INFORMATION REGARDING ENVIRONMENTAL AUDIT REPORTS

August 2007

VICTORIA'S AUDIT SYSTEM

An environmental audit system has operated in Victoria since 1989. The *Environment Protection Act 1970* (the Act) provides for the appointment by the Environment Protection Authority (EPA Victoria) of environmental auditors and the conduct of independent, high quality and rigorous environmental audits.

An environmental audit is an assessment of the condition of the environment, or the nature and extent of harm (or risk of harm) posed by an industrial process or activity, waste, substance or noise. Environmental audit reports are prepared by EPA-appointed environmental auditors who are highly qualified and skilled individuals.

Under the Act, the function of an environmental auditor is to conduct environmental audits and prepare environmental audit reports. Where an environmental audit is conducted to determine the condition of a site or its suitability for certain uses, an environmental auditor may issue either a certificate or statement of environmental audit.

A certificate indicates that the auditor is of the opinion that the site is suitable for any beneficial use defined in the Act, whilst a statement indicates that there is some restriction on the use of the site.

Any individual or organisation may engage appointed environmental auditors, who generally operate within the environmental consulting sector, to undertake environmental audits. The EPA administers the environmental audit system and ensures its ongoing integrity by assessing auditor applications and ensuring audits are independent and conducted with regard to guidelines issued by EPA.

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Environmental audit reports are stored digitally by EPA in three parts: the audit report (part A), report appendices (part B) and, where applicable, the certificate or statement of environmental audit and an executive summary (part C). A report may be in colour and black-and-white formats. Generally, only black-and-white documents are text searchable.

Report executive summaries, findings and recommendations should be read and relied upon only in the context of the document as a whole, including any appendices and, where applicable, any certificate or statement of environmental audit.

AUDIT REPORT CURRENCY

Audit reports are based on the conditions encountered and information reviewed at the time of preparation and do not represent any changes that may have occurred since the date of completion. As it is not possible for an audit to present all data that could be of interest to all readers, consideration should be made to any appendices or referenced documentation for further information.

When information regarding the condition of a site changes from that at the time an audit report is issued, or where an administrative or computation error is identified, environmental audit reports, certificates and statements may be withdrawn or amended by an environmental auditor. Users are advised to check EPA's website to ensure the currency of the audit document.

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Web: www.epa.vic.gov.au/envaudit

Email: environmental.audit@epa.vic.gov.au

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

ENVIRONMENTAL AUDIT REPORT 7-15 HORNE STREET, ELSTERNWICK, VICTORIA

EPA CARMS NUMBER: 68829-2

20 APRIL 2021
217057
VERSION 2

EXECUTIVE SUMMARY

This Environmental Audit report has been prepared in response to a request for a Certificate of Environmental Audit, consistent with Part IXD of the *Environment Protection Act 1970*. In accordance with the Environment Protection Authority of Victoria (EPA) (December 2015) Publication 1147.2 Environmental Auditor Guidelines – Provision of Environmental Audit reports, Certificates and Statements, a summary of the Environmental Audit is presented in Table 1 below.

Table 1: Summary of Audit Information

Item	Details
Auditor	Mark Stuckey
Auditor account number	101031
Auditor appointment end date	17/09/2021
Date EPA notified of audit	1/06/2017
Audit service order number	8005410
Name of person requesting audit	Tony Huang Auyin Property Development Pty Ltd Director 03 9598 1242 tony.huang@auyindevelopment.com.au
Relationship of person requesting audit to site	Owner
Date of auditor engagement	29/05/2017
Completion date of the audit	17/04/2020
Reason for audit	Planning System Environmental Audit Overlay
Audit categorisation	Risk
Environmental Segments	Air, Land, Groundwater and Surface water
If the audit was required by an EPA notice, licence or other, please provide EPA reference number	-
Current land use zoning	Commercial 1 Zone
EPA region	Southern Metro

Item	Details
Municipality	Glen Eira
Dominant – Lot on plan	Plan CP163463 (7-12 Horne Street), Lot 5 Section 1 LP1423 (13 Horne Street), Lot 6 Section 1 LP1423 (15 Horne Street)
Additional – Lot on plan(s)	-
Site/premises name	-
Building/complex sub-unit No.	-
Street/Lot – Lower No.	7
Street/Lot – Upper No.	15
Street Name	Horne
Street type (road, court, etc)	Street
Street suffix (North, South etc)	-
Suburb	Elsternwick
Postcode	3185
GIS coordinate of site centroid **Latitude (GDA94)** **Longitude (GDA94)**	 -37.88473 144.99973
Site area (hectares)	Approx. 0.1239
Plan of site/premises showing the audit site boundary attached	Yes
Plan of site/premises showing the audit site boundary attached in a spatial data format	No
Members and categories of support team utilised	None
Further work or requirements	None
Nature and extent of continuing risk	Risks in soil include elevated metals above ecological criteria, and metals and benzo(a)pyrene above residential and open space criteria, which will be managed by a barrier to remove direct contact with soil across the site. Risks in groundwater include elevated nitrate, PCE and metals (Cu, Zn, Fe, Mn) above relevant criteria for the protection of beneficial uses associated with water dependant ecosystems and species, agriculture and irrigation (irrigation and stock watering), water-based recreation (primary contact recreation) and industrial and commercial use, which will be managed by testing before use and review of results by a suitably qualified professional to confirm its suitability for the proposed use.

Item	Details
Outcome of the audit	Statement of Environmental Audit
Has EPA determined CUTEP at this site	No
Has the Auditor determined CUTEP at this site	Yes
Has a GQRUZ been identified at the site/beyond the site by EPA	GQRUZ recommended
Does NAPL remain at the site	No

Please indicate which of the protected beneficial uses of groundwater are precluded due to pollution

(NA = Not Applicable)

(n = naturally occurring)

(b = background/ regional pollution)

Beneficial Use	Precluded
Water dependent ecosystems and species	Yes (n, b)
Potable water (desirable)	NA
Potable water (acceptable)	NA
Mineral water	NA
Agriculture and irrigation (irrigation)	Yes (n, b)
Agriculture and irrigation (Stock watering)	Yes (n, b)
Water based recreation (primary contact recreation)	Yes (n, b)
Industrial and commercial	Yes (n, b)
Buildings and structures	No
Traditional Owner cultural values	Yes (n, b)
Cultural and spiritual values	Yes (n, b)
Geothermal properties	NA

Table 2: Physical Site Information

Information Component	Site Specific Information
Historical land use	Various commercial uses including furniture warehouse, hardware store, office space, laundry.
Current land use	Rehabilitation centre (7-12 Horne Street), vacant office space currently undergoing renovations (13 Horne Street) and vacant warehouse (15 Horne Street)

Information Component	Site Specific Information
Proposed future land use	Mixed use development – commercial and high-density residential (with two-level basement)
Surrounding land use - north	Commercial premises (including restaurants and interior design architects) and Glen Huntly Road
Surrounding land use - south	Commercial premises (including hair salon, gymnasium and lawyers) and Rusden Street
Surrounding land use – east	Horne Street, residential apartments, multi-level carpark, commercial premises, railway line and Elsternwick train station
Surrounding land use – west	Unnamed laneway, residential housing and Ross Street
Proposed land use zoning	Mixed use development – commercial and high-density residential
Nearest surface water receptor – name	Elster Creek
Nearest surface water receptor – direction	Approximately 450 m south-west
Likely point of groundwater discharge	Elster Creek (south-west of the site)
Site aquifer formation	Brighton Group Aquifer
Groundwater flow direction	West-south-west
Groundwater TDS range (mg/L)	1,500 to 2,100 mg/L
Groundwater segment	B
Are there multiple aquifers impacted by pollution at the site	No
Perched groundwater depth – upper (mbgl)	-
Perched groundwater depth – lower (mbgl)	-
Regional groundwater depth - upper (mbgl)	~9
Regional groundwater depth - lower (mbgl)	~18
Number of bores within 2 km	253
Closest extractive industry use (distance in m)	400 m (southeast)
Zone of groundwater plume influence (m from site boundary)	NA
Year groundwater last monitored	2019

Information Component	Site Specific Information
Have you attached electronic copies of current groundwater analytical results presented as a summary table	Yes

This summary must be read in conjunction with the full Environmental Audit Report and the Statement of Environmental Audit that has been issued for the site. The Environmental Audit Report provides more data and discussions that are not in the above summary table for reasons of space and clarity. All owners of the site, all occupiers and those made responsible for the management of the site (including any future sub divisions) should be provided with a copy of this Statement of Environmental Audit.

The Statement of Environmental Audit is issued based on the site conditions at the time of issue. The Environmental Auditor cannot control future activities that may result in contamination of the site.

Table 3: Distribution List

Number of copies	Date	Version	Document type	Distribution to
1	17/04/2020	1	Electronic (EPA format)	Auyin Property Development Pty Ltd
1	17/04/2020	1	Electronic (EPA format)	Manager Environmental Audit – EPA
1	17/04/2020	1	Electronic (EPA format)	CEO – Glen Eira Council
	17/04/2020	1	Paper Copy	
1	17/04/2020	1	Electronic	Environmental Earth Sciences
1	20/04/2021	2	Electronic (EPA format)	Auyin Property Development Pty Ltd
1	20/04/2021	2	Electronic (EPA format)	Manager Environmental Audit – EPA
1	20/04/2021	2	Electronic (EPA format)	CEO – Glen Eira Council
	20/04/2021	2	Paper Copy	
1	20/04/2021	2	Electronic	Environmental Earth Sciences

ENVIRONMENT PROTECTION ACT 1970
STATEMENT OF ENVIRONMENTAL AUDIT

I, Mark Stuckey of Environmental Earth Sciences, a person appointed by the Environment Protection Authority ('the Authority') under the *Environment Protection Act 1970* ('the Act') as an environmental auditor for the purposes of the Act; having

1. been requested by Auyin Property Development Pty Ltd to issue a certificate of environmental audit in relation to the site located at 7-15 Horne Street, Elsternwick, Victoria ('the site') owned by Auyin Property Development Pty Ltd;
2. had regard to, among other things:
   (i) guidelines issued by the Authority for the purposes of Part IXD of the Act;
   (ii) the beneficial uses that may be made of the site; and
   (iii) relevant State environment protection policies/ industrial waste management policies, namely:
   - Victorian Government (June 2002) *State Environment Protection Policy - Prevention and Management of Contamination of Land*;
   - Victorian Government (October 2018) *State Environment Protection Policy - Waters*; and
   - Victorian Government (June 2009) *Environment Protection (Industrial Waste Resource) Regulations 2009*

   in making a total assessment of the nature and extent of any harm or detriment caused to, or the risk of any possible harm or detriment which may be caused to, any beneficial use made of the site by any industrial processes or activity, waste or substance (including any chemical substance); and
3. completed an environmental audit report in accordance with section 53X of the Act, a copy of which has been sent to the Authority and the relevant planning and responsible authority.

HEREBY STATE that I am of the opinion that the site is suitable for the beneficial uses associated with:

- high-density residential;
- commercial; and
- industrial.

subject to the following conditions attached thereto:

1. Prior to the occupation/ commencement of the use of the site, the site must be covered with a physical barrier, such as the building slab or pavement, in accordance with the development plans for the site.

2. All physical barriers (as prescribed in condition 1 above), must be maintained on the site and if subsequently damaged or removed during development or occupation of the site, must be reinstated as soon as possible and to the same condition or better as they were prior to any disturbance.

3. If removal of the physical barrier (as prescribed in conditions 1 and 2 above) is proposed, an environmental auditor appointed under Part IXD of the Environment Protection Act 1970 ("the Act") must be engaged to conduct an environmental audit of the site under Section 53X of the Act, to consider if the barrier is no longer required.

4. Groundwater at the site is polluted and is not suitable for the use of water dependant ecosystems and species, agriculture and irrigation (irrigation and stock watering), water-based recreation (primary contact recreation) and industrial and commercial. Groundwater must not be used for any precluded beneficial use without prior testing and review of results by a suitably qualified professional to confirm its suitability for the proposed use. It may be extracted for the purpose of environmental monitoring or remediation.

5. This statement is directly referrable to and based upon the layout and construction of the development shown and described in the attached development plans (Appendix A). Any substantive change(s) to the basement extent/ depth and site coverage must be verified by an environmental auditor appointed under Part IXD of the Environment Protection Act 1970, and this verification advised in writing to EPA and the planning authority.

The condition of the site is detrimental or potentially detrimental to any (one or more) beneficial uses of the site. Accordingly, I have not issued a Certificate of Environmental Audit for the site in its current condition, the reasons for which are presented in the environmental audit report. The terms and conditions that need to be complied with before a Certificate of Environmental Audit may be issued are set out as follows:

- identified polluted land is remediated such that all beneficial uses of land and water are restored, or it is demonstrated that all elements of land at the site do not pose an unacceptable human health and/or environmental risk through appropriate risk-based assessment.

Other related information

- The auditor is satisfied that the groundwater has been cleaned up to the extent practicable and recommends the Authority identify the site as a groundwater quality restricted use zone (also known as a GQRUZ).
- Groundwater at the site is polluted with nitrate and tetrachloroethene (PCE) and is not suitable for the beneficial uses of water dependant ecosystems and species, agriculture and irrigation (irrigation and stock watering), water-based recreation (primary contact recreation) and industrial and commercial. The groundwater is suitable for the beneficial uses of buildings and structures.
- In accordance with clause 58(4) of the SEPP (Waters), the Authority may require periodic reassessment of the practicability of groundwater clean up.
- Groundwater monitoring bores present at the site/ installed off-site (BH01, BH02, BH03 and BH05) should be decommissioned within 12 months of cessation of use in accordance with the requirements of "Minimum Construction Requirements for Water Bores in Australia", published by the Land and Water Biodiversity Committee 2012.
- Groundwater at the site contains natural elevated concentrations of sodium, chloride, bicarbonate and metals (Cu, Fe, Mn and Zn). The levels are considered typical of the natural groundwater quality surrounding the site and do not constitute pollution in accordance with clause 17(3)(b) of State Environment Protection Policy Waters 2018.

- Groundwater at the site contains elevated concentrations of nitrate and PCE. The concentrations are considered to be associated with off-site regional sources of pollution. The pollution is not sourced from the site.
- Any groundwater extracted at the site for the purpose of dewatering, construction or control of infiltration into basements, is likely to be contaminated and will require disposal to sewer (potentially requiring pre-treatment) or a licensed treatment plant, subject to the requirements of the relevant water authority.
- Groundwater may impact on the building footings due to its natural salinity and corrosiveness potential.
- This statement of Environmental Audit (SoEA) supersedes the SoEA issued by Michael Seignior of Lloyd Consulting Pty Ltd which was provided in the Audit report titled Environmental Audit 15 Horne Street Elsternwick, Victoria and dated 16 June 2011.
- Any soil that is proposed to be removed from the site after the completion of the Environmental Audit must be tested and disposed of in accordance with EPA (June 2009) *Industrial Waste Resource Guideline 621 – Soil Hazard Categorisation and Management* (IWRG621) and to statutory requirements (or replacement publication). Also, any soil that is proposed to be imported onto the site must be IWRG621 classified "Fill Material" prior to use onsite (or replacement publication).

