** SS **LOGGED:** RMcA **CASING:** 3.0m

TYPE OF BORING: Push tubes

WATER OBSERVATIONS: Free water observed at 1.0m during drilling. Groundwater observed at 1.07m bgl on 18/1/13

REMARKS: * Replicate sample BD1/ 141212 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia)
PROJECT: Delineation of LNAPL
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.15 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 302
PROJECT No: 37278.03
DATE: 13/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE SLAB							Flush gatic cover
		FILLING - grey sandy ash and slag filling							Bentonite
		-gravel layer							
	0.6	FILLING - grey gravelly silty sand filling with some ash and slag							
	0.9	ORGANIC CLAY - black sandy organic clay with slight organic odour, moist to wet		U90	0.9				
	1			U90	1.0			18-01-13	1 Gravel
					1.3				
	1.4	SILTY SAND - grey silty sand, wet							Machine slotted PVC screen
	1.9	SAND - yellow brown sand							
	2								2
		-slight petroleum odour (2.8-3.1m)		U90	2.9				End cap
	3				3.0				3
		-slight chemical (solvent) odour(3.1-3.5m)			3.2				
				*U90					
	3.5	Bore discontinued at 3.5m target depth reached			3.5				
	4								4

RIG: Dando Terrier **DRILLER:** SS **LOGGED:** NLE **CASING:** 0-1m
TYPE OF BORING: Push tubes
WATER OBSERVATIONS: Free water observed at 1.1m during drilling. Groundwater observed at 1.12m bgl on 18/1/13
REMARKS: Replicate samples BD1A/ 131212 & BD1B/131212 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia)
PROJECT: Delineation of LNAPL
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.18 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 303
PROJECT No: 37278.03
DATE: 13/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.13	CONCRETE SLAB							Flush gatic cover
	0.3	FILLING - dark grey gravelly sand filing with trace brick fragments. (base course)							Bentonite
		FILLING - dark black peaty sand filling with trace gravel. Natural organic odour (possible re-worked natural)		U90	0.3 0.4				
	0.6	SAND- grey sand with trace clay nodules & coffey rock. Slight petroleum and swampy odour (possibly filling)							
	1	-petroleum odour becoming stronger between 1and 2m		U90	0.9 1.0				1
				U90					Machine slotted PVC screen Gravel
	2	-becoming clayey from 1.9m			2.0				2
		-petroleum odour decreasing from 2.1m		U90	2.1 2.3				End cap
				U90	2.6				
	2.8	Bore discontinued at 2.8m target depth reached			2.8				
	3								3
	4								4

RIG: Dando Terrier **DRILLER:** SS **LOGGED:** NLE **CASING:** 0-1m
TYPE OF BORING: Push tubes
WATER OBSERVATIONS: Free water observed at 1.1m during drilling. Groundwater observed at 1.28m bgl on 18/1/13
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia)
PROJECT: Delineation of LNAPL
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.16 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 304
PROJECT No: 37278.03
DATE: 13/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.12	CONCRETE SLAB							Flush gatic cover
		FILLING - grey brown sand filling with trace gravel, moist		U90	0.2				Casing
					0.4				Bentonite
	0.6	FILLING - grey sand, ash and slag filling with some coarse gravel		U90	0.7				
					0.9				
	0.95	ORGANIC SAND - black organic sand with natural organic odour, wet (possibly filling)		U90	0.95				
	1.1	ORGANIC CLAY - black organic clay with trace sand, clay, Natural organic odour, wet		*U90	1.0			▼ 21-01-13	
					1.1				
					1.3				Machine slotted PVC screen
	1.6	ORGANIC SAND - black organic sand with some clay Natural organic odour, wet		U90	1.6				
					1.8				
	1.9	SAND - grey sand with natural organic odour							Gravel
	2.3	SAND - light yellow sand with slight chemical (chlorine) odour							
				U90	2.7				End cap
					2.9				
				U90	3.4				
	3.6	Bore discontinued at 3.6m			3.6				

RIG: Dando Terrier **DRILLER:** SS **LOGGED:** NLE **CASING:** 0-3m

TYPE OF BORING: Push tubes

WATER OBSERVATIONS: Free water observed at 1.0m during drilling. Groundwater observed at 1.25m bgl on 21/1/13

REMARKS: * Replicate samples BD2A/131212 & BD2B/131212 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia)
PROJECT: Delineation of LNAPL
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.18 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 305
PROJECT No: 37278.03
DATE: 14/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE SLAB							Flush gatic cover
		FILLING - brown slightly gravelly, fine to coarse sand filling		U90	0.2 0.4				Bentonite Casing
	0.5	FILLING - black brown, very gravelly sand with some fragments of clinker and concrete		U90	0.5 0.7				
	0.9	ORGANIC SAND - black brown organic sand		U90	0.9				
	1.1	SAND - brown, fine to medium sand		U90	1.1 1.2 1.4			21-01-13	Machine slotted PVC screen Gravel End cap
	2.3	Bore discontinued at 2.3m borehole collapsed							

RIG: Dando Terrier **DRILLER:** SS **LOGGED:** RMcA **CASING:** 0-3.0m
TYPE OF BORING: Push tubes
WATER OBSERVATIONS: Free water observed at 1.0m during drilling. Groundwater observed at 1.33m bgl on 21/1/13
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia)
PROJECT: Delineation of LNAPL
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.17 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 306
PROJECT No: 37278.03
DATE: 14/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.2	CONCRETE SLAB							Flush gatic cover
		FILLING - brown, fine to coarse sand filling, with some concrete gravel		U90	0.2 0.4				Bentonite Casing
	0.5	FILLING - black brown, ashy slightly clayey, gravelly fine to coarse sand. Gravel comprise clinker and concrete		U90	0.5 0.7				
	1.0	ORGANIC SAND - black, organic sand		U90	1.0 1.2				Gravel
	1.3	SAND - brown, fine to medium sand with some organic matter (peat)		U90	1.4 1.6			18-01-13	Machine slotted PVC screen
	2.8	Bore discontinued at 2.8m							End cap

RIG: Dando Terrier **DRILLER:** SS **LOGGED:** RMcA **CASING:** 3.0m
TYPE OF BORING: Push tubes
WATER OBSERVATIONS: Free water observed at 1.0m during drilling. Groundwater observed at 1.33m bgl on 18/1/13
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia)
PROJECT: Delineation of LNAPL
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.11 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 307
PROJECT No: 37278.03
DATE: 17/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CONCRETE SLAB							Flush gatic cover
	0.18	FILLING - medium to dark grey silty gravelly sand filling with some brick fragments							Bentonite
	0.3	FILLING - dark grey ashy sand filling			0.4				
				A					Casing
					0.6				
					0.8				
				A					
	1.0	SAND - dark grey sand with slight organic (swampy) odour, wet			1.0				Gravel
					1.1				
				A					
		-becoming brown			1.3				
								17-01-13	
									Machine slotted PVC sreen
									End cap
	3.7	Bore discontinued at 3.7m target depth reached							

RIG: Dando Terrier **DRILLER:** SS **LOGGED:** NLE **CASING:**
TYPE OF BORING: Auger
WATER OBSERVATIONS: Free water observed at 1.0m during drilling. Groundwater observed at 1.38m bgl on 17/1/13
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Veolia Environmental Services (Australia)
PROJECT: Delineation of LNAPL
LOCATION: 34-36 McPherson Street, Banksmeadow

SURFACE LEVEL: 5.08 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 308
PROJECT No: 37278.03
DATE: 17/12/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.02	ASPHALT							Flush gatic cover
		CONCRETE SLAB							Concrete
	0.2								
	0.25	FILLING - dark grey gravelly sand filling (base course)			0.3				Bentonite
		FILLING - dark grey black ashy sand filling with some brick fragments		A	0.5				Casing
	0.8	FILLING - dark grey/black silty sand filling (possibly natural)		A	0.8				
1	1.0	SAND - brown sand, wet, no petroleum odour			1.0				1 Machine slotted PVC screen
				A	1.2				
					1.3			▼ 17-01-13	
									Gravel
2									2
									End cap
3									3
	3.7	Bore discontinued at 3.7m target depth reached							
4									4

RIG: Dando Terrier **DRILLER:** SS **LOGGED:** NLE **CASING:**
TYPE OF BORING: Auger
WATER OBSERVATIONS: Free water observed at 1.3m during drilling. Groundwater observed at 1.29m bgl on 17/1/13
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Table C1 – Summary of Laboratory Results for Soils