This statement forms part of the environmental audit report (Environmental Earth Sciences, Environmental Audit Report for 7-15 Horne Street, Elsternwick, Victoria, Report Number 217057 Version 2, dated 20 April 2021).

Further details regarding the condition of the site may be found in the environmental audit report.

DATED: 20 April 2021

Signed: M Stuckey

Mark Stuckey of Environmental Earth Sciences
ENVIRONMENTAL AUDITOR
(appointed pursuant to the *Environment Protection Act 1970*)

Site Plans: 7 – 15 Horne Street, Elsternwick, Victoria
53X Environmental Audit

Plan CP163463
(7 – 12 Horne Street)

TITLE PLAN		EDITION 1	TP 298244R

Location of Land

Parish: AT ELSTERNWICK PARISH OF PRAHRAN
Township:
Section:
Crown Allotment:
Crown Portion:

Last Plan Reference: CP 163463Y
Derived From: VOL 9709 FOL 911
Depth Limitation: NIL

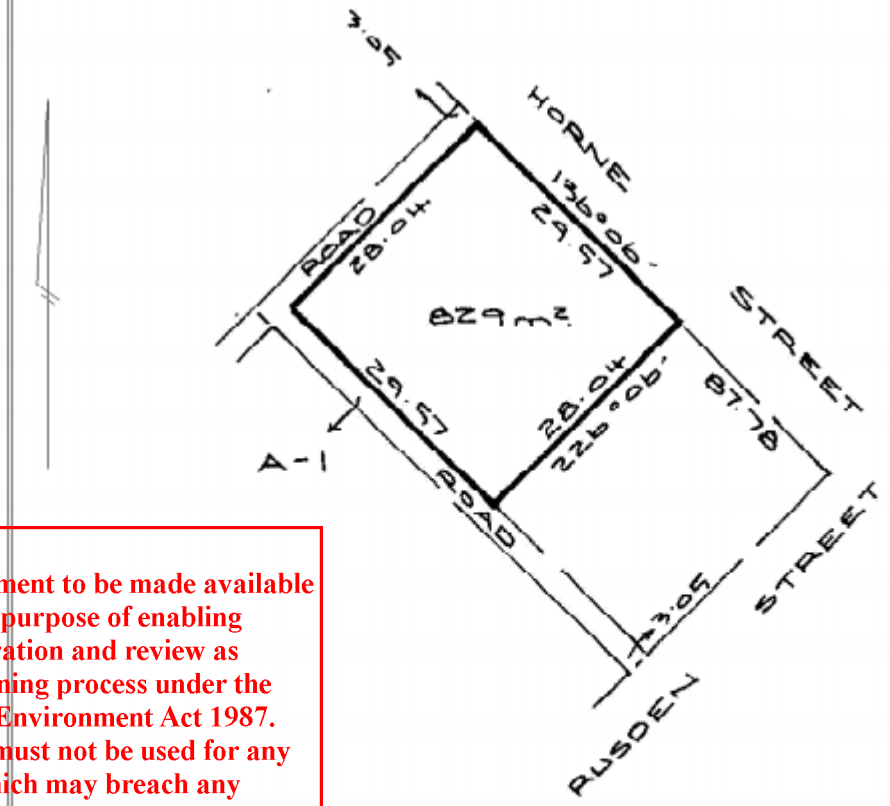
Notations

ANY REFERENCE TO MAP IN THE TEXT MEANS THE DIAGRAM SHOWN ON THIS TITLE PLAN

Description of Land / Easement Information

all that piece of land ~~in~~ at Elsternwick Parish of Prahran County of Bourke being the land in Plan of Consolidation No.163463Y which land is shown enclosed by continuous - - lines on the map hereon - TOGETHER with a right of carriage-way over the land shown - marked A-1 -

THIS PLAN HAS BEEN PREPARED FOR THE LAND REGISTRY, LAND VICTORIA, FOR TITLE DIAGRAM PURPOSES AS PART OF THE LAND TITLES AUTOMATION PROJECT
COMPILED: 24/06/2002
VERIFIED: BP



LENGTHS ARE IN METRES | Metres = 0.3048 x Feet | Metres = 0.201168 x Links | Sheet 1 of 1 sheets

Lots 5 & 6 of Section 1 LP1423
(13 & 15 Horne Street)

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Appendices

1 INTRODUCTION

On 29 May 2017, Auyin Property Development Pty Ltd (herein referred to as "the Client") requested the Environmental Auditor (Mark Stuckey of Environmental Earth Sciences) to complete an Environmental Audit of the property located at 7-15 Horne Street, Elsternwick, Victoria (herein after referred to as "the site").

The Client engaged Cardno (the Assessor) to complete environmental investigation works in support of the Environmental Audit, for which a preliminary site investigation (PSI) and detailed site investigation (DSI) were completed in 2017 and 2019, respectively.

The regional location of the site is shown in Figure 1 (included in the Figures Section of this Environmental Audit report). The boundary of the Site that is subject to the Environmental Audit is shown in Figures 1 and 2 (included in the Figures Section of this Environmental Audit report).

1.1 Purpose and objective of the Environmental Audit

The Client requires an Environmental Audit to satisfy requirements of the planning system triggered by an Environmental Audit Overlay (EAO), to allow development of the site.

The general purpose of this Environmental Audit is to evaluate whether the site is suitable for the issue of a Certificate of Environmental Audit indicating that the site is suitable for any beneficial use, and if not, whether it is suitable for the proposed commercial and high density residential development. Such determination would result in the issue of a Statement of Environmental Audit.

1.2 Environmental Audit scope and methodology

The scope of work undertaken as part of this Environmental Audit is consistent with that defined in the proposal, accepted by the Client on 29 May 2017 (our reference PO217079). Works undertaken included the following:

- Notified EPA of the request to issue a Certificate of Environmental Audit for the site;
- reviewed and provided comment on the Assessor's reports including the following;
    - Preliminary site investigation and sampling & analysis quality plan.
    - Detailed site investigation.
- completion of site inspections and Auditor verification sampling;
- liaised with the Assessor and the client;
- prepared and issued Environmental Audit report; and
- prepared and issued a Statement of Environmental Audit.

1.3 Environmental Audit requirements

An Environmental Audit is a total assessment of the nature and extent of any harm caused to, or the risk of any possible harm or detriment which may be caused to, any beneficial use made of any segment of the environment by any industrial process or activity, waste, substance (including any chemical substance) or noise. It is noted that Section 3 of EPA Publication 759.3 (2015), Environmental Auditor (Contaminated Land): Guidelines for Issue of Certificates and Statements of Environmental Audit states that "noise is not a relevant consideration when conducting an Environmental Audit (contaminated land) but is a factor which can impact on a beneficial use".

The Minister for Planning re-issued Ministers Direction No. 1 – Section 12 (2) (a) of the *Planning and Environment Act 1987 – Potentially Contaminated Land* on 27 September 2001. This document specifically addresses how planning authorities make a decision on whether potentially contaminated land (i.e. land used for industry, mining, chemical, gas, wastes or liquid fuel storage) can be used for more sensitive uses (such as residential, a child care centre, a pre-school centre or a primary school).

The Minister's Direction No. 1 directs planning authorities that in preparing any amendment to a planning scheme that would allow potentially contaminated land to be used for a more sensitive use; they must satisfy themselves that the environmental condition of the land is suitable for the nominated use. The planning authority must satisfy itself by obtaining either a Certificate of Environmental Audit or Statement of Environmental Audit by an Environmental Auditor appointed pursuant to Part IXD of the *Environment Protection Act 1970*. A Certificate of Environmental Audit certifies that the site is suitable for all beneficial uses. A Statement of Environmental Audit is a conditional certification with some restriction on the use of the site.

An Environmental Auditor must have regard to the requirements of relevant State Environment Protection Policies (SEPP), Industrial Waste Resource Guidelines (IWRG), guidelines issued by EPA for the purpose of the *Environment Protection Act 1970*, and any National Environment Protection Measure (NEPM) publication. In addition, the Environmental Auditor should also refer to published guidelines and standards relevant to the assessment and environmental auditing of sites.

This Environmental Audit has been undertaken using the guidance contained in EPA guidelines, in particular EPA Publication 759.3 (2015). A full list of general and site-specific reference documents used in the preparation of the Environmental Audit report is provided in Section 13.

1.4 Auditor independence

The Environmental Auditor had no prior involvement in the site, before being engaged to conduct an Environmental Audit. Furthermore, the Auditor has not been directly involved in the design or implementation of clean-up or management of the site. Based on this, there is no conflict of interest.

1.5 Documents reviewed

Four environmental reports produced by the Assessor, were provided to the Environmental Auditor for review. In addition, a previous Environmental Audit report and associated

assessment report completed for part of the site, were also provided for review. Copies of these environmental investigation reports are included in Appendix B of this Environmental Audit Report and summarised in Section 2. The Assessor has advised the Environmental Auditor that the Environmental Auditor can legally rely on the reports provided, for the purpose of this Environmental Audit.

2 ENVIRONMENTAL REPORT REVIEW

2.1 Senversa (2011) – Preliminary Environmental Site Assessment

Senversa undertook an assessment of 15 Horne Street in 2011, which included a historical review and a soil investigation consisting of six grid-based boreholes (SB01-SB06 – see Figure 3 included in the Figures Section of this Environmental Audit report for locations). Field observations included the presence of a slight hydrocarbon odour in fill material containing ash and charcoal fragments at boreholes SB05 and SB06, and minor amounts of waste (brick, concrete, glass) were observed in shallow fill.

Twelve samples (two from each borehole) were selected for analysis of contaminants of potential concern including metals, TPH, BTEXN and PAH, with four samples also analysed for a wider screen. Exceedances of adopted criteria for the proposed land use (high density) include B(a)P and lead above adopted health investigation levels (NEPC,1999) and arsenic, lead and zinc above the adopted ecological criteria (NEPC, 1999).

Based on assessment of the results against the most recent investigation levels (NEPC, 2013), arsenic does not exceed ecological criteria.

2.2 Lloyd Consulting (2011) – Environmental Audit Report 15 Horne Street, Elsternwick Victoria

Michael Seignior (Lloyd Consulting) completed an Environmental Audit in 2011 for 15 Horne Street, the south-eastern Lot of the site. The Audit findings were supported by the assessment work conducted by Senversa (see Section 2.1). The Auditor's findings were that fill material (up to 1.2 m depth) was contaminated with lead, zinc and PAH and that this precluded the beneficial uses Maintenance of Ecosystems, Human Health and possibly Aesthetics and Production of Food, Flora and Fibre. The presence of concrete paving across the site prevented exposure to the fill, therefore the risk to human health and the environment were considered acceptable.

An intrusive groundwater investigation was not conducted, as no potential sources of groundwater contamination were identified. The potential for groundwater contamination originating from a former service station located north-east of the site was investigated, and based on the remediation and completed environmental audit, the service station was not found to be impacting on groundwater beneficial uses.

A Statement of Environmental Audit was issued stating that the site is suitable for high density residential, commercial and industrial land uses, with conditions that the site must be covered with a physical barrier and an Environmental Management Plan must be implemented and maintained.

2.3 Cardno (2017) – Preliminary Site Investigation and Sampling & Analysis Quality Plan

Cardno undertook a preliminary site investigation (PSI) in 2017 which consisted of a review of site history and physical setting. Potential sources of contamination identified included imported fill and historical use of 15 Horne Street as a laundry and storage yard on-site, and off-site sources included a former service station, railway siding and possible storage depot and former laundry. In addition to the PSI, a sampling and analysis quality plan (SAQP) covering soil, groundwater and soil vapour sampling was prepared.

2.4 Cardno (2019) – Contamination and Hydrogeological Investigation 7-15 Horne Street, Elsternwick, Victoria

Cardno undertook the first phase of intrusive investigations of soil, soil vapour and groundwater assessment works in 2018. The scope of work included soil sampling from four boreholes (BH02, BH03, BH05 and SB04/ BH04). Bores BH01 (off-site), BH02, BH03 and BH05 were installed as groundwater bores and sampled over two sampling events in November and December 2018. Soil vapour assessment also included installation of three sub slab vapour pins (SV01, SV02 and SV03) and soil vapour sampling in November 2018.

Field observations did not indicate gross soil contamination. Two samples from each borehole were tested for metals, TRH, BTEX and PAH, while one sample was tested for a wider screen including chlorinated hydrocarbons, MAH, phenols, OCPs and PCBs. Exceedances of adopted criteria for the proposed land use (high density) include nickel, zinc and B(a)P above adopted ecological criteria (EIL and ESL) and B(a)P TEQ above HIL B (human health investigation limits for medium density residential).

Groundwater laboratory results found the following chemicals above one or more criteria adopted for the protection of groundwater beneficial uses:

- Inorganics (Na, Cl, NH_4, NO_3, HCO_3);
- metals (Al, Cu, Fe, Mn, Ni, Zn); and
- Tetrachloroethene (PCE).

TCE and cis-1,2 DCE (daughter products of PCE) and TRH C_6-C_{10} were also reported above the laboratory limit of reporting (LOR), consistent with detection of solvents.

Vapour results were below adopted assessment criteria and volatile organics in groundwater were considered unlikely to represent risk to human health under current site conditions.

2.5 Cardno (2019) – SAQP May 2019

A SAQP for further soil and groundwater assessment was prepared to fill data gaps resulting from the first round of investigations. The SAQP outlined additional soil sampling for previously inaccessible areas on the site, an additional groundwater sampling event and preparation of DSI report.

2.6 Cardno (2019) – Detailed Site Investigation

The scope of work, in addition to that reported in the previous report (Section 2.4) included additional soil sampling at four boreholes (BH07, BH08, BH09 and BH10) to fill data gaps/provide site coverage and an additional groundwater sampling event in July 2019.

The DSI report consolidates the previously reported desktop review of site history and physical setting, review of previous assessments, soil, soil vapour and groundwater investigations completed in 2018, as well as further soil and groundwater investigation completed in 2019.

Soil field observations show fill material to between 0.6 and 1 mbgl with natural soil profile below, described as a mottled orange brown and red brown with grey, very stiff sandy, silty clay, consistent with Brighton Group sediments. Two to three samples from each borehole (BH07, BH08, BH09 and BH10) were tested for metals, total recoverable hydrocarbons (TRH), BTEXN and polycyclic aromatic hydrocarbons (PAHs), monocyclic aromatic hydrocarbons (MAHs) and chlorinated hydrocarbons. Three samples were also tested for a broad screen of contaminants including phenols, organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs).

Exceedances of adopted criteria for the proposed land-use include nickel, zinc and B(a)P above adopted ecological criteria (EIL and ESL) and B(a)P TEQ above HILB. Select samples underwent ASLP tests for As, Pb, Ni, Zn and B(a)P to assess leachability and mobility of these chemicals.

Groundwater laboratory results were generally consistent with those reported following 2018 sampling rounds and found the following chemicals above one or more criteria adopted for the protection of groundwater beneficial uses:

- Inorganics (Na, Cl, NH_4, NO_3, HCO_3);
- Metals (Al, Cu, Fe, Mn, Ni, Zn); and
- PCE (off-site bore BH01 only).