Sample ID	Date Sampled	Soil Type	Depth Below Design Level	Total Metals													PAH				TRH (pre-NEPM 2013)				TRH (NEPM 2013)						BTEX				MTBE	VOC	phenol	PCB[m]	OCP[m]	CN	asbestos
				As	Be	B	Cd	Cr	Co	Cu	Pb	Mn	Hg	Ni	Zn		total[b]	BaP	BaP TEQ	naphthalene	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	TRH C_6 - C_{10}	TRH >C_{10} - C_{16}	vTPH C_6 - C_{10} less BTEX (F1)	TRH >C_{10} - C_{16} less Naphthalene (F2)	TRH >C_{16}-C_{34}	TRH >C_{34} -C_{40}	B	T	E	X							
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	0.1g/kg
Phase 2 Contamination Assessment [DP (2004)]																																								
101/0.5	-	-	0.5	<3	-	-	<0.5	5	-	13	17	-	<0.05	8	32		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	<0.90	<PQL	-	-
102/0.5	-	-	0.5	<3	-	-	<0.5	1	-	9	5	-	0.09	2	130		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
103/1.5	-	-	1.5	13	-	-	<0.5	5	-	15	4	-	0.06	590	580		<PQL	<0.05	-	-	<20	22		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	<0.50	-	-	-	-
103/4.0	-	-	4	<3	-	-	<0.5	1	-	<0.5	<2	-	<0.05	4	10		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
104/0.5	-	-	0.5	<3	-	-	<0.5	9	-	11	83	-	<0.05	5	120		<PQL	<0.05	-	-	<20	186		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	-	-	-	-
Y3	-	-	0.5	<3	-	-	<0.5	12	-	10	48	-	<0.05	5	140		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
104/1.5	-	-	1.5	<3	-	-	<0.5	15	-	24	290	-	<0.05	10	360		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	-	-	-	-
105/0.5	-	-	0.5	9	-	-	<0.5	9	-	17	7	-	<0.05	31	80		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	<0.50	<0.90	<PQL	-	-
105/1.5	-	-	1.5	12	-	-	<0.5	5	-	1	3	-	<0.05	3	38		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
106/0.5	-	-	0.5	<3	-	-	<0.5	3	-	25	39	-	0.05	5	320		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	<PQL	<0.50	<0.90	<PQL	-	-
107A/0.7	-	-	0.7	<3	-	-	<0.5	2	-	22	8	-	<0.05	3	150		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	-	-	-	-
108/0.5	-	-	0.5	<3	-	-	0.7	57	-	360	42	-	0.31	120	1,800		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Yes**
109/0.5	-	-	0.5	<3	-	-	<0.5	12	-	160	59	-	0.06	110	2,200		<PQL	<0.05	-	-	<20	1,224		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-		<0.90	<PQL	-	**Yes**
110/0.5	-	-	0.5	7	-	-	2	44	-	1,392	220	-	0.21	380	58,200		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	1.1	<0.50	<0.50	<1.5	-	-	<0.50	<0.90	<PQL	-	-
110/3.0	-	-	3	<3	-	-	<0.5	5	-	29	4	-	0.06	14	1,700		<PQL	<0.05	-	-	<20	75		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	<0.50	-	-	-	-
111/1.5	-	-	1.5	<3	-	-	0.8	7	-	82	77	-	0.17	6	1,500		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
112/0.5	-	-	0.5	<3	-	-	<0.5	2	-	10	110	-	0.06	2	490		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	-	-	-	-
113/0.5	-	-	0.5	<3	-	-	0.6	27	-	210	93	-	0.21	160	1,500		15	1.6	-	-	<20	130		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	-	-	-	NAD
114/0.5	-	-	0.5	<3	-	-	<0.5	1	-	5	17	-	<0.05	1	86		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	<PQL	<0.50	-	-	-	-
114/3.0	-	-	3	<3	-	-	<0.5	1	-	3	3	-	<0.05	2	38		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	<PQL	-	-	-	-	-
115/0.5	-	-	0.5	5	-	-	0.5	13	-	35	230	-	0.26	11	510		8.2	0.6	-	-	<20	550		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	<PQL	<0.50	<0.90	<PQL	-	-
Y5	-	-	0.5	3	-	-	0.6	6	-	27	240	-	0.28	7	520		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115/3.0	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	<20	**16,300**		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	-	-	-	-
116/0.5	-	-	0.5	4	-	-	<0.5	27	-	450	63	-	0.26	69	1,800		81	6.7	-	-	<20	813		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	-	-	-	-
117/0.5	-	-	0.5	<3	-	-	0.9	18	-	120	220	-	0.32	65	2,100		1.6	0.1	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-		0.5	<0.90	<PQL	-	-
118/0.5	-	-	0.5	<3	-	-	<0.5	0.7	-	0.8	<2	-	<0.05	0.2	16		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	<PQL	-	-	-	-	-
118/3.0	-	-	3	<3	-	-	<0.5	1	-	0.6	<2	-	<0.05	0.7	24		<PQL	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	-	-	-	-
119/0.5	-	-	0.5	<3	-	-	<0.5	40	-	56	10	-	0.08	67	100		0.7	<0.05	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	<0.90	<PQL	-	NAD
120A/0.5	-	-	0.5	6	-	-	<0.5	3	-	29	33	-	0.05	4	110		8.4	0.6	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	<0.90	<PQL	-	-
Z1	-	-	0.5	5	-	-	<0.5	3	-	28	30	-	0.09	4	170		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121/0.5	-	-	0.5	11	-	-	7	160	-	2,555	300	-	0.6	1,416	21,990		26	2.2	-	-	<20	<120		-	-	-	-	-	-	<0.50	<0.50	<0.50	<1.5	-	-	-	<0.90	<PQL	-	**Yes**
A2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Yes**
Supplementary Contamination Assessment [DP (2012)]																																								
201 / 0.15-0.3	25/01/12	F	0.15-0.3	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
201 / 0.5-0.7	25/01/12	F	0.5-0.7	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
201 / 1.1-1.3	25/01/12	N	1.1-1.3	-	-	-	-	-	-	-	-	-	-	-	-		<0.1	<0.05	<PQL	<0.1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	<1	-	-	-	-	-
201 / 3.0-3.5	25/01/12	N	3.0-3.5	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	<1	-	-	-	-	-
BD6A / 250112[a]	25/01/12	N	3.0-3.5	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	<1	-	-	-	-	-
BD6B / 250112[a]	25/01/12	N	3.0-3.5	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	<20	<20	<50	<50	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.3	<0.5	<0.1	-	-	-	-	-
202 / 0.1-0.3	23/01/12	F	0.1-0.3	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
202 / 0.4-0.5	23/01/12	F	0.4-0.5	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
202 / 0.9-1.0	23/01/12	F	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
202 / 2.8-3	23/01/12	N	2.8-3	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
203 / 0.3-0.5	23/01/12	F	0.3-0.5	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
203 / 0.9-1.0	23/01/12	F	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	<1	-	-	-	<0.5	NAD