TCE and cis 1,2,-DCE (daughter products of PCE) and TRH C_6-C_{10} were also reported above the laboratory LOR, consistent with detection of solvents.

Potential vapour risks were further assessed considering PCE in groundwater and depth of proposed basement. The findings indicate that the risk is low and acceptable.

3 SITE IDENTIFICATION

3.1 Site definition and zoning

Key site information is summarised in Table 4. Refer to Figure 1 and Figure 2 for site location and boundary (in the Figures Section of this report). A copy of the Property Reports (which details the zoning and overlay at the site) are provided in Appendix A.

Table 4: Site Details

Item	Details		
Site address	7 - 12 Horne Street, Elsternwick	13 Horne Street, Elsternwick	15 Horne Street, Elsternwick
Site area	0.0845 ha	0.0209 ha	0.0203 ha
Lot and plan	Plan CP163463 / Lot 5 Section 1 LP1423	Lot 5 Section 1 LP1423	Lot 6 Section 1 LP1423
Current site owner	Auyin Property Development Pty Ltd		
Local government	Glen Eira		
Current zoning	Commercial 1 Zone (C1Z)		
Planning overlays	Environmental Audit Overlay (EAO) Design and development Overlay (DDO) Parking Overlay (PO)		

3.2 Current site status and surrounding land uses

At the time of Audit completion, the site was predominantly covered by commercial buildings, including the following:

- 7-12 Horne Street – multi-storey building with small courtyard in west corner - former Daily Planet brothel (used as a rehabilitation centre);
- 13 Horne Street – multi-storey building with paved ground-level parking at rear - office spaces (vacant); and
- 15 Horne Street – single storey building with split level floor – former furniture warehouse (vacant).

The surrounding land uses at the time of reporting included the following:

- North: Commercial premises (including restaurants, convenience store and interior design architects) and major arterial Glen Huntly Road.
- East: Horne Street, residential apartments (including multi-level carpark and commercial premises), a railway line and Elsternwick train station.
- South: Commercial premises (including a hair salon, gymnasium, and accountant firm), and Rusden Street.
- West: Unnamed laneway, medium density residential housing, Nepean Highway and Elsternwick Nature Reserve approximately 290 m west of site. Elster Creek flows through the Elsternwick Nature Reserve.

3.3 Proposed development

The proposed development includes mixed use high density residential, commercial and basement carparking. A maximum three-level basement (two levels of parking) is proposed to a depth of approximately 2 mAHD (9 m below ground level). The ground level is proposed to be utilised for commercial retail, a café and office spaces, levels 1 and 2 for office and residential apartments, whilst the remaining upper seven levels for residential apartments and common spaces. The proposed development plans are provided in Appendix A.

It is noted that the current development plans only include a two-level basement, however the Auditor has also considered the potential for a three-level basement based on Plan SD10 of Appendix A, which would potentially be in contact with groundwater.

4 CONCEPTUAL SITE MODEL DEVELOPMENT

4.1 Introduction

A key component of a total assessment of the risk of harm to beneficial uses is the development of a conceptual site model (CSM). This identifies potential sources of contamination, potential migration pathways along which identified contaminants could migrate and potential receptors which may become exposed. The CSM considers all plausible pollutant linkages associated with the identified contamination, as well as the geophysical characteristics (as defined in NEPC 2013, Schedule B4 Section 2.3.3 and Schedule B2 pages 11-12 and 18 and Section 6.4 pages 26-27) at play at the site.

4.2 Topography and drainage

The surface elevation at site is approximately 12-14 mAHD, sloping from east to west (DELWP, 2020). The regional topography is undulating with a local high point of 25 mAHD approximately 550 m east-north-east of the site to Port Phillip Bay (0 mAHD) approximately 1.5 km west-south-west of the site.

Elster Creek is approximately 450 m south-west of site at its closest point, ultimately discharging out to Port Phillip Bay, approximately 2 km from the Elsternwick Nature Reserve.

4.3 Soils

Van de Graaf and Wootton (1996) describes the soils typically found in the region to consist of black to dark grey sandy topsoil with lots of organic matter, grading into light grey sand. The subsoil is described as a brown, red and grey mottled clay. The soils can be acidic and the clay horizon can impede drainage. According to the Australian Soil Resource Information System (ASRIS), the soils are classified as Chromosols which are soil profiles with a strong texture contrast between the A horizon and the sodic B horizon (CSIRO, 2020).

A review of the Department of Environmental and Primary Industries (DEPI, 2014) *Coastal Acid Sulfate Soils (CASS) Map 3 for Central Coast of Victoria* indicates that the site is not located in an area with the potential for coastal or inland acid sulfate soils.

4.4 Geology

A review of the Geological Survey of Victoria 1:63,360 scale Ringwood map sheet (GSV, 1981) and Melbourne 1: 63,360 map sheet (GSV, 1974) indicate that the site is located on unconsolidated Quaternary aged aeolian sediments (Qbd) which overlie the Tertiary aged Brighton Group sediments (Tpr). The Quaternary aged sediments are likely to form a thin layer and consist of sand ridges and hills. The Brighton Group is characterised by mottled unconsolidated sands, silts and clays. The Brighton Group is underlain by Tertiary aged Newport Formation marine sediments consisting of grey silty sands or clays with carbonaceous deposits.

4.5 Hydrology and Hydrogeology

4.5.1 Groundwater aquifers and potentiometric surface

The uppermost water bearing zone is expected to be encountered at 5-10 m below ground level (bgl) in the Upper Tertiary Aquifer (Brighton Group) consisting of sand, gravel and clay extending to approximately 16 mbgl (DELWP, 2020). Based on surface topography, groundwater is likely to flow in a west-south-west direction from the site towards Elsternwick Creek, approximately 450 m south-west of the site and to Port Phillip Bay, approximately 1.5 km from the site.

4.5.2 Groundwater salinity

The groundwater salinity is expected to range between 1,001 – 3,500 mg/L, reported as total dissolved salts (TDS). Site specific TDS results from the Assessors intrusive groundwater assessment reported salinity from 1,500 mg/L to 2,100 mg/L TDS (Cardno, 2019). Therefore, groundwater beneath the site has been classified as Segment B (1,200 mg/L – 3,100 mg/L) according to State Environment Protection Policy (SEPP) Waters (2018).

Under this policy, the beneficial uses that are to be protected under Segment B include:

- water dependent ecosystems and species;
- portable mineral water supply;
- agriculture and irrigation (irrigation);
- agriculture and irrigation (stock watering);
- industrial and commercial;
- water-based recreation (primary contact recreation);
- Traditional Owner cultural values;
- culture and spiritual values;
- buildings and structures; and

- geothermal properties.

4.5.3 Groundwater dependent ecosystems (GDE)

VVG Groundwater Dependent Ecosystems (GDE) map indicates Elster Creek (approximately 450 m south-west of site) has a high potential for groundwater interaction.

4.5.4 Groundwater resource utilisation

The aquifer is located within the Moorabbin groundwater management area which has a permissible consumptive volume of 2,700 ML/year (DELWP, 2020).

A search of the Department of Environment and Primary Industries (DEPI) Groundwater Monitoring Information database was conducted to identify bores within a 2 km radius of the site: 253 registered bores were identified and are summarised in Table 24 within the tables section of the Audit report.

Groundwater bores in the vicinity of the site are largely registered for investigation or observation purposes, as well as domestic, stock, irrigation and industrial use.

The closest abstraction bores registered for domestic/ stock use are located approximately 400 m south-east (WRK091607) and 730 m north-west (88682), while the closest bore registered for industrial purposes is located approximately 860 m south-east of the site. Based on the inferred groundwater flow direction (south-west from site) and installation depth these bores are not considered to be a receptor of groundwater from the site. Based on the above, no registered bore users in the vicinity of the site are likely to be impacted by contamination identified at the site.

The nearest potential surface water receptor is Elster Creek, located approximately 450 m south-west of site.

4.6 Nearby Audit reports

A summary of key information from nearby completed Audits is provided in Table 5.

4.7 EPA Victoria Records

The Priority Sites Register lists properties which EPA have issued a clean-up notice or pollution abatement notice under the *Environment Protection Act 1970*. A search conducted on the Priority Sites Register, identified that the site is not listed.

A review of the Victorian Landfill Register (VLR) revealed no landfills are located within a 5km radius of the site.

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Table 5: Summary of nearby Audits

Address	Distance and direction from site	CARMS & date	Groundwater depth and flow direction	Groundwater salinity	Site History	Contaminants	Outcome
15 Horne Street, Elsternwick	On-site	68829-1 (16/06/2011)	No intrusive groundwater investigation		Residence, financier, laundry, woodyard/storage yard, hardware supplier.	Arsenic, lead, zinc, BaP and PAH in fill.	Statement - suitable for high density, commercial and industrial land uses. Site Environmental Management Plan for residual soil contamination.
Lots A & B, 242 Glen Huntly Road, Elsternwick	20 m E	43141-1 (18/12/2001)	10 m, SW	TDS 2,300-6,000 mg/L	Lot A was previously used as a service station and Lot B was used as a railway siding and car park. All sources and potential sources of contamination were removed from site, including all fill, USTs and associated infrastructure.	TPH and BTEX in soil (largely remediated). TPH and BTEX in groundwater (below criteria).	Statement – suitable for most land uses with condition for 1 m clean fill in landscaped areas.
41 Horne Street, Elsternwick	46 m SE	43141-2 (11/09/2003)	>9 m, SW	TDS 2,250 – 2,400 mg/L	Site was previously used as a railway siding and then a car park for the train station.	Arsenic, nickel, vanadium, BaP, PAH, TPH in soil. Arsenic, zinc and tetrachloroethene (PCE) in groundwater.	Statement – suitable for high density, commercial and industrial land uses. Site must be covered in hardstand.
28 Horne Street, Elsternwick	53 m SE	53780-1 (17/05/2004)	No intrusive groundwater investigation		Various (light) commercial and residential purposes.	Lead and BaP in fill (remediated).	Certificate of Environmental Audit
30-31 Horne Street, Elsternwick	62 m SE	58334-1 (25/05/2006)	No intrusive groundwater investigation		Various commercial uses.	Arsenic, zinc, BaP and PAH in fill (remediated).	Statement - suitable for most uses including sensitive land uses.

Address	Distance and direction from site	CARMS & date	Groundwater depth and flow direction	Groundwater salinity	Site History	Contaminants	Outcome
216 Glen Huntly Road, Elsternwick	67 m NW	51536-1 (30/04/2003)	No intrusive groundwater investigation		Various commercial uses.	Lead, zinc, BaP in fill.	Statement - suitable for high density residential, commercial and industrial land uses.
39 Horne Street, Elsternwick	86 m SE	30229-1 (18/12/1996)	No intrusive groundwater investigation		At the time of the audit, the site was being leased for storage, showroom and office purposes. The site was proposed to be redeveloped for residential purposes.	Chromium, nickel, benzo(a)pyrene in soil.	Statement – suitable for residential land uses with condition the site is covered by buildings/ hardstand or clean fill in landscaped areas.
19-21 Selwyn Street, Elsternwick	170 m NE	42557-1 (4/10/2001)	11 m, W	TDS 2,600 – 3.700 mg/L	The site was a former Telstra telephone exchange and there were three USTs.	Zinc (natural occurring) in groundwater.	Statement – suitable for all uses, with condition that aesthetically unacceptable material (building rubble) is removed in exposed areas.

4.8 Site history

A review of site history is provided in Section 2 and Appendix I of Cardno's (2019) report. In summary, the current buildings appear to have been in their present configuration since the 1970s, with some changes in building configuration prior to this date. The building at 15 Horne Street appears unchanged since at least 1945. The site and surrounding area has been well-established with buildings since the earliest available photograph in 1931. Infilling of the site is likely to have occurred prior to this date.

Information from historical titles and business directories show that the site has had various private and commercial owners, including the following on-site uses:

7-12 Horne Street

- 1950s:
    - a laundry (Lee Goon) operated at 7 Horne Street;
    - Funeral Directors (Apps WG & Sons) at 9 Horne Street;
    - Painters, decorators and paper hangers (Hayter) at 12 Horne Street;
    - Elsternwick Mens Club at 13 Horne Street;
- Daily Planet Brothel; and
- Rehabilitation Centre.

13 Horne Street

- Multi-storey office building – vacant but undergoing internal refurbishment in 2017.

15 Horne Street

- 1980s:
    - Fairline Distributors - furniture manufacturer and/or wholesaler.
- 1991s:
    - McLaren Hardware Distributors – building supplier.

Offsite:

- 1950s: Motor engineers at 16 Horne Street (adjacent to southeast).
- Several dry cleaners/ dryers or pressures located from approximately 30 m east (103, 150, 196, 206, 255, 270 and 294 Glenhuntly Road) and 190 m east (22 Riddell Parade).
- Several service stations or motor garages located directly north (Cnr Glenhuntly Road and Horne Street), 30 m NW (2 Horne Street), 30 m east (16, 220, 293 and 325

Glenhuntly Road), 150 m north east (5 Selwyn Street), and 170 m north east (4 Selwyn Street).

4.9 Potential sources and contaminants of potential concern

Based on the historical review, the potential for contamination exists from the following historical site uses and surrounding land uses/ features:

- imported fill;
- former laundries/dry cleaning premises on-site (7 Horne Street) and off-site (east/northeast); and
- former service stations and motor garages off-site including directly north.

Based on these potential sources of contamination, the following chemicals of potential concern (CoPC) were identified by Cardno (2017):

- heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury);
- polycyclic aromatic hydrocarbons (PAH);
- total recoverable hydrocarbons (TRH);
- benzene, toluene, ethyl benzene, xylenes and naphthalene (BTEXN); and
- chlorinated hydrocarbons (halogenated aliphatic compounds such as trichloroethene and vinyl chloride).

4.10 Environmental Auditor conclusion on adequacy of site definition

The Environmental Auditor concludes that the Assessor has adequately described the site and completed an appropriate assessment of CoPC potentially originating from the site and surrounding area.

5 AUDITOR VERIFICATION OF SITE CONDITIONS

5.1 Objectives of inspection and verification sampling

The Environmental Auditor and his Assistant completed an inspection of the site on 12 December 2018. The objectives of the site inspection were to:

- verify the conditions of the site;
- observe the Assessor completing sampling and assess the adequacy of their field procedures; and
- collect independent verification samples.

An Environmental Auditor verification sample of groundwater was also collected on 12 December 2018. The objectives of the verification sampling was to:

- independently verify the data provided by the Assessor;
- correlate the Environmental Auditor's field observations of soil conditions with independent analytical results; and
- independently verify the data provided by the Assessor and to satisfy the Environmental Auditor that the data presented by the Assessor is sufficiently reliable in order to enable him to issue a Certificate of Environmental Audit or Statement of Environmental Audit for the site.

This section presents the findings of the site inspections conducted and of the Environmental Auditor verification sampling by the Environmental Auditor and his Assistant.

5.2 Site inspection and verification sampling – 12 December 2018

The Auditor and Auditors Assistant undertook a site inspection and verification sampling on 12 December 2018.

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

- the site was largely covered by buildings, with the remainder covered in concrete hardstand;
- the former Daily Planet building at 7-15 Horne Street (north-western portion of the site) was being used as a rehabilitation facility; and
- the locations of groundwater and vapour bores were observed.