Sample ID	Date Sampled	Soil Type	Depth Below Design Level	Total Metals												PAH				TRH (pre-NEPM 2013)				TRH (NEPM 2013)						BTEX				MTBE	VOC	phenol	PCB[m]	OCP[m]	CN	asbestos
				As	Be	B	Cd	Cr	Co	Cu	Pb	Mn	Hg	Ni	Zn	total[b]	BaP	BaP TEQ	naphthalene	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	TRH C_6 - C_{10}	TRH >C_{10}-C_{16}	vTPH C_6 - C_{10} less BTEX (F1)	TRH >C_{10} - C_{16} less Naphthalene (F2)	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	B	T	E	X							
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	0.1g/kg
203 / 2.7-3.0	23/01/12	N	2.7-3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
204 / 0.1-0.3	25/01/12	F	0.1-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
204 / 0.8-1.0	25/01/12	F	0.8-1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
204 / 1.0-1.2	25/01/12	F	1.0-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
204 / 2.5-3.0	25/01/12	N	2.5-3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<25	<50	<100	<100	-	-	-	-	-	-	<0.2	<0.5	<1	<3	<0.5	<1	-	-	-	-	-
F205 / 0.4	24/01/12	fibro	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
205 / 0.5-0.6	24/01/12	F	0.5-0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	150	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
205 / 0.6-0.7	24/01/12	F	0.6-0.7	-	-	-	-	-	-	-	-	-	-	-	190	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
205 / 2.6-2.9	24/01/12	N	2.6-2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
206 / 0-0.5	24/01/12	fibro	0-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Yes**[k]
206 / 0.4-0.7	24/01/12	F	0.4-0.7	9	<1	6	0.7	10	3	9	27	160	0.2	42	1,800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BD3A / 240112[a]	24/01/12	F	0.4-0.7	<4	<1	<3	<0.5	4	<1	2	2	4	<0.1	4	550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BD3B / 240112[a]	24/01/12	F	0.4-0.7	<3	<0.3	<3	<0.3	2.9	0.3	1.3	1	3.9	<0.05	2.5	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
206 / 0.8-1	24/01/12	F	0.8-1	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
206 / 1.4-1.6	24/01/12	N	1.4-1.6	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
206 / 1.8-2	24/01/12	N	1.8-2	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
207 / 0-0.3	24/01/12	F	0-0.3	-	-	-	-	-	-	-	-	-	-	-	140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
207 / 0.4-0.5	24/01/12	F	0.4-0.5	-	-	-	-	-	-	-	-	-	-	-	1,200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
207 / 0.6-0.7	24/01/12	F	0.6-0.7	-	-	-	-	-	-	-	-	-	-	-	26,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
207 / 0.95-1	24/01/12	F	0.95-1	-	-	-	-	-	-	-	-	-	-	-	6,100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
207 / 1-1.2	24/01/12	F	1-1.2	-	-	-	-	-	-	-	-	-	-	-	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
207 / 1.8-2	24/01/12	N	1.8-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
208 / 0.3-0.8	25/01/12	F	0.3-0.8	<4	<1	3	<0.5	47	6	71	63	250	0.2	95	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	NAD
208 / 1.6-1.8	25/01/12	N	1.6-1.8	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
209 / 0.1-0.3	23/01/12	F	0.1-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
209 / 0.4-0.6	23/01/12	F	0.4-0.6	<4	<1	47	<0.5	5	2	35	14	23	0.2	10	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	<0.5	NAD
210 / 0.5-0.7	24/01/12	F	0.5-0.7	<4	<1	3	<0.5	9	2	86	31	70	0.2	20	1,000	-	-	-	<1	<25	<50	550	410	<25	<50	<25	<50	1,100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	<0.1	<0.1	<0.5	-
210 / 0.9-1.0	24/01/12	F	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	140	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	NAD
211 / 0.3-0.5	25/01/12	F	0.3-0.5	5	<1	<3	0.8	21	5	200	92	140	0.6	76	1,100	-	-	-	<1	<25	<50	490	510	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	NAD
212 / 0.6-0.75	24/01/12	F	0.6-0.75	5	<1	3	0.8	22	7	210	71	260	0.7	80	620	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	NAD
212 / 0.9-1.0	24/01/12	N	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-	111	11	17.51	0.6	<25	<50	570	790	<25	<50	<25	<50	1,300	160	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
213 / 0.1-0.5	24/01/12	F	0.1-0.5	<4	<1	<3	<0.5	<1	<1	3	6	14	<0.1	<1	10	-	-	-	<1	<25	<50	370	110	<25	<50	<25	<50	480	<100	<0.2	<0.5	<1	<3	<0.5	-	-	5.3[j]	<0.1	<0.5	NAD
213 / 2.5-2.6	24/01/12	N	2.5-2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
214 / 0.2-0.3	25/01/12	F	0.2-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
214 / 0.5-0.6	25/01/12	F	0.5-0.6	-	-	-	-	-	-	-	-	-	-	-	360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214 / 0.9-1	25/01/12	F	0.9-1	<4	<1	<3	1	7	2	20	490	42	0.2	10	770	806	130	**179.8**	2.1	<25	340	**9,000**	**7,800**	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	<1	<5	<1	<1	<0.5	-
214 / 2.7-2.9	25/01/12	N	2.7-2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
215 / 0.5-0.6	25/01/12	F	0.5-0.6	-	-	-	-	-	-	-	-	-	-	-	760	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
215 / 0.9-1.0	25/01/12	N	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
215 / 1.0-1.2	25/01/12	N	1.0-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
215 / 1.7-1.9	25/01/12	N	1.7-1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
215 / 2.8-3.0	25/01/12	N	2.8-3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
216 / 0.2-0.4	25/01/12	F	0.2-0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<100	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
216 / 0.5-0.6	25/01/12	F	0.5-0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
216 / 0.7-0.8	25/01/12	F	0.7-0.8	-	-	-	-	-	-	-	-	-	-	-	690	-	-	-	-	-	50	**7,900**	**18,000**	-	94	-	-	**20,000**	**7,700**	-	-	-	-	-	-	-	-	-	-	-
216 / 0.9-1.0	25/01/12	F	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	**2,500**	**5,400**	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	<1	<5	-	-	-	-
216 / 2.4-2.6	25/01/12	N	2.4-2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
217 / 0.2-0.3	25/01/12	F	0.2-0.3	<4	<1	<3	<0.5	4	2	26	86	56	0.2	6	170	-	-	-	-	-	-	-	-	-	<50	-	-	<100	<100	-	-	-	-	-	-	-	-	-	-	-

Sample ID	Date Sampled	Soil Type	Depth Below Design Level	Total Metals												PAH				TRH (pre-NEPM 2013)				TRH (NEPM 2013)						BTEX				MTBE	VOC	phenol	PCB[m]	OCP[m]	CN	asbestos
				As	Be	B	Cd	Cr	Co	Cu	Pb	Mn	Hg	Ni	Zn	total[b]	BaP	BaP TEQ	naphthalene	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	TRH C_6 - C_{10}	TRH >C_{10}-C_{16}	vTPH C_6 - C_{10} less BTEX (F1)	TRH >C_{10} - C_{16} less Naphthalene (F2)	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	B	T	E	X							
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	0.1g/kg
217 / 0.4-0.6	25/01/12	F	0.4-0.6	-	-	-	-	-	-	-	-	-	-	-	490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
BD4A / 250112[a]	25/01/12	F	0.4-0.6	-	-	-	-	-	-	-	-	-	-	-	750	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
BD4B / 250112[a]	25/01/12	F	0.4-0.6	-	-	-	-	-	-	-	-	-	-	-	700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Yes**[c]
217 / 0.9-1.0	25/01/12	N	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	470	810	<25	<50	<25	<50	1,200	280	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
217 / 1.7-1.9	25/01/12	N	1.7-1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	140	<25	<50	<25	<50	180	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
217 / 2.8-2.9	25/01/12	N	2.8-2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
218 / 0.2-0.4	23/01/12	F	0.2-0.4	-	-	-	-	-	-	-	-	-	-	-	99	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	<1	<5	-	-	<0.5	-
218 / 0.5-0.7	23/01/12	F	0.5-0.7	-	-	-	-	-	-	-	-	-	-	-	660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
218 / 1.2-1.4	23/01/12	F	1.2-1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<100	<100	-	<50	-	<50	<100	<100	-	-	-	-	-	-	-	-	-	-	-	-
219 / 0.1-0.4	23/01/12	F	0.1-0.4	-	-	-	-	-	-	-	-	-	-	-	-	13	<0.5	<PQL	13	<25	**7,900**	**5,300**	**5,400**	230	-	230	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
219 / 0.4-0.6	23/01/12	F	0.4-0.6	-	-	-	-	-	-	-	-	-	-	-	11,000	-	-	-	<1	<25	840	1,200	1,000	47	-	47	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
219 / 1.0-1.4	23/01/12	F	1.0-1.4	-	-	-	-	-	-	-	-	-	-	-	5,300	0.1	<0.05	<PQL	0.1	<25	**2,100**	1,900	2,000	53	-	53	-	-	-	<0.2	<0.5	<1	<3	<0.5	<1	<5	-	-	-	NAD
219 / 1.4-1.6	23/01/12	N	1.4-1.6	-	-	-	-	-	-	-	-	-	-	-	120	-	-	-	-	-	<50	<100	<100	-	<50	-	<50	<100	<100	-	-	-	-	-	-	-	-	-	-	-	-
219 / 3.4-3.6	23/01/12	N	3.4-3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
220 / 0.2-0.4	23/01/12	F	0.2-0.4	<4	<1	30	<0.5	6	4	25	34	130	0.1	31	67	11	<0.5	<PQL	11	<25	**4,700**	2,300	1,900	40	-	40	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	<0.5	-
BD2A / 230112[a]	23/01/12	F	0.2-0.4	<4	<1	18	0.6	7	4	64	40	180	0.1	21	83	20	<0.5	<PQL	20	<25	**6,800**	3,200	2,700	-	-	-	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	<0.5	-
BD2B / 230112[a]	23/01/12	F	0.2-0.4	<3	<0.3	16	0.5	4.5	2.9	17	21	130	0.08	22	41	17	<0.1	-	-	<20	**9,500**	**3,600**	1,700	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.3	-	-	-	-	0.2	-
220 / 0.6-0.7	23/01/12	F	0.6-0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
220 / 0.9-1.0	23/01/12	F	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	1,900	-	-	-	<1	<25	<50	<100	110	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	NAD
220 / 1.1-1.3	23/01/12	N	1.1-1.3	-	-	-	-	-	-	-	-	-	-	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220 / 1.6-2.0	23/01/12	N	1.6-2.0	-	-	-	-	-	-	-	-	-	-	-	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220 / 2.4-2.6	23/01/12	N	2.4-2.6	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220 / 3.4-3.6	23/01/12	N	3.4-3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
221 / 0.8-1	23/01/12	F	0.8-1	-	-	-	-	-	-	-	-	-	-	-	63	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	NAD
221 / 1.5-1.8	23/01/12	N	1.5-1.8	-	-	-	-	-	-	-	-	-	-	-	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
221 / 1.9-2.5	23/01/12	N	1.9-2.5	-	-	-	-	-	-	-	-	-	-	-	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
221 / 2.6-3	23/01/12	N	2.6-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
222 / 0.1-0.3	23/01/12	F	0.1-0.3	4	<1	5	0.6	11	3	100	26	220	0.3	17	290	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
222 / 0.5-0.6	23/01/12	F	0.5-0.6	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
222 / 1.4-1.6	23/01/12	F	1.4-1.6	-	-	-	-	-	-	-	-	-	-	-	4,600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
222 / 2.8-3.0	23/01/12	N	2.8-3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
223 / 0.4-0.6	23/01/12	F	0.4-0.6	-	-	-	-	-	-	-	-	-	-	-	13	-	-	-	<1	<25	<50	<100	<100	<25	-	<25	-	-	-	<0.2	<0.5	<1	<3	<0.5	<1	-	-	-	<0.5	-
223 / 0.7-1.0	23/01/12	F	0.7-1.0	12	1	16	3	150	6	1500	340	200	1.6	430	5,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD
223 / 1.3-1.4	23/01/12	F	1.3-1.4	-	-	-	-	-	-	-	-	-	-	-	250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
223 / 1.4-1.6	23/01/12	F	1.4-1.6	-	-	-	-	-	-	-	-	-	-	-	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
223 / 1.7-2.0	23/01/12	N	1.7-2.0	-	-	-	-	-	-	-	-	-	-	-	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LNAPL Delineation Assessment [DP (2013)]																																								
301 / 1.0-1.2	14/12/12	N	1.0-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
302 / 0.9-1.0	13/12/12	N	0.9-1.0	7	-	-	<0.5	3	-	11	28	-	0.3	8	300	<0.1	<0.05	<0.5	<0.1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
302 / 1.0-1.3	13/12/12	N	1.0-1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
302 / 2.9-3.0	13/12/12	N	2.9-3.0	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.05	<0.5	<0.1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
302 / 3.2-3.5	13/12/12	N	3.2-3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	<1	-	-	-	-	-
303 / 0.9-1.0	13/12/12	N	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-	1.37	0.17	<0.5	0.2	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
303 / 1.0-2.0	13/12/12	N	1.0-2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	560	220	280	<25	470	<25	470	350	120	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
303 / 2.1-2.3	13/12/12	N	2.1-2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	<25	610	260	400	240	510	230	500	460	200	<0.2	<0.5	<1	7	<0.5	-	-	-	-	-	-
304 / 0.95-1.0	13/12/12	N	0.95-1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
304 / 1.1-1.3	13/12/12	N	1.1-1.3	5	-	-	<0.5	3	-	2	18	-	<0.1	2	75	<0.1	<0.05	<0.5	<0.1	<25	<50	<100	100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
BD2A / 131212[a]	13/12/12	N	1.1-1.3	8	-	-	<0.5	3	-	2	27	-	<0.1	3	100	<0.1	<0.05	<0.5	<0.1	<25	<50	<100	110	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
BD2B / 131212[a]	13/12/12	N	1.1-1.3	6	-	-	<0.3	3	-	1.8	18	-	<0.05	1.8	94	<0.1	<0.1	<0.5	<0.1	<20	<20	<45	<45	-	<100	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	-	-	-	-	-	-	-
304 / 3.4-3.6	13/12/12	N	3.4-3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	<1	-	-	-	-	-
305 / 0.5-0.7	14/12/12	F	0.5-0.7	<4	-	-	1.7	5	-	11	27	-	0.1	8	110	<0.1	<0.05	<0.5	<0.1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
305 / 0.9-1.0	14/12/12	N	0.9-1.0	-	-	-	-	-	-	-	-	-	-	-	-	4.5	0.6	1	<0.1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-

Sample ID	Date Sampled	Soil Type	Depth Below Design Level	Total Metals												PAH				TRH (pre-NEPM 2013)				TRH (NEPM 2013)						BTEX				MTBE	VOC	phenol	PCB[m]	OCP[m]	CN	asbestos
				As	Be	B	Cd	Cr	Co	Cu	Pb	Mn	Hg	Ni	Zn	total[b]	BaP	BaP TEQ	naphthalene	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	TRH C_6 - C_{10}	TRH >C_{10}-C_{16}	vTPH C_6 - C_{10} less BTEX (F1)	TRH >C_{10} - C_{16} less Naphthalene (F2)	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	B	T	E	X							
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	0.1g/kg
306 / 1.0-1.2	14/12/12	N	1.0-1.2	<4	-	-	<0.5	<1	-	<1	3	-	<0.1	1	63	<0.1	<0.05	<0.5	<0.1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
307 / 0.8-1	17/12/12	F	0.8-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
307 / 1.1-1.3	17/12/12	N	1.1-1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
308 / 0.3-0.5	17/12/12	F	0.3-0.5	5	-	-	1.1	62	-	2100	89	-	<0.1	220	29,000	<0.1	<0.05	<0.5	<0.1	<25	<50	220	<100	<25	<50	<25	<50	270	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
308 / 0.8-1	17/12/12	F	0.8-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	190	<25	<50	<25	<50	210	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
308 / 1.2-1.3	17/12/12	N	1.2-1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<25	<50	<100	<100	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.5	-	-	-	-	-	-
Summary Statistics																																								
No. Samples Analysed (incl. replicates)				53	16	16	53	53	16	53	53	16	53	53	87	40	40	17	66	93	97			65	42	65	65	65	65	93	93	93	93	68	19	12	13	13	12	33
Minimum (incl. replicates)				<4	<1	<3	<0.5	<1	<1	<0.5	<2	3.9	<0.05	0.2	5	<PQL	<0.05	<PQL	<0.1	<20	<120			<25	<50	<25	<50	<100	<100	<0.1	<0.1	<0.1	<0.3	<0.5	<0.1	<0.50	<0.1	<0.1	<0.5	-
Maximum (incl. replicates)				**13**	**1**	**47**	**7**	**160**	**7**	**2,555**	**490**	**260**	**1.6**	**1,416**	**58,200**	**806**	**130**	**179.8**	**20**	**<25**	**25,950**			**240**	**510**	**230**	**500**	**20,000**	**7,700**	**1.1**	**<0.5**	**<1**	**7**	**<0.5**	**<1**	**0.5**	**5.3**	**<1**	**0.2**	**-**
No. Results >PQL (incl. replicates)				20	1	10	18	51	14	51	50	16	33	52	87	16	10	3	8	0	25			5	3	5	2	12	5	1	0	0	1	0	0	1	1	0	1	6
Average (of detectable primary samples)				7	1	14	1.5	20	4	239	82	130	0.3	96	2604	78	15	66	4.7	<PQL	4,255			122	358	120	485	2153.33	1692	1.1	<PQL	<PQL	7	<PQL	<PQL	0.5	5.3	<PQL	<PQL	-
SOIL ASSESSMENT CRITERIA[3]																																								
End Site Users & Construction Workers																																								
HILs Commercial/Industrial				3,000	500	300,000	900	3,600[d]	4,000	240,000	1,500	60,000	730	6,000	400,000	4,000	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	240,000	7	-[n]	1,500	-
HSL D - Direct Contact	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11,000	-	-	-	-	-	-	26,000	20,000	27,000	38,000	430	99,000	27,000	81,000	-	-	-	-	-	-	-
Inhalation HSL D	Sand	0m to <1m		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	260	NL	-	-	3	NL	NL	230	-	-	-	-	-	-	-
Inhalation HSL D	Sand	1m to <2m		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	370	NL	-	-	3	NL	NL	NL	-	-	-	-	-	-	-
Inhalation HSL D	Sand	2m to 4m		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	630	NL	-	-	3	NL	NL	NL	-	-	-	-	-	-	-
Inhalation HSL D	Sand	4m+		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	NL	NL	-	-	3	NL	NL	NL	-	-	-	-	-	-	-
Management Limit	Coarse	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	700	1,000	-	-	3,500	10,000	-	-	-	-	-	-	-	-	-	-	-
Intrusive Maintenance Workers Only																																								
HSL D - Direct Contact	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29,000	-	-	-	-	-	-	82,000	62,000	85,000	120,000	1,100	120,000	85,000	130,000	-	-	-	-	-	-	-
Inhalation HSL	Sand	0m to <2m		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	NL	NL	-	-	77	NL	NL	NL	-	-	-	-	-	-	-
Inhalation HSL	Sand	2m to 4m		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	NL	NL	-	-	160	NL	NL	NL	-	-	-	-	-	-	-
Inhalation HSL	Sand	4m+		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	NL	NL	-	-	NL	NL	NL	NL	-	-	-	-	-	-	-
Construction Workers Only																																								
Direct Contact HSL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11,000	-	-	-	-	-	-	26,000	20,000	27,000	38,000	430	99,000	27,000	81,000	-	-	-	-	-	-	-

Notes

a	QA/QC replicate/triplicate of sample listed directly above
b	Where results are above practical quantitation limit (PQL) sum of all results given, when below PQL results quoted as <PQL of majority of individual analytes
c	NSW DEC Contaminated Sites: *Guidelines for the NSW Site Auditors Scheme 2nd edition, 2006*. Health-based guidelines for commercial or industrial (Column 4)
d	Guideline concentrations are for Cr (VI). Laboratory results are for total chromium, however all chromium is assumed to exist in the stable Cr (III) oxidation state, as Cr (VI) is generally too reactive and unstable in normal environmental conditions
e	NSW EPA (1994) *Contaminated Sites Guidelines for Assessing Service Station Sites* threshold concentrations for sensitive land use
f	Toluene thresholds given in the order: human health and ecological based protection level/protection of terrestrial organisms in soil
g	Ethyl benzene and total xylene thresholds given in order: human health/protection of terrestrial organisms in soil
h	OCP thresholds given in order: aldrin + dieldrin/ chlordane/ DDT+DDD+DDE/ heptachlor
i	Refer to report body for full asbestos guidance
j	Detected as arochlor 1254
k	Chrysotile, amosite and crocidolite asbestos detected in fibre cement
l	asbestos fibres detected >0.01%
m	Cyanide SAC quoted as complex cyanides/ free cyanides (laboratory results are total cyanide)
n	Various, not included as all results <PQL
-	not analysed/ not defined/ not applicable
Bold	exceedance of SAC
Bold	hotspot relative to SAC (i.e. more than 2.5 times SAC)