Cardno were undertaking groundwater sampling at the time of the inspection. The collection of groundwater samples was observed, noting the following:

- samples were collected using a micro-purge pump, with field chemistry readings recorded and allowed to stabilise prior to sample collection;
- samples were collected directly into laboratory supplied containers and stored in an Esky following collection;
- equipment was decontaminated between sample locations; and
- overall, the sample collection practices observed onsite were satisfactory.

One environmental Auditor verification sample was collected from groundwater bore BH03 and laboratory analysed for pH, TDS, major ions, dissolved metals, TRH, BTEXN and halogenated aliphatic compounds (refer to Appendix C for laboratory transcripts). Results from the environmental Auditor verification samples, and the corresponding sample collected by the Assessor, were compared by calculating the relative percentage difference (RPD) as presented in Table 6.

The RPDs for nitrate, arsenic, zinc and iron were above 50%, these variations are considered to be attributed to varying extraction and analysis times by the laboratories used. Overall, the samples collected by the Assessor are considered to be reliable and representative of the conditions encountered.

Table 6: Auditor verification sample

Chemical	Units	LOR	BH02 Primary result (Cardno)	BH02 Auditor verification sample	RPD (%)
Date			12/12/2018	12/12/2018	
pH Value	pH Unit	0.01	7.00	6.53	6.9
Total Dissolved Solids	mg/L	10	2000	2140	6.8
Calcium	mg/L	1	67	54	21.5
Magnesium	mg/L	1	48	47	2.1
Sodium	mg/L	1	660	580	12.9
Potassium	mg/L	1	<5	5	NA
Ammonia as N	mg/L	0.01	0.54	0.56	3.6
Bicarbonate as $CaCO_3$	mg/L	1	550	542	1.5
Sulfate	mg/L	1	120	107	11.5
Chloride	mg/L	1	810	848	4.6
Fluoride	mg/L	0.1	0.6	0.7	15.4
Nitrite as N	mg/L	0.01	NA	0.38	NA
Nitrate as N	mg/L	0.01	0.93	1.76	**61.7**
Reactive Phosphorus as P	mg/L	0.01	NA	<0.01	NA
Aluminium	mg/L	0.01	<0.05	<0.01	NA
Arsenic	mg/L	0.001	0.019	0.006	**104**
Cadmium	mg/L	0.0001	<0.0002	<0.0001	NA
Chromium	mg/L	0.001	<0.001	<0.001	NA
Copper	mg/L	0.001	<0.001	<0.001	NA
Lead	mg/L	0.001	<0.001	<0.001	NA
Manganese	mg/L	0.001	6.7	6.02	10.7
Nickel	mg/L	0.001	0.006	0.006	0

Chemical	Units	LOR	BH02 Primary result (Cardno)	BH02 Auditor verification sample	RPD (%)
Zinc	mg/L	0.005	0.027	0.009	**100**
Iron	mg/L	0.05	5.8	1.8	**105**
Mercury	mg/L	0.0001	<0.0001	<0.0001	NA
C6 - C10 Fraction	µg/L	20	60	50	18.2
Vinyl chloride	µg/L	0.2	<0.2	<0.2	NA
trans-1.2-Dichloroethene	µg/L	1	<1	<1	NA
1.1-Dichloroethane	µg/L	1	0.06	<1	NA
cis-1.2-Dichloroethene	µg/L	1	0.75	1	28.6
1.1.1-Trichloroethane	µg/L	1	<1	<1	NA
Carbon Tetrachloride	µg/L	1	<1	<1	NA
1.2-Dichloroethane	µg/L	1	<1	<1	NA
Trichloroethene	µg/L	1	2.3	2	14.0
Dibromomethane	µg/L	1	0.18	<1	NA
1.1.2-Trichloroethane	µg/L	1	<1	<1	NA
Tetrachloroethene	µg/L	1	52	40	26.1
1.1.1.2-Tetrachloroethane	µg/L	1	<1	<1	NA
cis-1.4-Dichloro-2-butene	µg/L	1	<1	<1	NA
1.1.2.2-Tetrachloroethane	µg/L	1	<1	<1	NA
Hexachlorobutadiene	µg/L	1	<1.0	<1.0	NA

6 EVALUATION OF QUALITY AND COMPLETENESS

This section of the Environmental Audit Report details the QA/QC procedures and documentation undertaken by the Assessor throughout their fieldwork program. This section also provides the Environmental Auditor's conclusion on the adequacy of the Assessor's QA/QC procedures (and whether the data produced can be relied upon for the purpose of the Environmental Audit).

6.1 Data-set quality control

The findings of the QA/QC review are summarised in Table 7.

Table 7: Findings of the QA/QC review

Item	Comments
General	
Work plan	A sampling and analysis quality plan (SAQP) was prepared and submitted for Auditor review with the PSI, prior to the commencement of the field program. A second SAQP was prepared and submitted for Auditor review, prior to the second stage of field work completed in July 2019. Works conducted were developed in accordance with regulatory guidelines and industry best practice.
Data validation	The Assessor has provided a data quality validation report (included in Appendix G of Cardno's [2019] report).
Qualifications of field staff	The Assessor's report states that field work was undertaken by an experienced environmental scientist/engineer.
Sample preservation	Soil samples were stored in glass jars provided by the laboratory and groundwater samples were collected directly into appropriately preserved containers with no headspace. Samples for metals analysis were filtered to 0.45 µm. All samples were stored on ice in an Esky, while in transit to the laboratory. Groundwater sample collection was observed by the Auditor on 12 December 2018 and considered acceptable by the Auditor.
Laboratories used and COC documentation	Primary samples were sent to Eurofins, while secondary samples were sent to ALS. Both laboratories are National Association of Testing Authorities accredited for the analyses requested.
Laboratory internal QC procedures	A review of laboratory internal QC procedures was undertaken by the Assessor (covering such elements as method blanks, duplicate sample RPD, laboratory control sample recovery and matrix spike recovery). The review identified some results outside the acceptable limits, however, in the context of the dataset as a whole, the Auditor considers the dataset to be reliable and acceptable.
Laboratory LOR	The laboratory LORs were generally less than the adopted investigation levels, with the exception of a number of chemicals tested in groundwater (refer to Appendix G of Cardno, 2019). These chemicals were generally of low mobility and not expected to have migrated to groundwater. In addition, the LOR for vinyl chloride for two of the three rounds was above the adopted investigation level. As the results from the December 2018 round were <0.05 µg/L, and the variability of chlorinated hydrocarbons was generally consistent across the three rounds, the Auditor considers that the data is acceptable.
Soil	
Selection of soil investigation locations and sampling density	A total of 14 sampling locations were advanced at the site. This sampling density meets the requirements of Standards Australia (2005) Australian Standard AS4482.1. A sampling rationale was provided in Section 4.2 of Cardno (2019).
Completeness of data set	A total of 32 primary soil samples were analysed from fill and natural soil profiles onsite. The Environmental Auditor considers this sufficient to characterise soils at the site.

Item	Comments
Soil bore target depth	Soil boreholes were advanced to between 1.2 and 2.0 mbgl, with natural soil encountered at all boreholes. The Environmental Auditor is of the opinion that the depths advanced were sufficient to characterise soils at the site.
Soil sampling method	Soil samples were collected from hand auger due to accessibility limitations. The Environmental Auditor is of the opinion that the method employed was adequate.
Equipment calibration	The Assessor states that a calibrated PID was used to screen soil samples. Calibration records for soil sampling dates were not provided.
Equipment decontamination	Reusable sampling equipment was decontaminated with Decon90 and deionised water prior to the collection of each sample.
Sample nomenclature	Soil samples collected by Cardno were denoted by their location number, followed by the depth (e.g. BH04_0.2 or BH07/0.2). Soil samples collected by Senversa were denoted as SB01_1.4-2.0.
Soil logging	Borehole logs have been produced for each of the borehole locations.
Field screening	General field observations (texture, colour, moisture) were noted on the borehole logs. Odour observations were not noted for boreholes SB01-SB06 and BH01-BH05.
Soil sampling depths	Soil samples were generally collected from surface and from at least 0.5 m intervals or changes in lithology. The Environmental Auditor considers this to be adequate.
Composites	No compositing of soil samples was undertaken.
Analytical schedule	Selected samples were analysed for the identified contaminants of potential concern including metals, TPH, BTEX, PAH, as well as some broader screens and VOCs. Overall, the Auditor considers the analytical schedule to be adequate.
QC rinsate blanks	Rinsate blanks were collected for each day of the soil sampling program.
QC trip blanks	Trip blanks were collected and analysed as part of the soil sampling program.
QC field duplicate and split sample collection	Of the 19 primary soil samples collected, one duplicate and two split samples were analysed. The frequency of collection is considered sufficient to meet the requirements of AS4482.1 (which specifies a minimum of one per 20 primary samples). The Auditor considers this to be acceptable.
QC field duplicate and split data precision	RPDs were <50% for the duplicate. Three RPDs >50% were calculated for arsenic, lead and zinc for the split samples and are attributed to sample heterogeneity. The Auditor considered the quality of the dataset to be acceptable.
Holding times	All soil samples were analysed within holding times.
Soil cuttings disposal and re-instatement	Excess soil cuttings were removed from site by an EPA certified waste transport contractor.
Groundwater	
Selection of sampling locations	Four groundwater bores were installed at the site (BH01, BH02, BH03 and BH05). A groundwater bore was also proposed to be installed on the south-eastern end of the site, however due site accessibility constraints, this was not able to be completed.

Item	Comments
Groundwater bore depth	The groundwater bores were installed to 12.9-13.0 mbgl. Groundwater strike was unable to be assessed due to the drilling method (washbore). Based on the potentiometric surface of approximately 9 to 10 mbgl, the Auditor considers the depth of monitoring bores to be adequate.
Bore construction	Bore construction details are provided on the borehole logs. Bores were constructed with 500 mm, flush jointed, class 18 PVC, with the screen extending to 1 m above the observed water level (where possible). The sand filter pack extended to approximately 1 m above the top of the screen, followed by a 1 m bentonite seal, and grout to surface.
Bore surveying	Bores were surveyed to the Australian Map Grid (AMG) and Australian Height Datum (AHD) by a licensed surveyor.
Bore development	Bores were developed using air or manual bailing with between 40 and 60L removed, until clear.
Gauging	The bore was gauged using an interface probe prior to sampling.
Purging and sampling	Groundwater samples were collected using a low flow sampling techniques and field parameters were allowed to stabilise prior to sample collection.
Equipment decontamination	All re-usable field sampling equipment was rinsed in Decon 90 and de-ionised water between each bore.
Field quality parameter sampling	Field quality parameters (dissolved oxygen [DO], oxidation reduction potential [ORP], temperature, electrical conductivity [EC] and pH) were measured during purging and allowed to stabilise before sample collection. The Environmental Auditor notes that this is in accordance with EPA (2000) *Publication 669 – Groundwater sampling Guidelines*.
Equipment calibration	The water quality meter was calibrated prior to use. Calibration certificates were provided for the November and December 2018 sampling events. Calibration certificate was not provided for the July 2019 event.
Sample nomenclature	Groundwater samples were labelled with the borehole identification e.g. BH01, and the date sampled.
Analytical schedule	The groundwater analytical schedule is provided in Table 4.12, Section 4.43. (Cardno, 2019) and included major ions, nutrients, pH, TDS, TRH, BTEX, phenols and VOCs. The Environmental Auditor is of the opinion that the analytical suite is sufficient to characterise groundwater beneath the site.
QC rinsate blanks	Rinsate samples were collected on each day of sampling. Results were generally below the LOR with the exception of some metals concentrations above LOR (RIN01). The magnitude of metals concentrations are similar to those measured concentrations in some groundwater samples, indicating that cross contamination between sampling locations may have occurred, or the rinsate water used was contaminated.
QC trip blanks	Trip blanks were submitted for volatile analyses with the groundwater. The results were below the LOR and shipping procedures are considered acceptable.
QC field duplicate and split sample collection	Of the 12 primary samples collected over three sampling rounds, three duplicate and three split samples were collected and analysed.

Item	Comments
	The frequency of collection is considered sufficient to meet the requirements of AS4482.1 (which specifies a minimum of one per 20 primary samples). The Auditor considers this to be acceptable.
QC field duplicate and split data precision	RPDs were <50% for the duplicate samples. One RPD >50% were calculated for TPH C_{15}-C_{28} for the split samples and are attributed to sample volatility. The Auditor considered the quality of the dataset to be acceptable.
Holding times	Groundwater samples were analysed within holding times.
Purged groundwater disposal	Purged water was removed from site by an EPA certified waste transport contractor.
Decommissioning of bores	Groundwater bores have not been decommissioned.
Soil vapour	
Selection of sampling locations	Three soil vapour pins (SV01-SV03) were installed. This is less than the initially proposed seven soil vapour sample locations. Nevertheless, the Auditor considers the number and location of sample locations to be acceptable to characterise vapour risk at the site.
Methodology	The use of vapour pins is considered suitable for the purposes of assessing potential vapours at the site, given the presence of existing buildings covering the entirety of the site.
Sample collection & leak testing	Samples were collected into 1 L Summa canisters in general accordance with the methods outlined in CRC Care (2011 and 2013). Dam leak tests, isopropanol trace gas leak tests and a vacuum shut-in test were conducted to check the integrity of the vapour pins. Overall, the sampling methodology and leak test results are considered to be acceptable.
Equipment calibration	Field screening was undertaken using a PID and landfill gas meter. Calibration certificate for the PID was provided, however evidence of calibration for the landfill gas meter was not provided.
Sample nomenclature	Samples were labelled SV01, SV02 and SV03.
Analytical schedule	Samples were analysed for TO-15 volatile organic compounds suite and TRH NEPM speciation. The analytical schedule is considered suitable.
QC field duplicate and split sample collection	Of the three primary soil vapour samples collected, one field duplicate and is considered acceptable.
QC field duplicate and split data precision	RPDs were generally <50% with the exception of F1 (84%), acetone (69%) and isopropanol (156%). Overall, the Auditor considered the quality of the dataset to be acceptable.

6.2 Data set quality assurance

In addition to the field and laboratory QA/QC assessment already undertaken, the Environmental Auditor has considered the following elements (in making a conclusion on whether the data set can be relied upon):

- scope of works undertaken;
- geology (regional anticipated and actual encountered during intrusive works);
- topography (regional anticipated and actual encountered during site inspections); and
- the anticipated contaminants of concern (derived from the desktop site history review) and the actual contaminants encountered during intrusive works.

The Environmental Auditor concludes the following:

- the scope of work undertaken, including the spatial distribution of soil, soil vapour and groundwater sampling locations and the temporal distribution of groundwater monitoring events, is adequate;
- the site-specific geology and topography encountered during the field work program is in agreement with the anticipated regional conditions;
- the contaminants encountered were what was anticipated during the desktop site history review; and
- based on this, the data set is considered to be accurate, precise and representative of actual site conditions (and can be relied upon for the purpose of this Environmental Audit).

6.3 Environmental Auditor conclusion on quality assurance and quality control and on the reliability of data

In conclusion, the Environmental Auditor is of the opinion that the data set is of sufficient quality and adequately characterises the status of contaminant indicators at the site. As such, the Environmental Auditor considers it can be relied upon for the purposes of this Environmental Audit.