Acronyms

F	filling soil	B	boron	CN	cyanide (total)
N	natural soil	Co	cobalt		
As	arsenic	Mn	manganese		
Cd	cadmium	PAH	polycyclic aromatic hydrocarbons		
Cr	chromium (total)	BaP	benzo(a)pyrene		
Cu	copper	TRH	total recoverable hydrocarbons, including total petroleum hydrocarbons (TPH)		
Pb	lead	BTEX	benzene, toluene, ethyl benzene, total xylenes		
Hg	mercury	MTBE	Methyl tert-butyl Ether		
Ni	nickel	VOC	volatile organic compounds		
Zn	zinc	PCB	polychlorinated biphenyls		
Be	beryllium	OCP	organochlorine pesticides		

Douglas Partners
Geotechnics | Environment | Groundwater

Table C2 – Summary of Laboratory Results for Groundwater - Potential Contaminants

Sample ID	Date	Hardness	Heavy Metals (total dissolved)												CN	PAH										TRH				TRH (NEPM 2013)						BTEX				MTBE	VOC					phenol	PCB [b]		OCP [b]		OPP [b]	NH3
			As	Be	B	Cd	Cr	Co	Cu	Pb	Mn	Hg	Ni	Zn		Naphthalene	BaP	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	other PAH [a]	C6-C9	C10-C14	C15-C28	C29-C36	TRH C_6 - C_{10}	TRH $>C_{10}$ - C_{16}	vTPH C_6 - C_{10} less BTEX (F1)	TRH $>C_{10}$ - C_{16} less Naphthalene (F2)	TRH $>C_{16}$ - C_{34}	TRH $>C_{34}$ - C_{40}	Benzene	Toluene	Ethyl benzene	Xylenes		cis-1,2-DCE	TCE	CB	other VOC [b]		Aroclor 1254	other PCB	HCB	other OCP [b]		
		mgCaCO3/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
Phase 2 Contamination Assessment [DP (2004)]																																																			
GW103	Jul-04	110	3	-	-	<0.2	40	-	2	1	-	0.1	41	5	-	<PQL	<PQL	<PQL	<PQL	<0.5	<PQL	<PQL	<PQL	<PQL	<40	<100	<200	<200	-	-	-	-	-	-	<1	2	<1	<3	-	0.6	<0.50	-	0.6	-	-	-	-	-	-	-
GW110	Jul-04	99	2	-	-	<0.2	10	-	9	8	-	<0.1	57	7,500	-	<PQL	<PQL	<PQL	<PQL	1	<PQL	<PQL	<PQL	<PQL	150	520	1,000	<200	-	-	-	-	-	-	9	<1	<1	<3	-	17	4.9	-	4.8	-	-	-	-	-	-	-
GW121	Jul-04	110	2	-	-	<0.2	2	-	1	<1	-	<0.1	11	540	-	<PQL	<PQL	<PQL	<PQL	<0.5	<PQL	<PQL	<PQL	<PQL	<40	<100	<200	<200	-	-	-	-	-	-	<1	<1	<1	<3	-	0.9	<0.50	-	2	-	-	-	-	-	-	-
GWZ1	Jul-04	-	3	-	-	<0.2	2	-	1	<1	-	<0.1	12	550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Supplementary Contamination Assessment [DP (2012)]																																																			
GW201/080212	8/2/12	130	4	<0.5	70	<0.1	<1	<1	2	<1	43	0.06	2	37	<0.004	<0.1	<0.1	0.2	0.1	<0.1	<0.1	0.5	0.5	<0.1	22	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	2	2	<1	<10/<1	<0.05	0.02	<0.01	<0.001	<0.001/ <0.005	<0.01	0.18
GW202/080212	8/2/12	170	2	<0.5	88	<0.1	1	<1	<1	<1	44	0.08	1	26	-	-	-	-	-	-	-	-	-	-	<10	<50	440	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
GW206/080212	9/2/12	160	2	<0.5	120	<0.1	1	1	<1	<1	200	<0.05	6	47	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	2	<1	2	<10/<1	-	-	-	-	-	-	1.4
GW209/080212	8/2/12	180	3	<0.5	200	<0.1	<1	<1	<1	<1	180	<0.05	<1	<1	<0.004	<0.1	<0.1	0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<10	<50	660	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	3	<1	<1	<10/<1	<0.05	<0.01	<0.01	0.003	<0.001/ <0.005	<0.01	0.78
GWBD1A/080212[a]	8/2/12	180	3	<0.5	210	<0.1	<1	<1	<1	<1	180	0.06	<1	1	-	-	-	-	-	-	-	-	-	-	<10	<50	500	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
GWBD1B/080212[a]	8/2/12	190	<50	<5	190	<5	<5	<5	<10	<20	170	<0.1	<10	<10	-	-	-	-	-	-	-	-	-	-	<40	<100	<200	<200	-	-	-	-	-	-	<0.5	<0.5	<0.5	<1.5	<0.5	-	-	-	-	-	-	-	-	-	-	-
GW213/090212	9/2/12	97	4	<0.5	140	<0.1	1	<1	<1	<1	300	<0.05	3	11	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	2	<1	<1	<10/<1	-	-	-	-	-	-	1.9
GW216/090212	9/2/12	190	13	<0.5	180	<0.1	<1	3	<1	<1	420	<0.05	9	130	<0.004	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<10	140	890	210	-	-	-	-	-	-	<1	<1	<1	<3	<1	2	1	<1	<10/<1	<0.05	<0.01	<0.01	<0.001	<0.001/ <0.005	<0.01	2.4
GW220/080212	8/2/12	130	4	<0.5	310	<0.1	3	2	2	<1	150	<0.05	13	80	<0.004	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	370	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	<1	<1	<1	<10/<1	<0.05	<0.01	<0.01	<0.001	<0.001/ <0.005	<0.01	3.6
GW223/080212	8/2/12	170	<1	<0.5	320	<0.1	2	<1	<1	<1	160	<0.05	2	7	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
GW110/270212	27/2/12	-	-	-	-	-	-	-	-	-	-	-	-	2,100	-	-	-	-	-	-	-	-	-	-	14	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
LNAPL Delineation Assessment [DP (2013)]																																																			
GW213	18/1/13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	<10	<50	<100	<100	<10	<50	<10	<50	<100	<100	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
GW216	21/1/13	110	16	-	-	<0.1	<1	-	<1	<1	-	<0.05	7	180	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	1,300	2,800 [aa]	<10	<50	<10	<50	3,300	1,800	<1	<1	<1	<3	<1	-	-	-	-	-	0.06	<0.01	-	-	-	-
GW301	18/1/13	160	17	-	-	<0.1	<1	-	<1	<1	-	<0.05	1	10	-	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	13	<50	<100	<100	32	<50	28	<50	110	<100	<1	<1	<1	4	<1	-	-	-	-	-	-	-	-	-	-	-
GW302	18/1/13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	16	60	<100	<100	58	61	50	61	<100	<100	<1	<1	<1	8	<1	-	-	-	-	-	-	-	-	-	-	-
BD1A/180113	18/1/13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	14	<50	<100	<100	53	56	45	56	<100	<100	<1	<1	<1	7	<1	-	-	-	-	-	-	-	-	-	-	-
GWBD1/180113	18/1/13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	42	<50	<200	<200	-	-	-	-	-	-	<0.5	<0.5	<0.5	3.7	-	-	-	-	-	-	-	-	-	-	-	-
GW303	21/1/13	46	2	-	-	<0.1	<1	-	<1	<1	-	<0.05	1	990	-	17	<0.1	0.3	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	81	490	<100	<100	550	300	460	270	<100	<100	<1	5	5	77	<1	-	-	-	-	-	<0.01	<0.01	-	-	-	-
GW304	21/1/13	130	4	-	-	<0.1	<1	-	3	<1	-	<0.05	7	340	-	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<100	<100	<10	<50	<10	<50	<100	<100	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
GW305	21/1/13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	<10	<50	<100	<100	<10	<50	<10	<50	<100	<100	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
GW306	18/1/13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	<10	<50	<100	<100	<10	<50	<10	<50	<100	<100	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
GW307	17/1/13	110	3	-	-	<0.1	<1	-	<1	<1	-	<0.05	<1	12	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<10	<50	<100	<100	<10	<50	<10	<50	<100	<100	<1	2	<1	<3	<1	-	-	-	-	-	<0.01	<0.01	-	-	-	-
GW308	17/1/13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	<10	<50	<100	<100	<10	<50	<10	<50	<100	<100	<1	<1	<1	<3	<1	-	-	-	-	-	-	-	-	-	-	-
Additional Investigation by Veolia Environmental Services																																																			
BTT-MW202	17/7/13	-	-	-	-	-	-	-	-	-	-	-	-	31	-	<5	-	-	-	-	-	-	-	-	<20	<50	190	<50	<20	<100	<20	<100	150	<100	<1	<2	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-
BTT-MW216	17/7/13	-	-	-	-	-	-	-	-	-	-	-	-	740	-	<5	-	-	-	-	-	-	-	-	<20	370	530	180	<20	710	<20	710	420	130	<1	<2	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-
BTT-MW220	17/7/13	-	-	-	-	-	-	-	-	-	-	-	-	651	-	<5	-	-	-	-	-	-	-	-	<20	<50	340	110	<20	<100	<20	<100	350	<100	<1	<2	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-
BTT-MW302	17/7/13	-	-	-	-	-	-	-	-	-	-	-	-	139	-	<5	-	-	-	-	-	-	-	-	<20	<50	<100	<50	<20	<100	<20	<100	<100	<100	<1	<2	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-
BTT-MW304	17/7/13	-	-	-	-	-	-	-	-	-	-	-	-	351	-	<5	-	-	-	-	-	-	-	-	<20	<50	<100	<50	<20	<100	<20	<100	<100	<100	<1	<2	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-
BTT-MW308	17/7/13	-	-	-	-	-	-	-	-	-	-	-	-	463	-	<5	-	-	-	-	-	-	-	-	<20	<50	180	130	<20	<100	<20	<100	240	<100	<1	<2	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-
Groundwater Assessment Criteria (GAC)[c]																																																			
GILs	(marine - high reliability [e])	-	-	-	0.7	27/4.4 [f]	1	1.3	4.4	-	0.1	7	15	4	50	-	-	-	-	-	-	-	-	-	- [k]	- [k]	- [k]	- [k]	-	-	-	-	-	-	500	-	-	-	- [L]	400	-	-	-	- [L]	-	5.63 [m]
HSL	(project specific [f])	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NL	NL	-	-	NL	NL	NL	NL	-	-	-	-	-	-	-	-	-	-	-	-
ADWG [g]		10	60	4,000	2	50 [f]	-	2,000	10	500	1	20	-	80	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	800	300	600	-	60	-	300	- [L]	-	-	-	-	- [L]	- [L]	0.5 [m]
Reference Levels																																																		
marine - low reliability [h]		4.5/2.3 [d]	-	5,100 [n]	-	-	-	-	-	80	-	-	-	-	-	-	-	-	-	2	0.4	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	180	5	350/200/ 75 [o]	-	-	330	55	-	-	0.01	-	0.05	-	-	-
ADWG (aesthetic based) [i]		-	-	-	-	-	-	-	-	-	-	-	-	3,000 [w]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other		-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.14 [r]	0.0029 [r]	400 [r]	220 [r]	-	1,300 [r]	630 [r]	87 [r]	-	150 [p]	600 [p]		-	-	150 [p]	600 [p]			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes

a	QA/QC replicate/triplicate of sample listed directly above
b	Where results are above practical quantitation limit (PQL) sum of all results given, when below PQL results quoted as <PQL of majority of individual analytes
c	From NEPM(2013), refer to report body
d	Trigger level for As (V) / As (III). Marine low reliability value for As (III) is an Environmental Concern Level (ECL) based on limited data
e	NEPM (2013), sourced from ANZECC (2000) Guidelines for the protection of aquatic ecosystems – Marine Waters – 95% Level of Protection (LOP)
f	Determined in accordance with NEPM(2013), refer to Appendix D for more calculation
g	NEPM (2013) Sourced from NHMRC (2011) National Water Quality Management Strategy *Australian Drinking Water Guidelines* [ADWG]. health-based guideline
h	ANZECC (2000). Low reliability trigger value for marine water
i	NHMRC (2011) National Water Quality Management Strategy Australian Drinking Water Guidelines [ADWG]. Aesthetic based threshold, no health based guideline available
j	GIL for Cr (III) is 24µg/L, for Cr (VI) is 4.4µg/L. ADWG for Cr(VI) is 50µg/L
k	No threshold set. EPA advice indicates component compounds should be assessed were detectable TPH (detected as part of the TRH analysis) recorded
L	Various, not defined as all results <PQL
m	Trigger value for a pH of 6.3, average of recorded pH results
n	ANZECC (2000) recommends the established background level in seawater (5,100µg/L) be adopted due to insufficient data
o	Xylene thresholds given in order o-xylene/p-xylene/m-xylene
p	The Australian Government Airport (Environment Protection) Regulations (1997). Schedule 2 Water Pollution Accepted Limits: Table 1.03 – Accepted limits of contamination.
r	The US EPA Regional Screening Levels for tapwater, updated November 2011. Accessed at http://www.epa.gov/region9/superfund/prg/
-	not analysed/ not defined/ not applicable
Bold	Value detected above laboratory PQL
Bold	Value detected above GAC

Acronyms

As	arsenic, dissolved	BaP	benzo(a)pyrene
Be	beryllium, dissolved	TRH	total recoverable hydrocarbons, including total petroleum hydrocarbons (TPH)
B	boron, dissolved	BTEX	benzene, toluene, ethyl benzene, total xylenes
Cd	cadmium, dissolved	MTBE	Methyl tert-butyl Ether
Cr	chromium (total), dissolved	VOC	volatile organic compounds (excluding BTEX)
Co	cobalt, dissolved	Cis-1,2-DC	Cis-1,2-dichloroethene
Cu	copper, dissolved	TCE	Trichloroethene
Pb	lead, dissolved	CB	Chlorobenzene
Mn	manganese, dissolved	PCB	polychlorinated biphenyls
Hg	mercury, dissolved	OCP	organochlorine pesticides
Ni	nickel, dissolved	HCB	hexachlorobenzene
Zn	zinc, dissolved	OPP	organophosphorus pesticides
CN	Cyanide	NH3	ammonia
PAH	polycyclic aromatic hydrocarbons		

Appendix D

Supporting Information for RAC

RISK / HEALTH-BASED CRITERIA MODEL
GROUNDWATER SOURCE

INPUT SCREEN

Enter number of simulation columns (1-20)				
12				
SIMULATION NO.	1	2	3	4
CALCULATION TYPE				
0-Forward risk, 1-Health-based criteria	1	1	1	1
Select default scenario parameters	HSL-D	HSL-D	HSL-D	HSL-D
Select default chemical parameters	Toluene	Ethylbenzene	Xylenes	Naphthalene
Comments				
Groundwater source concentration (µg/L)				
CHEMICAL DATA				
PHYSICAL PROPERTIES				
Molecular weight (g/mol)	92.14	106.17	106.17	128.18
Diffusivity in air (cm^2/s)	0.087	0.075	0.0714	0.059
Diffusivity in water (cm^2/s)	8.60E-06	7.80E-06	9.34E-06	7.50E-06
Henry's Law Constant at Ref Temp ($atm\text{-}m^3/mol$)	6.610E-03	7.856E-03	6.610E-03	4.390E-04
Reference temperature (^oC)	25	25	25	25
Organic carbon partition coefficient (Koc) (cm^3/g)	2.69E+02	5.13E+02	4.47E+02	1.82E+03
Pure component solubility in water (mg/L)	5.26E+02	1.69E+02	1.98E+02	3.10E+01
Solubility Adjustment for Mixtures				
0-Mass fraction, 1-Mole fraction calculation	1	1	1	1
Mass or mole fraction	0.11508	0.02282	0.10458	0.00546
Fuel/TPH average molecular weight (g/mol)				
Henry's Law Temperature Adjustment				
Enthalpy of vaporization at the normal boiling point (cal/mol)	7930	8501	8569.666667	10373
Normal boiling point (^oK)	383.78	409.34	413.7966667	491.14
Critical temperature (^oK)	591.79	617.2	621.1833333	748.4
TOXICOLOGICAL / EXPOSURE PROPERTIES				
0-Cancer endpoint, 1-Non-cancer endpoint	1	1	1	1
Inhalation cancer unit risk $(\mu g/m^3)^{-1}$				
Inhalation reference concentration ($\mu g/m^3$)	5000	1300	870	3
Fraction of RfC to background exposure	0	0	0	0
VAPOUR EMISSION SCENARIO PARAMETERS				
Average temperature of groundwater (^oC)	25	25	25	25
Advection depth (cm)	20	20	20	20
Number of soil texture layers	homogeneous	homogeneous	homogeneous	homogeneous
Thickness of soil stratus A (cm)	100	100	100	100
Thickness of soil stratus B (cm)	disabled	disabled	disabled	disabled
Thickness of soil stratus C (cm)	disabled	disabled	disabled	disabled
Depth of groundwater from ground surface (cm) (calculated sum of soil layer thicknesses)	100	100	100	100
Selected soil layer properties for groundwater table	Layer A	Layer A	Layer A	Layer A
Maximum capillary thickness - by layer (cm)	80	80	80	80
Capillary thickness (cm)	20	20	20	20
Stratus A Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.257	0.257	0.257	0.257
Soil water porosity (unitless)	0.13	0.13	0.13	0.13
Fraction organic carbon content	0.003	0.003	0.003	0.003
Stratus B Properties				
Default soil properties				
Soil dry bulk density (g/cm^3)	disabled	disabled	disabled	disabled
Soil air porosity (unitless)	disabled	disabled	disabled	disabled
Soil water porosity (unitless)	disabled	disabled	disabled	disabled
Fraction organic carbon content	disabled	disabled	disabled	disabled
Stratus C Properties				
Default soil properties				
Soil dry bulk density (g/cm^3)	disabled	disabled	disabled	disabled
Soil air porosity (unitless)	disabled	disabled	disabled	disabled
Soil water porosity (unitless)	disabled	disabled	disabled	disabled
Fraction organic carbon content	disabled	disabled	disabled	disabled