7 ENVIRONMENTAL QUALITY CRITERIA, BENEFICIAL USES ASSESSMENT AND RISK

The Environmental Audit process requires that the levels of contamination reported be assessed in the context of beneficial uses that need to be protected. The applicable sections of the environment which need to be considered, such as soil, groundwater, surface water and air, are discussed in more detail below.

7.1 Soil

The Victorian Government (June 2002) *State Environment Protection Policy - Prevention and Management of Contamination of Land* (Land SEPP) provides the framework for the protection of land and associated beneficial uses throughout Victoria. This policy allows for a consistent approach to the prevention of contamination of land, and clean-up of pollution of land in Victoria, and sets environmental quality indicators and objectives for each beneficial use. The Land SEPP defines certain land use categories and associated beneficial uses of land to be protected, summarised in Table 8. The environmental quality indicators and objectives applicable to the site are detailed further in Table 9.

Table 8: Protected beneficial uses of land

Beneficial Use	Land use						
	Parks and reserves	Agricultural	Sensitive use		Recreation/ open space	Commercial	Industrial
			High Density	Other			
Maintenance of ecosystems							
Natural ecosystems	✓						
Modified ecosystems	✓	✓		✓	✓		
Highly modified ecosystems	✓	✓	✓	✓	✓	✓	✓
Human Health	✓	✓	✓	✓	✓	✓	✓
Building and structures	✓	✓	✓	✓	✓	✓	✓
Aesthetics	✓		✓	✓	✓	✓	
Production of food, flora and fibre	✓	✓		✓			

Table 9: Indicators and objectives for land

Beneficial use	Indicators	Objectives
Maintenance of ecosystems	Concentration of contaminants.	Contamination must not adversely affect the maintenance of relevant ecosystems and the level of any indicator must not be greater than any ecological investigation level (EIL) developed in accordance with the NEPM (NEPC, 2013) or levels approved by EPA Victoria.

Beneficial use	Indicators	Objectives
Human health	Concentration of contaminants.	Contamination must not cause an adverse effect on human health and the level of any indicator must not be greater than the investigation level specified for human health in NEPC (2013) or levels derived using a risk assessment methodology described in the NEPM, or levels approved by EPA Victoria.
Buildings and structures	pH; sulfate; ORP; salinity; other substance or waste that may have a detrimental impact on the structural integrity of buildings and other structures.	Contamination must not cause the land to be corrosive to or adversely affect the integrity of structures or building materials.
Aesthetics	Any chemical substance or waste that may be offensive to the senses.	Contamination must not cause the land to be offensive to the senses of human beings.
Production of food, flora and fibre	Concentration of contaminants.	Contamination must not adversely affect produce quality or yield; and affect the level of an indicator in the food, fibre or flora produced at the site (or that may be produced) such that the level of that indicator is greater than that specified in the Australian and New Zealand Food Authority Standards Codes.

7.1.1 Site specific land-use and beneficial uses to be protected

The site is currently zoned as Commercial 1 Zone (C1Z) and is proposed to be developed for commercial and high-density residential purposes. It should be noted that regardless of the proposed site use, in order to issue a Certificate of Environmental Audit for a site, an assessment of all beneficial uses of land is required.

These land use scenarios defined in SEPP Land are as follows:

- parks and reserves;
- agricultural;
- sensitive use (high density);
- sensitive use (other);
- recreation/ open space;
- commercial; and
- industrial.

The beneficial uses that are protected for a site where any land use is being assessed are as follows:

- maintenance of ecosystems (natural, modified and highly modified);
- human health;
- buildings and structures;
- aesthetics; and
- production of food flora and fibre.

7.1.2 Soil assessment criteria

This Section of the Environmental Audit report discusses the assessment criteria adopted for the protection of the identified relevant beneficial uses of soil beneath the site.

Maintenance of ecosystems

The Land SEPP states that contamination must not adversely affect the maintenance of relevant ecosystems (i.e. natural, modified and highly modified ecosystems). As stated in Table 9 above, any soil contamination must not adversely affect the maintenance of relevant ecosystems and the level of any indicator must not be greater than any EIL developed in accordance with the NEPM (NEPC, 2013).

The EILs assigned by the NEPC (2013) Schedule B5a - *Guideline on Ecological Risk Assessment* are adopted for this assessment. This guideline presents the methodology for deriving terrestrial EILs using aged (i.e. >2 years old) contamination for soil with the following land use types:

- areas of ecological significance;
- urban residential/ public open space (UR/ POS); and
- commercial/ industrial (C/ I).

The methodology has been developed to protect soil processes, soil biota (flora and fauna) and terrestrial invertebrates and vertebrates. As the Environmental Auditor is required to consider all potential future land-uses and their associated beneficial uses (in order to issue a Certificate of Environmental Audit), the EILs for areas of ecological significance (to protect *natural* ecosystems) have been considered. The EILs for urban residential/ public open space have been adopted as the relevant land use on the site.

The EILs developed by the Assessor are generally considered to be suitable, and have been adopted by the Auditor. Where EILs were not developed (e.g. areas of ecological significance), the Auditor has derived appropriate EILs based on the data collected by the Assessor. The Auditor has also adopted the CRC Care higher reliability ESL for BaP of 33 mg/kg for urban residential (further information provided below).

One fill and one natural soil sample were analysed for site specific characteristics as summarised in Table 10. The adopted soil characteristics for calculation of the added contaminant limit (ACL) are generally the most conservative value and generally reflective and relevant to the fill material on-site, rather than natural soil.

Table 10: Site specific EIL calculation data (from Cardno, 2019)

Sample ID	Material	Depth (mBGL)	CEC (meq/100g)	Clay %	TOC %	Lab pH
BH03_0.2	Fill	0.2	7.8	-	-	8.5
BH08_1.2	Natural	1.2	20	48	0.7	6.6
Adopted	Fill	-	7.8	1	1	6.6

Notes:
1. CEC – Cation exchange capacity
2. TOC – total organic carbon

A summary of the EILs for aged contamination in soil (>2 years) for the adopted land uses are presented in Table 11 (areas of significance) and Table 12 (urban residential / open space). EIL calculation spreadsheets are provided in Appendix D.

Table 11: Site specific EILS – Areas of ecological significance

Analyte	Ambient background concentration (mg/kg)[1]	Added contaminant limit (mg/kg)[2]	EIL (mg/kg)
Arsenic	-	40	40
Naphthalene	-	10	10
DDT	-	3	3
Chromium III	-	60	70
Copper	10	50	60
Lead	-	470	470
Nickel	10	15	25
Zinc	40	90	130

Notes:
1. ABC – Ambient background concentration, derived from Olszowy *et al.* (1995)
2. ACL – Added contaminant limit, determined using Tables 1B(1-5), Schedule B1, NEPC (2013)

Table 12: Site specific EILs / ESL – Urban residential / open space

Analyte	Ambient background concentration (mg/kg)[1]	Added contaminant limit (mg/kg)[2]	EIL / ESL (mg/kg)
Arsenic	-	100	100
Naphthalene	-	170	170

Analyte	Ambient background concentration (mg/kg)[1]	Added contaminant limit (mg/kg)[2]	EIL / ESL (mg/kg)
DDT	-	180	180
Chromium III	10	190	200
Copper	10	150	160
Lead	-	1,100	1,100
Nickel	10	90	100
Zinc	40	340	380
B(a)P	-	-	33*

Notes:
1. ambient background concentrations (ABC) were derived from Olszowy *et al.* (1995).
2. added contaminant limits (ACL) were determined using Tables 1B(1-5), Schedule B1, NEPC (2013).
3. * CRC CARE (2017) derived high reliability ESL value, based on the revised Canadian guidelines.

With reference to Cooperative Research Centre (CRC Care) for Contamination Assessment and Remediation of the Environment, Technical Report 39 (2017), the level of risk posed by BaP in soil and justification for adopting the CRC Care ESL of 33 mg/kg is provided below:

- CRC Care has derived a high reliability ESL based on the revised Canadian guidelines and following the NEPM guidance, of 33 mg/kg.
- Data used to derive the ESL value are based on recent published research which considers the biotoxicity and bioavailability of BaP in bacterial, fungal and plant species.
- The high reliability data considers the role of microbial processes in soil (aerobic decomposition) and soil properties that influence bioavailability (e.g. clay content, organic carbon content and source type).
- Leachability of BaP (ASLP) suggests that the bioavailability is likely to be low (Section 8.2.4 below).
- Given the NEPM ESL BaP criteria is based on low reliability data from 1999, the Auditor deems it appropriate to adopt the CRC Care BaP value over NEPM value.
- The above reasoning is supported by guidance provided by the New South Wales Office of Environment and Heritage (NSW OEH, 2017 and 2019).

Human health

The Land SEPP states that a chemical substance or waste must not be greater than the investigation level specified for human health in the NEPM (NEPC, 2013).

Schedule B(1) of the current version of the NEPM (NEPC, 2013) provides a range of investigation levels for the protection of human health, referred to as health investigation

levels (HILs), and provides health screening levels (HSLs) for BTEXN and petroleum hydrocarbons. HILs and HSLs are provided for four generic land use settings:

- HIL A: residential with garden / accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry), also includes children's day care centres, preschools and primary schools;
- HIL B: residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats;
- HIL C: public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate; and
- HIL D: commercial/ industrial such as shops, offices, factories and industrial sites.

HIL B and HSL B have been adopted for this assessment, as the relevant proposed land use. HIL A and HSL A have also been considered as the most sensitive land use.

Buildings and structures

The Land SEPP states that the contamination must not cause the land to be corrosive to or adversely affect the integrity of structures or building materials. The relevant indicators (as stated in the Land SEPP) include pH, sulfate, redox potential, salinity or any chemical substance or waste that may have detrimental impact on the structural integrity of buildings and other structures.

Objectives for these key indicators have primarily been sourced from AS 2159 (2009), *Piling Design and Installation*, in which levels of pH, chloride and sulphate which are considered to represent mild and/or non-aggressive conditions for concrete or steel piles are specified. The values adopted for initial screening (<5,000 mg/kg sulfate, pH >5 and <5,000 mg/kg chloride) are the most conservative of those reported in AS 2159 for concrete and steel piles and are considered to be associated with mild or non-aggressive conditions only where all objectives are met.

Aesthetics

The Land SEPP states that contamination must not cause the land to be offensive to the senses of human beings. Aesthetic issues may include: discoloured soil (stained from spills), solid inert waste (bricks, glass, steel, polyvinylchloride [PVC], etc.); fill with waste (demolition rubble, ash, coke, black carbon, foundry slag, etc.) and offensive odours.

Production of food, flora and fibre

The Land SEPP defers to the levels referenced in the Australian and New Zealand Food Authority Standards Codes for assessing the production of food, flora and fibre at a site. In this case, the Auditor has used the EILs (which are the most sensitive investigation level) as an initial screening level.

7.1.3 Considerations

For a contaminant concentration in soil to be considered acceptable for the respective land-use criteria, the data set must conform to the following requirements, as adopted by NEPC (2013):

- the 95% upper confidence limit (UCL) of the arithmetic mean of analytical results is below the site criteria;
- the arithmetic (or geometric in cases where the data is log normally distributed) mean is below the site criteria;
- the standard deviation is less than 50% of the site criteria; and
- no single sample analytical result is greater than 250% of the site criteria.

7.2 Groundwater

7.2.1 Beneficial uses to be protected and their criteria

The State Environment Protection Policy (SEPP) - Waters (2018) provides the framework for the protection of groundwater and associated beneficial uses throughout Victoria. The policy allows for a consistent approach to the prevention of contamination of groundwater and clean-up of pollution of groundwater and sets environmental quality indicators and objectives for each beneficial use. The SEPP Waters defines certain aquifer categories based on salinity reported as total dissolved salts (TDS) and associated beneficial uses to be protected. The most sensitive beneficial uses of groundwater being considered for this site is Segment B (Table 13).

For this site, the nearest significant receiving water ecosystem is Elster Creek located approximately 450 m south-west of the site.

Based on SEPP Waters (2018) and ASC NEPM (2013), in order to protect the beneficial uses associated with Segment B (relevant to this site), the following beneficial uses should be referred to and are described in Table 14.

Table 13: Protected Beneficial use of groundwater – Segment B

Beneficial use	Segment (mg/L TDS)						
	A1 (0-600)	A2 (601-1,200)	B (1,201-3,100)	C (3,101-5,400)	D (5,401-7,100)	E (7,101 - 10,000)	F (>10,000)
Water dependent ecosystems and species	✓	✓	✓	✓	✓	✓	✓
Potable water supply (desirable)	✓						
Potable water supply (acceptable)		✓					
Potable mineral water supply	✓	✓	✓	✓			
Agricultural and irrigation (irrigation)	✓	✓	✓				
Agricultural and irrigation (stock watering)	✓	✓	✓	✓	✓	✓	
Industrial and commercial	✓	✓	✓	✓	✓		
Water based recreation (PCR)	✓	✓	✓	✓	✓	✓	✓
Traditional Owner cultural values	✓	✓	✓	✓	✓	✓	✓
Cultural and spiritual values	✓	✓	✓	✓	✓	✓	✓
Buildings and structures	✓	✓	✓	✓	✓	✓	✓
Geothermal properties	✓	✓	✓	✓	✓	✓	✓

Table 14: Protected beneficial uses and assessment criteria of groundwater

Beneficial Use	Assessment Criteria
Water Dependent ecosystems and species	The SEPP Waters (2018) specifies Elster Creek falls under the 'Urban' rivers and streams segment, which identifies the waters as being *highly modified.* Where the SEPP does not specify contamination limits, the levels indicated in ANZG (2018) for 95% species protection (freshwater) has been applied as a conservative measure.
Potable mineral water supply	This beneficial use relates to the use of groundwater that is contributing to water in a potable mineral spring. The SEPP Waters (2018) specifies water quality indicator levels in groundwater should be less than the levels specified in the Australian Food Standards Code (1987) Standard 08 Mineral Water.

Beneficial Use	Assessment Criteria
Irrigation	This beneficial use relates to the extraction of groundwater for irrigation purposes (for watering crops, and plants in parks and gardens). The SEPP specifies water quality indicator levels in groundwater should be less than the levels specified in Section 4.2 of ANZECC/ ARMCANZ (2000) for "irrigation and general water use". The Environmental Auditor also notes that where ANZECC/ ARMCANZ (2000) does not have investigation levels for this beneficial use, then investigation levels in Table 5.1 of ANZECC (1992) can be used.
Stock watering	Those specified for livestock watering in ANZECC/ ARMCANZ (2000), defaulting to NHMRC/ NRMMC (2011) in the absence of criteria. Furthermore, the ANZECC/ ARMCANZ (2000) guidelines have been superseded by ANZG (2018) but these guidelines have not been revised.
Industrial and commercial water use	No trigger levels for industrial water quality have been adopted given the wide range of possible industrial uses of water. This beneficial use is generally assessed when an existing, proposed or likely industrial use is known. Groundwater TDS, pH, sulfate, chloride are some indicators that may be used in establishing the inherent capability of groundwater for industrial applications. For the purpose of this report, groundwater objectives for other uses are expected to be protective of this beneficial use.
Water-based recreation (primary contact recreation)	Those specified in NHMRC/ NRMMC (2008 and 2011) including adjusting criteria for non-volatile chemicals to account for lower exposure rates (100-200 mL/day for recreation compared to 2 L/day for drinking). The recent ANZG (2018) guideline values have not been revised at time of reporting.
Traditional Owner cultural values	Protecting water quality to ensure that Traditional Owner culture practices can continue. The SEPP Waters (2018) does not provide any specific environmental quality indicators or objectives for the Traditional Owner cultural values. The ANZG (2018) guidance recommends testing for other cultural values, particularly aquatic ecosystems, which can subsequently support the protection of water quality components of Traditional Owner cultural values.
Cultural and spiritual values	Ensuring water quality is suitable for communities aimed at culture values and spiritual needs. The SEPP (2018) does not provide any specific environmental quality indicators or objectives for the Traditional Owner cultural values. The ANZG (2018) guidance recommends testing for other cultural values, particularly aquatic ecosystems.
Buildings and structures	The SEPP (2018) specifies that contamination shall not cause groundwater to become corrosive to structures or building materials. As stated, pH, sulfate and redox potential are the relevant indicators when assessing this beneficial use.
Geothermal properties	The SEPP (2018) specifies that no activity must affect the geothermal properties of groundwater and specific indicators include temperatures between 30-70°C.

7.2.2 Environmental Auditor review of groundwater assessment criteria

The Environmental Auditor is generally satisfied that the assessor has adequately defined the regulatory framework for groundwater assessment. Where guideline values were not provided by the Assessor, the Auditor has made an assessment against relevant guideline values.

7.2.3 Other considerations

Prior to assessing whether a beneficial use is relevant at a site, several considerations should be made. Firstly, EPA Victoria may determine that these beneficial uses do not apply to groundwater when:

- there is insufficient yield;
- the background/ natural levels of water quality indicators other than TDS (e.g. such as nitrate) precludes a beneficial use;
- the soil characteristics preclude a beneficial use; and
- EPA Victoria has identified that the site is within a groundwater quality restricted use zone (GQRUZ).

In addition, any assessment of the likelihood of beneficial uses of groundwater being realised should be based on an evaluation of whether an owner/ occupier of the site (or in the vicinity of the site) may reasonably expect to use or be able to use groundwater for the relevant purposes.

The current land use is unlikely to allow for any groundwater extraction. Based on the registered groundwater bore search, groundwater is not used as a resource, down-gradient of the site.

7.3 Surface water

No surface water bodies are located on the site or in its immediate vicinity. In addition, there are unlikely to be any in the future. As such, the Environmental Auditor has not considered this environmental aspect in detail further.

7.4 Air

Ambient air is a segment of the environment that requires protection as a beneficial use at the site. In Victoria, the State Environment Protection Policy (SEPP) Ambient Air Quality (1999) defines the air quality goals for the state, whilst the SEPP Air Quality Management (2001) outlines the framework for managing emissions to air from pollution sources, including vapour emissions or odours derived from soil and/or groundwater at or in the vicinity of the site.

The NEPM (2013) and CRC CARE (2011) Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater (Technical Report 10) contains HSLs for BTEXN and TPH fractions for soil vapour, and for vapour intrusion from groundwater.

The NEPM (2013) also includes interim soil vapour Health Investigation Levels (HILs) for selected volatile chlorinated organic compounds, including:

- tetrachloroethylene (PCE);
- trichloroethylene (TCE);

- cis-1,2-dichloroethylene (DCE);
- 1,1,1-trichloroethane (1,1,1-TCA); and
- vinyl chloride (VC).

In the absence of published HSLs for vapour intrusion from groundwater and/or soil for other VOC in the NEPM (2013), Part 9 of Schedule B2 of NEPM (2013) outlines the vapour intrusion assessment framework where:

- as a preliminary screening measure, the potential for a vapour intrusion risk should be considered when the Henry's Law Constant for a substance is greater than 10^5 atm/ m^3/ mol and its vapour pressure is > 1 mm Hg at room temperature.

Parameters used in the preliminary screening measure for PCE vapour intrusion risk from groundwater are outlined in Section 8.3. The Johnson & Ettinger model was used as a preliminary screening measure based on guidance in Schedule B2 of NEPM (2013), which refers to the New Jersey Department of Environmental Regulation Vapor Intrusion Guidance (2005, updated January 2013, viewed at ww.nj.gov/dep/srp/guidance/vaporintrusion/vig.htm).

7.5 Environmental Auditors conclusion on assessment criteria

The Environmental Auditor is satisfied that the Assessor has adequately defined the regulatory framework. In addition, the Environmental Auditor is of the opinion that the Assessor has adopted appropriate guidelines for the assessment of contaminants in soil and groundwater beneath the site.

8 ENVIRONMENTAL AUDIT FINDINGS

This Section summarises the Environmental Auditor's assessment of the significance of the levels of contamination reported at the site by the Assessor.

8.1 Soil

8.1.1 Soil stratigraphy and field observations

Fill material was observed up to 1.2 mbgl and generally consisted of brown/grey/black sands, silts, clays and gravels. Anthropogenic materials including crushed bluestone, slate, ash, charcoal, brick, concrete and glass fragments were observed. The fill was dry to moist.

PID readings were generally low and did not indicate presence of volatile contamination. Further, no odours or visual indicators of gross soil contamination were observed. A slight hydrocarbon odour in fill material containing ash and charcoal fragments was observed at boreholes SB05 and SB06. No other odours or visual indicators of contamination, such as staining, were observed.

The natural soil profile encountered was consistent with Brighton Group sediments and was described as a red/ brown/ orange/ grey mottled clay or sandy clay with gravelly lenses. The natural soil profile was generally moist. No odours, staining or elevated PID readings were recorded. The underlying Newport Formation was interpreted to have been encountered at 18-19 mbgl, described as a grey clayey silt.

8.1.2 Soil laboratory analytical results

Table 15 summarises the chemical exceedances in soil. The presence of metals above investigation levels (nickel, lead and zinc) are attributed to the fill material. Elevated BaP is likely associated with ash/ charcoal also observed in fill material. Further discussion on the significance of these results is provided below.

Table 15: Summary of chemical exceedances in soil

Chemical	Sample ID	Concentration (mg/kg)	Exceedances
Ecological			
Nickel	BH02_0.3	110	EIL urban residential (100)
	BH09_0.2	130	
Lead	QS04 (SB06_0.8-0.9)	1,290	EIL urban residential (1,100)
Zinc	BH05_0.2	710	EIL urban residential (380) EIL commercial/ industrial (570)
	BH09_0.9	750	
	QS04 (SB06_0.8-0.9)	1,060	
Health			
Lead	BH04_0.2	590	HIL-A (300)
	SB01_0.55-0.65	961	
	SB03_0.15-0.25	501	
	SB06_0.8-0.9	330	
	QS04 (SB06_0.8-0.9)	1,290	HIL-A (300) HIL-B (1,100)
BaP TEQ	BH04_0.2	12	HIL-A (3) HIL-B (4) HIL-C (3)
	BH05_0.2	28	
	SB03_0.15-0.25	9.3	
	QS05 (SB06_0.8-0.9)	7.2	
	QS04 (SB06_0.8-0.9)	4.6	

A statistical review of the results from the fill material which exceeded the site criteria was undertaken by the Environmental Auditor. The findings are summarised in Table 16, while the ProUCL outputs are provided in Appendix E. The review takes into consideration the statistical requirements already presented in Section 7.1.3 of this Environmental Audit Report. These considerations are that:

- the level of any contaminant at a discrete location should not exceed the site criteria adopted for assessing human health by more than 250%;
- the standard deviation should be less than 50% of the site criteria adopted for assessing human health; and
- the 95% upper confidence limit (UCL) (and mean) should not exceed the site criteria adopted for assessing human health.

Table 16: Statistical appraisal for soil

Chemical	Number of samples	Mean	Standard deviation	Maximum	95% UCL	Investigation levels
Nickel	20	31	47	130	77	EIL urban residential (100)
Lead	20	235	353	1,290	481	HIL-A (300) HIL-B (1,200) EIL urban residential (1,100)
Zinc	20	205	290	1,060	369	EIL urban residential (380) EIL commercial/ industrial (570)
BaP TEQ	21	3.9	6.3	28	9.9	HILA (3) HILB (4) HILC (3)

Note: where results are below the laboratory LOR, the LOR has been used for calculations.

The findings are summarised below for the fill samples across the site:

- nickel: of the 20 fill samples analysed, nickel exceeded the EIL in two samples. The statistical appraisal found that the 95% UCL for fill across the site is less than the EIL;
- lead: of the 20 fill samples analysed, lead exceeded the EIL in one sample, HIL-A in five samples, and HIL-B in one sample. The statistical appraisal found that the 95% UCL for fill across the site is less than the EIL and HIL-B, however is greater than HIL-A;
- zinc: of the 20 fill samples analysed, zinc exceeded the EIL in three samples. The statistical appraisal found that the 95% UCL for fill across the site is less than the EIL, however the standard deviation (SD) is greater than 50% of the EILs and the maximum is above 250% the EIL (urban residential);

- benzo(a)pyrene (BaP) toxicity equivalence quotient (TEQ): of the 21 fill samples analysed, BaP TEQ exceeded HIL-A, HIL-C and HIL-B in five of those samples. The statistical appraisal found that the 95% UCL for fill across the site is greater than HIL-A, HIL-B and HIL-C.

Under the existing and proposed land-use and development (i.e. ~100% pavement coverage), there is little to no exposure pathway to human or environmental receptors (other than maintenance or building workers). In addition, there are limited environmental values that require consideration. Based on this, the chronic lifetime risk posed by zinc and BaP concentrations in soil are considered acceptable, as long as the site remains covered by hardstand.

Leachability results

Select samples were submitted for leachability testing based on the Australian Standard Leaching Procedure (ASLP), with results summarised in Table 17. Leachable concentrations of lead, zinc and BaP were low, indicating that mobility via rainwater is likely to be minimal and any amount leached to be sorbed to the underlying clay and therefore unlikely reach groundwater. Further, given the leachability and aged contamination source (fill), these concentrations are unlikely to present a risk to humans or the ecosystem due to low bioavailability.

Table 17: Leachability results

Chemical	Sample	Total concentration (mg/kg)	Leachable concentration (mg/L)	Leachable percentage (%)
Zinc	BH09/0.9	750	5	13
BaP	BH08/0.5	0.9	<0.001	<2
Lead	BH08/0.5	97	0.09	2
	BH09/0.9	250	0.21	2
	BH10/0.2	140	0.50	7
	BH10/1.4	23	0.06	5

PAH source analysis findings

An assessment of the likely source and the chemical form of the PAHs in fill across the site was undertaken by the Environmental Auditor (by comparing contaminant concentrations to those of known sources of PAHs using the "PAH Source Analyser" modelling tool – available online at www.pahsourceanalysist.com). The findings are presented in Appendix F. The findings of the assessment were that the likely source of PAH in fill was predominantly ash from black or brown coal and coke, consistent with the field observations. A high correlation with both coal tar and ash was found for samples QS04 and QS05.

Overall, this finding supports the leachability results and the conclusions that these chemicals have low mobility and low bioavailability.

8.2 Groundwater

8.2.1 Hydrogeology and potentiometric surface

The findings related to hydrogeology, potentiometric surface and flow direction are summarised below:

- Due to the drilling method used (washbore), the depth of groundwater encountered was not observed during drilling. Based on SWLs measured following bore installation, groundwater is present in a clayey sand layer of the Brighton Group, generally with a sandy clay layer above.
- Water levels are generally consistent over time and relative to each other, ranging between 2.21 and 2.46 mAHD or 8.8 to 10.3 mbgl, except for one anomalous result of 1.13 mAHD at bore BH02 in July 2019 (likely human error).
- Groundwater flow direction is inferred in a south-westerly direction (see Figure 4).

8.2.2 Field chemistry

The findings related to groundwater field chemistry are summarised below:

- Redox was mildly negative, ranging between -125 to 15 mV during November and December 2018 sampling, while it was positive in July 2019, ranging between 63 to 83 mV;
- Electrical conductivity (EC) ranged between 2,520 and 3,848 µS/cm, and correlated well with the measured TDS, classifying the groundwater as Segment B. The EC was also consistent across the site and over the three sampling events; and
- pH was slightly acidic to neutral, ranging between 5.75 and 7.32.

8.2.3 Hydro-geochemistry

The hydro-geochemistry was consistent across the site and over the three sampling rounds, and can be described as Na-Cl(HCO_3)>Mg/Ca-SO_4. Na/Cl ratios are generally close to or less then 1, indicating a reasonably recent/nearby recharge source.

Elevated nitrate concentrations suggest availability of nitrate as an electron acceptor for microbial respiration. Dissolved iron and manganese concentrations in groundwater were generally elevated associated with the dissolution of iron and manganese oxides from the aquifer matrix, indicating microbial activity, likely associated with the biodegradation of chlorinated solvents detected.

8.2.4 Groundwater laboratory analytical results

Table 18 summarises the current groundwater analytical results which includes exceedances of guidelines and their source (naturally occurring, sourced from site, upgradient source or representative of regional pollution). Complete groundwater results as prepared by the Assessor are also provided in the Tables Section.

Table 18: Summary of current groundwater results

Contaminant	Concentration range (µg/L)		Guideline values exceeded (µg/L)					
	Brighton Group (~9 mbgl)							
	Off-site/ up-gradient (BH01)	On-site/ down-gradient (BH02, BH03, BH05)	Water dependent ecosystems and species	Agriculture and irrigation (irrigation)	Agriculture and irrigation (stock watering)	Industrial and commercial	Water-based recreation (PCR)	Buildings and structures
Analytes considered by the auditor to be natural and hence not pollution								
pH	6.4	6.3-7.7	-	-	-	-	6.5-8.5	-
Cu	<1	<1-3	1.4	-	-	-	-	-
Fe	<50	<50-380	-	200	-	80	300 (aesthetic)	-
Mn	<5	370-1,900	1,900	200	200	-	5,000	-
Zn	<5	35-71	61	-	-	-	-	-
Na	660,000	660,000-700,000	-	460,000	-	-	180,000 (aesthetic)	-
Cl	660,000	810,000-900,000	-	700,000	-	-	250,000 (aesthetic)	-
HCO_3	512,000	475,000-670,000	-	-	-	140,000	-	-
Analytes considered by the auditor to be representative of regional pollution								
NO_3 (as NO_3)	84,000	20,000-58,000	10,600	20,000	-	-	-	-
Analytes considered by the auditor to be from an upgradient source								
PCE	53	24-41	-	-	50	-	50	-

The pH, sodium, chloride and bicarbonate, which exceeded recreational and/ or industrial/ commercial criteria are considered representative of natural groundwater conditions.

Aluminium was reported above ecosystem criteria in bore BH03 in December 2018 (0.06 mg/L). This is considered to be a false positive, as the pH is 7.7. Aluminium concentration at the subsequent sampling round (July 2019) was below the laboratory LOR (<0.05 mg/L).