RISK / HEALTH-BASED CRITERIA MODEL
GROUNDWATER SOURCE

INPUT SCREEN

Enter number of simulation columns (1-20)

12

SIMULATION NO.	1	2	3	4
CALCULATION TYPE				
0-Forward risk, 1-Health-based criteria	1	1	1	1
Select default scenario parameters	HSL-D	HSL-D	HSL-D	HSL-D
Select default chemical parameters	Toluene	Ethylbenzene	Xylenes	Naphthalene
Capillary Zone Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.039	0.039	0.039	0.039
Soil water porosity (unitless)	0.348	0.348	0.348	0.348
Dirt in Cracks Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.257	0.257	0.257	0.257
Soil water porosity (unitless)	0.13	0.13	0.13	0.13
Building				
Floor length (cm)	10300	10300	10300	10300
Floor width (cm)	4700	4700	4700	4700
Foundation thickness (cm)	20	20	20	20
Enclosed space height (cm)	1300	1300	1300	1300
Air exchange rate (h^{-1})	6	6	6	6
Aerial crack fraction	0.001	0.001	0.001	0.001
Advective Transport				
0-Qs/Qb, 1-Specify Qs, 2-Pressure Diff calculate	0	0	0	0
Qsoil/Qbuilding	0.005	0.005	0.005	0.005
Average vapour flowrate into building (Qsoil) (L/min)				
Soil-building pressure differential (g/cm/s^2)				
Soil-vapour permeability in upper soil profile (kv) (cm^2)	6.0E-08	6.0E-08	6.0E-08	6.0E-08
Building Type				
0-Slab on ground or basement, 1-Crawl space	0	0	0	0
Crawl space to indoor air attenuation factor				
Vapour Degradation				
Applied attenuation factor for vapour degradation	1	1	1	1
EXPOSURE / RISK DATA				
Exposure frequency (d/yr)	240	240	240	240
Average time (cancer) (yr)	70	70	70	70
Average time (non-cancer) (yr)	30	30	30	30
Exposure duration (yr)	30	30	30	30
Exposure time (hr/d)	8	8	8	8
HEALTH BASED CRITERIA RISK TARGETS				
Target cancer risk	1.00E-05	1.00E-05	1.00E-05	1.00E-05
Target non-cancer HI	1	1	1	1
COMBINE RISK SCENARIOS				
0				

RISK / HEALTH-BASED CRITERIA MODEL
GROUNDWATER SOURCE

INPUT SCREEN

Enter number of simulation columns (1-20)				
12				
SIMULATION NO.	5	6	7	8
CALCULATION TYPE				
0-Forward risk, 1-Health-based criteria	1	1	1	1
Select default scenario parameters	HSL-D	HSL-D	HSL-D	HSL-D
Select default chemical parameters	Benzene	TPH >C6-C8 aliphatic	TPH >C8-C10 aliphatic	TPH >C10-C12 aliphatic
Comments				
Groundwater source concentration (µg/L)				
CHEMICAL DATA				
PHYSICAL PROPERTIES				
Molecular weight (g/mol)	78.11	110	130	160
Diffusivity in air (cm^2/s)	0.088	0.07	0.06	0.05
Diffusivity in water (cm^2/s)	9.80E-06	1.00E-05	8.00E-06	6.00E-06
Henry's Law Constant at Ref Temp ($atm\text{-}m^3/mol$)	5.537E-03	1.878E+00	3.902E+00	3.902E+00
Reference temperature (^oC)	25	25	25	25
Organic carbon partition coefficient (Koc) (cm^3/g)	1.66E+02	3.16E+03	3.16E+04	3.16E+05
Pure component solubility in water (mg/L)	1.75E+03	1.60E+01	6.90E-01	5.30E-02
Solubility Adjustment for Mixtures				
0-Mass fraction, 1-Mole fraction calculation	1	1	1	1
Mass or mole fraction	0.0336	0.13104	0.28	0.2058
Fuel/TPH average molecular weight (g/mol)				
Henry's Law Temperature Adjustment				
Enthalpy of vaporization at the normal boiling point (cal/mol)	7342	6895.15	8130	12260
Normal boiling point (^oK)	353.24	341.7	399	447
Critical temperature (^oK)	562.16	508	569	617
TOXICOLOGICAL / EXPOSURE PROPERTIES				
0-Cancer endpoint, 1-Non-cancer endpoint	0	1	1	1
Inhalation cancer unit risk $(\mu g/m^3)^{-1}$	6.00E-06			
Inhalation reference concentration ($\mu g/m^3$)	30	18400	1000	1000
Fraction of RfC to background exposure	0.2	0.1	0.1	0.1
VAPOUR EMISSION SCENARIO PARAMETERS				
Average temperature of groundwater (^oC)	25	25	25	25
Advection depth (cm)	20	20	20	20
Number of soil texture layers	homogeneous	homogeneous	homogeneous	homogeneous
Thickness of soil stratus A (cm)	100	100	100	100
Thickness of soil stratus B (cm)	disabled	disabled	disabled	disabled
Thickness of soil stratus C (cm)	disabled	disabled	disabled	disabled
Depth of groundwater from ground surface (cm) (calculated sum of soil layer thicknesses)	100	100	100	100
Selected soil layer properties for groundwater table	Layer A	Layer A	Layer A	Layer A
Maximum capillary thickness - by layer (cm)	80	80	80	80
Capillary thickness (cm)	20	20	20	20
Stratus A Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.257	0.257	0.257	0.257
Soil water porosity (unitless)	0.13	0.13	0.13	0.13
Fraction organic carbon content	0.003	0.003	0.003	0.003
Stratus B Properties				
Default soil properties				
Soil dry bulk density (g/cm^3)	disabled	disabled	disabled	disabled
Soil air porosity (unitless)	disabled	disabled	disabled	disabled
Soil water porosity (unitless)	disabled	disabled	disabled	disabled
Fraction organic carbon content	disabled	disabled	disabled	disabled
Stratus C Properties				
Default soil properties				
Soil dry bulk density (g/cm^3)	disabled	disabled	disabled	disabled
Soil air porosity (unitless)	disabled	disabled	disabled	disabled
Soil water porosity (unitless)	disabled	disabled	disabled	disabled
Fraction organic carbon content	disabled	disabled	disabled	disabled

RISK / HEALTH-BASED CRITERIA MODEL
GROUNDWATER SOURCE

INPUT SCREEN

Enter number of simulation columns (1-20)

12

SIMULATION NO.	5	6	7	8
CALCULATION TYPE				
0-Forward risk, 1-Health-based criteria	1	1	1	1
Select default scenario parameters	HSL-D	HSL-D	HSL-D	HSL-D
Select default chemical parameters	Benzene	TPH >C6-C8 aliphatic	TPH >C8-C10 aliphatic	TPH >C10-C12 aliphatic
Capillary Zone Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.039	0.039	0.039	0.039
Soil water porosity (unitless)	0.348	0.348	0.348	0.348
Dirt in Cracks Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.257	0.257	0.257	0.257
Soil water porosity (unitless)	0.13	0.13	0.13	0.13
Building				
Floor length (cm)	10300	10300	10300	10300
Floor width (cm)	4700	4700	4700	4700
Foundation thickness (cm)	20	20	20	20
Enclosed space height (cm)	1300	1300	1300	1300
Air exchange rate (h^{-1})	6	6	6	6
Aerial crack fraction	0.001	0.001	0.001	0.001
Advective Transport				
0-Qs/Qb, 1-Specify Qs, 2-Pressure Diff calculate	0	0	0	0
Qsoil/Qbuilding	0.005	0.005	0.005	0.005
Average vapour flowrate into building (Qsoil) (L/min)				
Soil-building pressure differential (g/cm/s^2)				
Soil-vapour permeability in upper soil profile (kv) (cm^2)	6.0E-08	6.0E-08	6.0E-08	6.0E-08
Building Type				
0-Slab on ground or basement, 1-Crawl space	0	0	0	0
Crawl space to indoor air attenuation factor				
Vapour Degradation				
Applied attenuation factor for vapour degradation	1	1	1	1
EXPOSURE / RISK DATA				
Exposure frequency (d/yr)	240	240	240	240
Average time (cancer) (yr)	70	70	70	70
Average time (non-cancer) (yr)	30	30	30	30
Exposure duration (yr)	30	30	30	30
Exposure time (hr/d)	8	8	8	8
HEALTH BASED CRITERIA RISK TARGETS				
Target cancer risk	1.00E-05	1.00E-05	1.00E-05	1.00E-05
Target non-cancer HI	1	1	1	1
COMBINE RISK SCENARIOS				