Iron and manganese exceed several criteria. The elevated concentrations are attributed to microbial respiration and dissolution of iron and manganese oxides from the aquifer matrix.

Copper and zinc exceed the adopted ecosystem criteria. These are considered to be representative of natural groundwater conditions.

Ammonia exceeded recreational (aesthetic) criteria (0.5 mg/L) at bore BH02 in December 2018 (0.54 mg/L). The subsequent monitoring round (July 2019) was below the adopted guideline value (0.02 mg/L).

Nitrate concentrations exceeded criteria for irrigation and ecosystems, with the highest concentrations present at up-gradient bore BH01. Nitrate is likely sourced from urban sewers and septics, use of nitrogen fertilisers in gardens (particularly fruit trees), historical agricultural nutrient addition or addition of nitrate for bioremediation of former service stations up-gradient of the site. The increase in nitrate concentrations in July 2019 were reviewed and are attributed to a change in redox conditions in groundwater from negative to positive (also coincident with a reduction in ammonia).

PCE exceeded stock and recreational criteria at bore BH01. Bore BH01 is an off-site bore and is representative of up-gradient groundwater conditions. Onsite concentrations of PCE do not exceed criteria during the last sampling round, however concentrations of PCE at bore BH02 exceeded criteria during the December 2018 sampling round (but not the most recent). Nevertheless, it is possible that PCE concentrations in groundwater elsewhere on-site (i.e. north-eastern corner) exceed the adopted criteria for stock watering and recreational use, and hence the potential risks are further discussed in Section 10.

8.3 Vapour

Soil vapour results from the three sub slab vapour pins installed found detectable levels of TRH C_6-C_{10}, BTEX, trimethylbenzenes, propane, chloroform, PCE, methyl ethyl ketone, 2-hexanone, acetone, ethanol and isopropanol. Concentrations were below the adopted criteria, indicating that volatile organic compounds (VOCs) are unlikely to present a vapour risk under the current site setting. As the proposed development has the potential to include a basement to 9 mbgl, and due to the presence of VOCs in groundwater (PCE), further consideration to potential vapour risks has been made. This includes the worst-case scenario where the basement will be in contact with groundwater.

The maximum PCE concentration in groundwater has been modelled to assess vapour intrusion risks based on US EPA (2004) and Johnson and Ettinger (1991). The output of this modelling has been provided in Appendix G and summarised in Table 19.

The parameters used to construct the models include two scenarios, one based on the current site layout (slab on grade) and one based on the maximum proposed basement depth of 9 m, with a 9 m deep water-table. In addition, for conservatism, the planned ground

floor commercial/ retail space or attenuation between the three-level basement as well as mechanical extraction has not been factored into the calculations presented in this report. As the hazard index (HI) is <1 and the increased lifetime cancer risk (ILCR) is less than the nominated threshold of 1.0E-05 (as per NEPC 2013, Schedule B4, Section 6.5.2, p58), the risk can be assessed as being acceptable.

In addition, the vapour intrusion model calculates that the allowable PCE concentration in groundwater beneath the site under the worst-case scenario of a 9 m deep basement at the water-table, is 9,030 µg/L (compared to a maximum detected concentration of 50 µg/L).

In summary, it is the Auditors assessment that all potential current and future on-site receptors via the vapour intrusion pathway are protected by current soil, soil vapour and groundwater concentrations (and future groundwater concentrations up to 9,030 µg/L), with concentrations of VOCs in these media expected to continue to decline over time.

Table 19: Hazard index (HI) and increased lifetime cancer risk (ILCR) for PCE in groundwater

Chemical (concentration)	Scenario	HI	ILCR
PCE (57 µg/L)	Slab on grade	0.00586	2.26E-08
	Three-level basement	0.00631	2.44E-08
Acceptable level	-	<1	1E-05

9 SUMMARY OF RISK POSED BY THE CONDITION OF THE SITE

9.1 Source pathway receptor linkages

A discussion of the sources, potential receptors and pathways of the contaminants is presented below and illustrated on Figure 5.

9.1.1 Contaminants and source

The contaminants identified at the site and their likely sources are outlined below:

- Heavy metals (lead, zinc) and BaP in fill.
- Nitrate in groundwater associated with urban sewers and septics, urban use of nitrogen fertilisers in gardens (particularly fruit trees), historical agricultural nutrient addition or addition of nitrate for bioremediation of former service stations up-gradient of the site.
- PCE in groundwater (offsite up-gradient) of the site from former laundries/ dry cleaning premises.

9.1.2 Potential pathways

The potential pathways for exposure of receptors to the identified contaminants include:

- exposure to contaminated fill via dermal contact, ingestion or dust inhalation;
- exposure to contaminants in abstracted groundwater; and
- volatilisation (i.e. inhalation) of volatile chemicals from groundwater.

A discussion of the contamination status of the site and whether it precludes any beneficial use of the site (considering the conceptual site model) is presented below.

9.1.3 Potential receptors

The potential receptors of contaminants beneath the site include the following:

- future occupiers (when the site is developed for mixed uses, the most sensitive being for a high density residential);
- site workers (during construction works and development of the site);
- maintenance workers conducting intrusive works (i.e. in utilities, landscaped garden beds etc.);
- groundwater bore users for various uses; and
- recreational users and the ecosystems of Elster Creek.

9.2 Risk to beneficial uses of land

The site is proposed for high density residential and commercial use, therefore characterised as a 'sensitive use': high density (in accordance with SEPP Land). However, in order to issue the site with a Certificate of Environmental Audit, the Environmental Auditor must be satisfied that the site is suitable for any future land-use. A review of the condition of the land (at the time of the completion of the Environmental Audit) with respect to the protected beneficial uses is presented below.

9.2.1 Maintenance of ecosystems (natural, modified and highly modified)

Natural ecosystems

Concentrations of metals exceeded the EIL for areas of ecological significance. While this land-use is highly unlikely to be realised at the site, the beneficial use maintenance of ecosystems is precluded for parks and reserves.

Modified ecosystems

Concentrations of zinc across the site exceeded the EILs for urban residential and public open space. The zinc is attributed to the fill material at the site. Under the current and

proposed land use/ development, there are limited environmental values that require consideration and there is no complete exposure pathway to environmental receptors.

The Environmental Auditor concludes that the beneficial use "maintenance of ecosystems" is precluded under sensitive (residential) and recreation/ open space land-uses. However, use of the site for high density residential is considered suitable following Statement of Environmental Audit (SoEA) conditions described in Section 11.2.2 below.

Highly modified ecosystems

No concentrations of contaminants of potential concern were reported at levels above the EILs for commercial and industrial use. The Environmental Auditor concludes that the beneficial use "maintenance of ecosystems" is protected for commercial and industrial land-use.

9.2.2 Human health

Concentrations of BaP and lead were reported at levels above the adopted investigation levels for assessing the beneficial use "human health" in a sensitive (low- and medium-density) land-use scenario (NEPC, 2013 for HIL-A). The Environmental Auditor concludes that the beneficial use of "human health" is precluded under a sensitive (low- and medium-density) land-use scenario.

Concentrations of BaP were also reported at levels above the adopted investigation levels for assessing the beneficial use "human health" in a sensitive (high density) and recreational/ open space land-use scenario (NEPC, 2013 for HIL-B and HIL-C). The Environmental Auditor concludes that the beneficial use of "human health" is precluded under these land-use scenarios. However, use of the site for high density residential is considered suitable following Statement (SoEA) conditions described in Section 11.2.2 below.

9.2.3 Buildings and structures

Soil lab pH analysis was conducted on 17 samples at the site, with a range of 6.4 to 9.7. The soil pH generally indicates neutral to alkaline conditions. Sulfate analysis was conducted on 12 samples at the site with a maximum concentration of 170 mg/kg. Based on the soil pH and sulfate concentrations, the soils are considered to be non-aggressive to concrete and steel structures (Standards Australia, 2009 and 2011).

The Environmental Auditor considers that the beneficial use of "buildings and structures" is protected under all land-use scenarios (including the most sensitive use).

9.2.4 Aesthetics

There are quantities of anthropogenic waste (crushed bluestone, slate, ash, charcoal, brick, concrete and glass fragments) present in fill. The quantities are considered to be acceptable under high density residential and commercial land-uses. However, the presence of fill could pose an aesthetic issue under more sensitive residential or recreational/ open space land-uses where there is exposed soil.

Based on this, the Environmental Auditor considers aesthetics to be protected under high density residential and commercial land-uses. 'Aesthetics' is considered to be a precluded

beneficial use under other land-uses (low and medium density residential, parks and reserves and recreational open space).

9.2.5 Production of food, flora and fibre

Concentrations of zinc are present at levels above the adopted site criteria for assessing the beneficial use "production of food, flora and fibre" (NEPC, 2013 EIL). As such, the Environmental Auditor concludes that the production of food, flora and fibre is a precluded beneficial use of land at the site. Furthermore, the use of the site for the production of food, flora and fibre is not compatible with the proposed land-use and Statement conditions.

9.3 Risk to beneficial uses of groundwater

Groundwater beneath the site is classified as Segment B in accordance with SEPP Waters (2018). Each beneficial use (and whether or not they have been precluded at the site by groundwater contamination) is considered below.

9.3.1 Water dependent ecosystems and species

Groundwater beneath the site needs to consider water dependant ecosystems and species (WDES) as a beneficial use. The nearest significant receiving water is Elster Creek located approximately 450 m south-west of the site.

Cu, Mn and Zn exceeded ecosystem criteria and are considered to be naturally occurring. Concentrations of Mn are attributed to microbial respiration and dissolution from the aquifer matrix. Copper and zinc are considered to be representative of natural groundwater conditions.

Nitrate concentrations exceeded the adopted criteria for WDES, with the highest concentration reported at up-gradient bore BH01. Nitrate is likely sourced from urban septics, use of nitrogen fertilisers in gardens (particularly fruit trees), historical agricultural nutrient addition, and/ or leaking sewers (common and consistent with many urban areas). Elevated nitrate may also be a result of chemical injection for bioremediation of former service stations up-gradient of the site.

The Auditor considers that the beneficial use "water dependent ecosystems and species" is **precluded** by the site, due to the regional elevation of nitrate.

9.3.2 Potable mineral water

While potable mineral water supply is a protected beneficial use at the site based on measured TDS concentrations, the site is not located within or in the vicinity of a mineral spring area. Also, groundwater is not likely to discharge into such an area. Based on this, this beneficial use is **not relevant** and does not require further consideration.

9.3.3 Agriculture and irrigation (irrigation)

Whilst concentrations of Na and Cl are above criteria, levels are consistent with regional conditions and considered to be naturally occurring, and therefore do not represent pollution.

Elevated concentrations of Fe and Mn are also present and are attributed to natural (microbial respiration) processes occurring at the site.

Concentrations of nitrate are present in groundwater at the site in excess of the adopted criteria for assessing the beneficial use agriculture and irrigation (irrigation). Nitrate is considered to be an off-site source, representative of regional pollution.

Given the proposed commercial/ high density residential land use, surrounding land uses and that reticulated water is widely used for irrigation throughout Victoria, this beneficial use is unlikely to be realised. There are two registered irrigation bores located within 2 km of the site (WRK042499, 1.1 km north at 63 mBGL and WRK047161, 1.8 km north-east at 80 mBGL). Neither of these bores are receptors of groundwater from the site.

The Auditor considers that the beneficial use "agriculture and irrigation (irrigation)" is **precluded** at the site (however is unlikely to be realised).

9.3.4 Agriculture and irrigation (stock watering)

Concentrations of Mn exceed stock watering criteria and are attributed to natural (microbial respiration) processes occurring at the site.

Concentrations of PCE are present at off-site/ up-gradient bore BH01, which exceeds the adopted criteria for stock watering. PCE is considered to be from an off-site source.

The closest abstraction bores registered for domestic/ stock use are located approximately 400 m south-east (WRK091607) and 730 m north-west (88682) of site. Based on the inferred groundwater flow direction (south-west from site) and installation depth, these bores are not considered to be a receptor of groundwater from the site. Based on the current land zoning of the site and broader area, it is unlikely that an abstraction bore will be installed for stock watering use.

The Auditor considers that the beneficial use "agriculture and irrigation (stock watering)" is **precluded** at the site (however is unlikely to be realised).

9.3.5 Industrial and commercial

Concentrations of HCO_3 exceeding adopted criteria are consistent with regional conditions and considered to be naturally occurring, thus do not represent pollution at site. Concentrations of Fe also exceed industrial use criteria and are attributed to natural (microbial respiration) processes occurring at the site.

Investigation levels for industrial and commercial water quality are limited, given the wide range of possible industrial uses of water, and for the purpose of the Audit, groundwater objectives for other uses are expected to be protective of this beneficial use. Nevertheless, the concentrations of PCE are likely to preclude the beneficial use of "industrial and commercial", if relevant.

The abstraction of groundwater from bores in the uppermost water bearing zone is unlikely to be attempted in an area where reticulated water is readily available and the naturally occurring concentrations of ions are unlikely to be suitable for industrial water use. Furthermore, the yield and available drawdown are unlikely to be conducive to extracting

large volumes of groundwater. Therefore, industrial abstraction in the area is not considered likely.

One bore is registered for industrial purposes, located approximately 860 m south-east of the site and is installed to a depth of 54 m, in a different aquifer highly unlikely to be impacted by contamination in the uppermost water bearing zone. Based on the inferred groundwater flow direction (south-west from site) and installation depth this bore is not considered to be a receptor of groundwater from the site.

The Auditor considers that the beneficial use "industrial and commercial" is **precluded** (however unlikely to be realised).

9.3.6 Water-based recreation (primary contact recreation)

Whilst concentrations of pH, Na and Cl exceed adopted criteria for PCR, the concentrations are consistent with regional conditions and are considered to be naturally occurring, thus do not represent pollution. Elevated concentrations of Fe and Mn are also present on-site and are attributed to natural (microbial respiration) processes.

Concentrations of PCE are present at off-site/ up-gradient bore BH01 which exceed the adopted criteria for assessing the beneficial use primary contact recreation. PCE is considered to be sourced from an off-site source.

Based on the high density residential and commercial land uses in the vicinity of the site, low aquifer yield potential, and the site being located in a mains water supply area, groundwater down-gradient of the site is unlikely to be used as a resource in the near future. Therefore, groundwater beneath the site is unlikely to be used for water based recreation (such as filling swimming pools).

The closest abstraction bores registered for domestic/ stock use are located approximately 400 m south-east (WRK091607) and 730 m north-west (88682). Based on the inferred groundwater flow direction (south-west from site) and installation depth, these bores are not considered to be a receptor of groundwater from the site.

Due to the presence of PCE above adopted criteria, the Auditor considers that the beneficial use water-based recreation (primary contact recreation) is **precluded** at the site (however is unlikely to be realised).

9.3.7 Traditional Owner cultural values

In the absence of specific guideline values, the ANZG (2018) guidance recommends testing for other cultural values, particularly aquatic ecosystems, which can subsequently support the protection of water quality components of Traditional Owner cultural values. Based on the concentrations of nitrate exceeding water dependant ecosystems criteria, the Auditor considers that the beneficial use "Traditional Owner cultural values" to be **precluded**. Due to the modified nature of the discharge location (Elster Creek) and its distance from the site (450 m), this beneficial use is unlikely to be realised.