0

RISK / HEALTH-BASED CRITERIA MODEL
GROUNDWATER SOURCE

INPUT SCREEN

Enter number of simulation columns (1-20)

12

SIMULATION NO.	9	10	11	12
CALCULATION TYPE				
0-Forward risk, 1-Health-based criteria	1	1	1	1
Select default scenario parameters	HSL-D	HSL-D	HSL-D	HSL-D
Select default chemical parameters	TPH >C12-C16 aliphatic	TPH >C8-C10 aromatic	TPH >C10-C12 aromatic	TPH >C12-C16 aromatic
Comments				
Groundwater source concentration (µg/L)				
CHEMICAL DATA				
PHYSICAL PROPERTIES				
Molecular weight (g/mol)	210	120	140	150
Diffusivity in air (cm^2/s)	0.04	0.07	0.06	0.06
Diffusivity in water (cm^2/s)	5.00E-06	8.00E-06	8.00E-06	8.00E-06
Henry's Law Constant at Ref Temp ($atm\text{-}m^3/mol$)	3.902E+00	1.024E-02	8.293E-03	2.366E-03
Reference temperature (^oC)	25	25	25	25
Organic carbon partition coefficient (Koc) (cm^3/g)	5.01E+06	1.26E+03	3.16E+03	6.31E+03
Pure component solubility in water (mg/L)	3.50E-04	1.10E+02	3.00E+01	9.30E+00
Solubility Adjustment for Mixtures				
0-Mass fraction, 1-Mole fraction calculation	1	1	1	1
Mass or mole fraction	0.4732	0.06048	0.0504	0.1624
Fuel/TPH average molecular weight (g/mol)				
Henry's Law Temperature Adjustment				
Enthalpy of vaporization at the normal boiling point (cal/mol)	10400	9344.9	10373	12155
Normal boiling point (^oK)	489	440.095	491.14	550.54
Critical temperature (^oK)	658	643.21	748.4	803.15
TOXICOLOGICAL / EXPOSURE PROPERTIES				
0-Cancer endpoint, 1-Non-cancer endpoint	1	1	1	1
Inhalation cancer unit risk $(\mu g/m^3)^{-1}$				
Inhalation reference concentration ($\mu g/m^3$)	1000	200	200	200
Fraction of RfC to background exposure	0.1	0.1	0.1	0.1
VAPOUR EMISSION SCENARIO PARAMETERS				
Average temperature of groundwater (^oC)	25	25	25	25
Advection depth (cm)	20	20	20	20
Number of soil texture layers	homogeneous	homogeneous	homogeneous	homogeneous
Thickness of soil stratus A (cm)	100	100	100	100
Thickness of soil stratus B (cm)	disabled	disabled	disabled	disabled
Thickness of soil stratus C (cm)	disabled	disabled	disabled	disabled
Depth of groundwater from ground surface (cm) (calculated sum of soil layer thicknesses)	100	100	100	100
Selected soil layer properties for groundwater table	Layer A	Layer A	Layer A	Layer A
Maximum capillary thickness - by layer (cm)	80	80	80	80
Capillary thickness (cm)	20	20	20	20
Stratus A Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.257	0.257	0.257	0.257
Soil water porosity (unitless)	0.13	0.13	0.13	0.13
Fraction organic carbon content	0.003	0.003	0.003	0.003
Stratus B Properties				
Default soil properties				
Soil dry bulk density (g/cm^3)	disabled	disabled	disabled	disabled
Soil air porosity (unitless)	disabled	disabled	disabled	disabled
Soil water porosity (unitless)	disabled	disabled	disabled	disabled
Fraction organic carbon content	disabled	disabled	disabled	disabled
Stratus C Properties				
Default soil properties				
Soil dry bulk density (g/cm^3)	disabled	disabled	disabled	disabled
Soil air porosity (unitless)	disabled	disabled	disabled	disabled
Soil water porosity (unitless)	disabled	disabled	disabled	disabled
Fraction organic carbon content	disabled	disabled	disabled	disabled

RISK / HEALTH-BASED CRITERIA MODEL
GROUNDWATER SOURCE

INPUT SCREEN

Enter number of simulation columns (1-20)

12

SIMULATION NO.	9	10	11	12
CALCULATION TYPE				
0-Forward risk, 1-Health-based criteria	1	1	1	1
Select default scenario parameters	HSL-D	HSL-D	HSL-D	HSL-D
Select default chemical parameters	TPH >C12-C16 aliphatic	TPH >C8-C10 aromatic	TPH >C10-C12 aromatic	TPH >C12-C16 aromatic
Capillary Zone Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.039	0.039	0.039	0.039
Soil water porosity (unitless)	0.348	0.348	0.348	0.348
Dirt in Cracks Properties				
Default soil properties	SAND	SAND	SAND	SAND
Soil dry bulk density (g/cm^3)	1.625	1.625	1.625	1.625
Soil air porosity (unitless)	0.257	0.257	0.257	0.257
Soil water porosity (unitless)	0.13	0.13	0.13	0.13
Building				
Floor length (cm)	10300	10300	10300	10300
Floor width (cm)	4700	4700	4700	4700
Foundation thickness (cm)	20	20	20	20
Enclosed space height (cm)	1300	1300	1300	1300
Air exchange rate (h^{-1})	6	6	6	6
Aerial crack fraction	0.001	0.001	0.001	0.001
Advective Transport				
0-Qs/Qb, 1-Specify Qs, 2-Pressure Diff calculate	0	0	0	0
Qsoil/Qbuilding	0.005	0.005	0.005	0.005
Average vapour flowrate into building (Qsoil) (L/min)				
Soil-building pressure differential (g/cm/s^2)				
Soil-vapour permeability in upper soil profile (kv) (cm^2)	6.0E-08	6.0E-08	6.0E-08	6.0E-08
Building Type				
0-Slab on ground or basement, 1-Crawl space	0	0	0	0
Crawl space to indoor air attenuation factor				
Vapour Degradation				
Applied attenuation factor for vapour degradation	1	1	1	1
EXPOSURE / RISK DATA				
Exposure frequency (d/yr)	240	240	240	240
Average time (cancer) (yr)	70	70	70	70
Average time (non-cancer) (yr)	30	30	30	30
Exposure duration (yr)	30	30	30	30
Exposure time (hr/d)	8	8	8	8
HEALTH BASED CRITERIA RISK TARGETS				
Target cancer risk	1.00E-05	1.00E-05	1.00E-05	1.00E-05
Target non-cancer HI	1	1	1	1
COMBINE RISK SCENARIOS				

0

RISK / HEALTH-BASED CRITERIA MODEL
GROUNDWATER SOURCE

RESULTS SCREEN

SIMULATION NO.	1	2	3	4	5	6	7	8	9	10	11	12
VOLATILISATION FACTOR (non-capped) (µg/m^3)/(µg/L)	1.12E-04	1.10E-04	1.02E-04	3.54E-05	1.06E-04	1.68E-02	2.99E-02	2.49E-02	1.99E-02	1.27E-04	9.95E-05	5.39E-05
EFFECTIVE SOLUBILITY LIMIT (µg/L)	6.05E+04	3.86E+03	2.07E+04	1.69E+02	5.88E+04	2.10E+03	1.93E+02	1.09E+01	1.66E-01	6.65E+03	1.51E+03	1.51E+03
THEORETICAL MAXIMUM AIR CONCENTRATION (µg/m^3)	6.78E+00	4.25E-01	2.12E+00	5.99E-03	6.25E+00	3.52E+01	5.77E+00	2.71E-01	3.30E-03	8.48E-01	1.50E-01	8.14E-02
THEORETICAL MAXIMUM AIR CONCENTRATION WITH ATTENUATION (µg/m^3)	6.78E+00	4.25E-01	2.12E+00	5.99E-03	6.25E+00	3.52E+01	5.77E+00	2.71E-01	3.30E-03	8.48E-01	1.50E-01	8.14E-02
GROUNDWATER CONCENTRATION (µg/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BREATHABLE AIR CONCENTRATION - vapour non-limited (µg/m^3)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BREATHABLE AIR CONCENTRATION - vapour limited (µg/m^3)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CANCER RISK - vapour non-limited	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CANCER RISK - vapour limited	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Health-based criteria - vapour non-limited (µg/L)	NA	NA	NA	NA	1.67E+05	NA	NA	NA	NA	NA	NA	NA
Health-based criteria - vapour limited (µg/L)	NA	NA	NA	NA	NL	NA	NA	NA	NA	NA	NA	NA
NON-CANCER HAZARD INDEX - vapour non-limited	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NON-CANCER HAZARD INDEX - vapour limited	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Health-based criteria - vapour non-limited (µg/L)	2.04E+08	5.38E+07	3.88E+07	3.86E+05	NA	4.50E+06	1.38E+05	1.65E+05	2.06E+05	6.44E+06	8.25E+06	1.52E+07
Health-based criteria - vapour limited (µg/L)	NL	NL	NL	NL	NA	NL	NL	NL	NL	NL	NL	NL