9.3.8 Cultural and spiritual values

In the absence of specific guideline values, the ANZG (2018) guidance recommends testing for other cultural values, particularly aquatic ecosystems, which can subsequently support the protection of water quality components of cultural and spiritual values. Based on the concentrations of nitrate exceeding water dependant ecosystems criteria, the Auditor considers that the beneficial use "cultural and spiritual values" to be **precluded**. Due to the modified nature of the discharge location (Elster Creek) and its distance from the site (450 m), this beneficial use is unlikely to be realised.

9.3.9 Buildings and structures

All groundwater beneath the site needs to consider contact with buildings and structures as a potential beneficial use. The depth of groundwater occurrence is approximately 9-10 mBGL. Based on the potential for the construction of a three-level basement extending to approximately 9 mBGL, buildings and structures are likely to intercept groundwater.

The pH, sulfate and chloride concentrations were assessed against Standards Australia (2009) and are considered to be non-aggressive to concrete and steel structures.

The Auditor considers that the beneficial use "buildings and structures" is **protected**.

9.3.10 Geothermal properties

While geothermal properties is a protected beneficial use at the site based on measured TDS concentrations, the site is not located within a designated geothermal area or where the temperatures range between 30 to 70ºC. Also, groundwater is not likely to discharge into such an area. Based on this, this beneficial use is **not relevant** and does not require further consideration.

9.3.11 Summary of protected beneficial uses precluded by polluted groundwater

Following the above discussion, a summary of the precluded beneficial uses at the site is provided in Table 20.

Table 20: Precluded beneficial use summary

Beneficial Use	Precluded	Contaminant(s)
Water dependent ecosystems and species	Yes	Cu (n), Mn (n), Zn (n), NO_3 (b)
Potable and Mineral water	Not relevant	NA
Agriculture and irrigation (irrigation)	Yes	Fe (n), Mn (n), Na (n), Cl (n), NO_3 (b)

Beneficial Use	Precluded	Contaminant(s)
Agriculture and irrigation (stock watering)	Yes	Mn (n), PCE (u)
Industrial and commercial	Yes	Fe (n), HCO_3 (n), PCE (u)
Water-based recreation (primary contact recreation)	Yes	pH (n), Fe (n), Mn (n), Na (n), Cl (n), PCE (u)
Traditional Owner cultural values	Yes	Cu (n), Mn (n), Zn (n), NO_3 (b)
Cultural and spiritual values	Yes	Cu (n), Mn (n), Zn (n), NO_3 (b)
Buildings and structures	No	NE
Geothermal properties	Not relevant	NA

Notes: (n) naturally occurring; (b) background/ regional pollution; (s) site source; (u) upgradient source; NA not applicable; NE no exceedance.

9.4 Risk to beneficial uses of surface water

As previously discussed, there are no surface water bodies and no extractive groundwater bores for filling surface water bodies onsite or in the immediate vicinity of the site. Nor are they proposed or likely to be introduced in the foreseeable future. As such, the protection of this environmental aspect has not been considered further by the Environmental Auditor.

9.5 Risk to beneficial uses of air

The data collected does not indicate that the beneficial uses of air is being negatively impacted by contamination at the site. Soil vapour measurements (sub-slab) and groundwater concentrations of volatile chemicals (PCE) were assessed for potential to present a vapour risk inside the proposed development (with a two- to three-level basement potentially in contact with groundwater). The findings were that the concentrations do not present an unacceptable level of risk to the beneficial uses of air under the proposed development (including basement construction).

10 CLEAN UP TO THE EXTENT PRACTICABLE

The Environmental Auditor has determined “Clean Up to the Extent Practicable” (CUTEP) in accordance with EPA Publication 759.3 (2015). In accordance with Section 13.6 of EPA Publication 759.3 (2015), EPA was notified on 11 February 2020 that the Environmental Auditor intends to determine CUTEP. The CUTEP checklist is provided in Appendix H.

As part of the Environmental Auditor determined CUTEP, the Environmental Auditor considers the following:

- The site is not the source (or likely source) of the pollution.
- Beneficial uses of the groundwater are not 'relevant'.
- Access to the site is not required to affect the only practicable clean-up options to protect surface water from the effects of groundwater pollution.

Information to support this determination and abovementioned considerations and recommendations is provided in the subsections below.

10.1 Is groundwater polluted?

Groundwater is polluted due to the presence of nitrate at concentrations which exceed the objectives for protection of the beneficial uses "water dependant ecosystems and species" and "agriculture and irrigation (irrigation)". It is also possible that PCE will be present in groundwater beneath the site at concentrations which exceed the objectives for protection of beneficial uses "agriculture and irrigation (stock watering)", "water-based recreation (primary contact recreation)" and "industrial and commercial". All other chemical concentrations in groundwater beneath and about the site (pH, Na, Cl, Fe, Mn, Cu, Zn, HCO_3) are deemed natural elevations.

10.2 Relevance of beneficial uses

The beneficial use is considered to be 'existing' if a groundwater receptor that exists is impacted by the pollution, based on the SEPP Waters (2018). The beneficial use is considered to be 'likely' if the groundwater beneath the site is used for the beneficial use or the land-uses are compatible with the beneficial use. The relevance of the beneficial uses for groundwater at the site is described in Table 21. Note that there are no groundwater extraction bores installed at the site, except for the purpose of environmental monitoring.

Table 21: Relevance of beneficial uses at the site

Beneficial Use	Relevant	Comment
Water dependent ecosystems and species	No	There are no on-site surface water receptors and the nearest surface water discharge point is Elster Creek, 450 m south-west of the site.
Potable water supply (desirable/ acceptable)	No	Not protected.
Potable mineral water supply	No	The site is not located within a known mineral water area.
Agricultural and irrigation (irrigation)	No	Given the urban setting, land zoning, availability of reticulated water supply, low yielding aquifer, and the

Beneficial Use	Relevant	Comment
Agricultural and irrigation (stock watering)	No	proposed land-use (commercial/ high density residential), these beneficial uses are not considered relevant on site.
Industrial and commercial	No	
Water based recreation (PCR)	No	Given the availability of reticulated water supply, low yielding aquifer, and the proposed land use (commercial/ high density residential with no swimming pool), this beneficial use is not considered relevant on site.
Traditional Owner cultural values	No	There are no on-site surface water receptors and the nearest surface water discharge point is Elster Creek, 450 m south-west of the site.
Cultural and spiritual values	No	
Buildings and structures	Yes	Not precluded due to pollution.
Geothermal properties	No	The site is not located within an area where groundwater has geothermal properties.

10.3 Non-source site

The elevated nitrate in groundwater is likely to be sourced from urban use of nitrogen fertilisers in gardens (particularly fruit trees), historical agricultural nutrient addition, leaking sewers/ septics and/ or addition of nitrate for bioremediation of former service stations up-gradient of the site. The elevated concentrations of PCE is likely to be sourced from an up-gradient source (former laundries/ dry cleaning or other industrial users of solvents). Concentrations of PCE at bores on-site in down-gradient locations have lower concentrations of PCE than up-gradient (bore BH01), which suggests an up-gradient source and that degradation and attenuation is taking place.

Based on the Auditor's experience, elevated nitrate in groundwater is particularly common across urbanised areas of Victoria. Table 22 summarises nitrate and PCE results of nearby audit sites which investigated groundwater. Elevated levels of nitrate and PCE have been identified in other audits in the surrounding area, consistent with the presence of off-site sources.

Remediation of groundwater at the site will have no long-term effect on the groundwater quality at the site as sources of nitrate and PCE are unknown and may be numerous.

Table 22: Regional groundwater quality

Location	Nitrate (mg/L)	PCE (µg/L)	Source as concluded in the Audit report
Investigation levels	20 (irrigation) and 10.6 (ecosystem)	50 (stock watering and PCR)	-
Site			
BH01 (up-gradient, offsite)	15-84	53-57	Up-gradient sources
BH02 (down-gradient)	0.4-20	30-52	
BH03 (down-gradient)	20-53	24-48	
BH05 (down-gradient)	32-58	11-26	
Surrounding Audit sites			
41 Horne Street (2003)	Not tested	22-25	Off-site source
19-21 Selwyn Street (2001)	140	Not tested	-

10.4 Consideration of NAPL and vapour risk

No NAPL was noted during gauging and sampling. Concentrations of dissolved volatile chemicals in groundwater were assessed for vapour intrusion risk.

There were no volatile hydrocarbons detected in soil, nor were there elevated PID readings measured during the soil assessment program. A soil vapour investigation was also undertaken and did not identify concentrations of chemicals above the adopted investigation levels.

Vapour risk is covered in further detail in Sections 8.3 and 9.5 above. The Auditor concludes that the vapour risk at the site is acceptable for the current (commercial) and proposed (high-density) land-uses, including for the current proposed building design as included in Appendix A.

10.5 Remediation options

The Environmental Auditor has considered the financial, technical and logistical considerations for clean-up of nitrate and PCE in groundwater. Table 23 provides an assessment of remediation options and their feasibility. Overall, the Environmental Auditor considers that remediation is not practicable at the site and if implemented and would not change the groundwater quality at the site or within the surrounding area.

Table 23: Remediation options table

Item	Feasibility
Technical	The Auditor is of the view that it is not feasible to identify a suitable technology to clean up polluted groundwater of unknown regional extent, with potential for multiple and numerous sources. The likely sources include an up-gradient site/s and nitrogen fertilisers in gardens (particularly fruit trees), historical agricultural nutrient addition and underground sewer and drainage services which are extensive beneath urban areas of Melbourne (and Victoria).
Financial	The Auditor is of the view that it is not possible to estimate the costs for a remediation strategy of unknown extent and timeframe and expects that the cost would likely be prohibitive.
Logistical	The Auditor is of the view that it is not feasible to implement a remediation strategy for polluted groundwater with unknown regional extent and potential for multiple and numerous sources of both PCE and nitrate.

10.6 Assessment of CUTEP

The Environmental Auditor has taken into account technical, logistical, and financial considerations in accordance with EPA Publication 840.2 and is of the opinion that it is not feasible to remove pollution from groundwater of a regional extent where the source, or sources, of pollution are unknown (and are off-site). The Environmental Auditor considers that remediation is not practicable at the site, and if implemented and would not change the groundwater quality at the site or within the surrounding area.

In accordance with Section 13.7 of the EPA Auditor Guidelines (Publication 759.3), the Environmental Auditor is satisfied that:

- the site is not the source (or likely source) of the pollution;
- precluded beneficial uses of the groundwater (i.e. groundwater dependant ecosystems, irrigation, stock watering, primary contact recreation and industrial and commercial use) at the site are not 'relevant';
- access to the site is not required to affect the only practicable clean up options to protect surface water from the effects of groundwater pollution; and
- there is no NAPL or vapour risk.

The Environmental Auditor concludes that clean up to the extent practicable of groundwater has occurred and has provided advice in the Statement of Environmental Audit contained in this report that the groundwater at the site is not suitable for the following beneficial uses:

- groundwater dependant ecosystems (including water dependent ecosystems and species, Traditional Owner cultural values, and cultural and spiritual values);
- agriculture and irrigation (irrigation);
- agriculture and irrigation (stock watering);

- water-based recreation (primary contact recreation); and
- industrial and commercial.

The Auditor considers groundwater at the site to be suitable for the following beneficial uses:

- buildings and structures.

10.7 GQMP requirement

The Auditor does not consider that a groundwater quality management plan (GQMP) is required to manage groundwater pollution at the site, given that the pollution originates from off-site sources and the identified pollution does not impact any relevant beneficial uses at the site (including human health via vapour intrusion). PCE also appears to be naturally attenuating at down-gradient bores on-site.

10.8 Groundwater quality restricted use zone (GQRUZ)

Groundwater quality restricted use zones (GQRUZ) are referred to in clause 58 of the SEPP Waters (2018). GQRUZs are areas of aquifers that have been identified by EPA where one or more beneficial uses of the groundwater are precluded by pollution. Based on the audit performed at this site, the beneficial uses of agriculture and irrigation (irrigation), agriculture and irrigation (stock watering), water-based recreation and industrial and commercial are relevant to the site and considered precluded, due to the presence of nitrate and PCE. Therefore, the Auditor recommends the Authority identify the site as a GQRUZ.

As the site is not the source for these chemicals in groundwater and the (unidentified off-site) source/s and extent of plumes has not been defined, the Auditor recommends that the boundary of the GQRUZ be placed along the boundaries of the site, with the addition of the laneway along the north-western boundary (refer to Figure 6 for proposed GQRUZ).

11 ENVIRONMENTAL AUDITOR CONCLUSION

The Environmental Auditor's conclusions on the findings of the Environmental Audit are presented below.

11.1 Environmental Audit outcome

The Environmental Auditor concludes that the site is suitable for the issue of a Statement of Environmental Audit. A copy of the Statement of Environmental Audit is attached to the Executive Summary at the start of this Environmental Audit Report.

The Statement of Environmental Audit states that (subject to conditions) the site is suitable for all beneficial uses associated with:

- high density residential;
- commercial; and
- industrial.

The conditions subject to this Statement of Environmental Audit are outlined below.

11.2 Management of residual contamination

11.2.1 Consideration of proposed future site use

The Environmental Auditor has not issued a Certificate of Environmental Audit due to the condition of the site being detrimental or potentially detrimental to one or more beneficial uses of the site.

The Environmental Auditor is of the opinion that on-going monitoring of contamination in groundwater is not required, based on the discussion provided in Section 10.7 above. The risk to the proposed land-use has been considered and deemed acceptable.

11.2.2 Conditions of the Statement of Environmental Audit

The conditions attached to the Statement of Environmental Audit are that:

1. Prior to the occupation/ commencement of the use of the site, the site must be covered with a physical barrier, such as the building slab or pavement, in accordance with the development plans for the site.

2. All physical barriers (as prescribed in condition 1 above), must be maintained on the site and if subsequently damaged or removed during development or occupation of the site, must be reinstated as soon as possible and to the same condition or better as they were prior to any disturbance.

3. If removal of the physical barrier (as prescribed in conditions 1 and 2 above) is proposed, an environmental auditor appointed under Part IXD of the Environment Protection Act

1970 ("the Act") must be engaged to conduct an environmental audit of the site under Section 53X of the Act, to consider if the barrier is no longer required.

4. Groundwater at the site is polluted and is not suitable for the use of water dependant ecosystems and species, agriculture and irrigation (irrigation and stock watering), water-based recreation (primary contact recreation) and industrial and commercial. Groundwater must not be used for any precluded beneficial use without prior testing and review of results by a suitably qualified professional to confirm its suitability for the proposed use. It may be extracted for the purpose of environmental monitoring or remediation.

5. This statement is directly referrable to and based upon the layout and construction of the development shown and described in the attached development plans (Appendix A). Any substantive change(s) to the basement extent/ depth and site coverage must be verified by an environmental auditor appointed under Part IXD of the Environment Protection Act 1970, and this verification advised in writing to EPA and the planning authority.

11.2.3 Certificate of Environmental Audit terms and conditions

Section 53Z Part 2(c) of the Environment Protection Act 1970 requires than an Environmental Audit details the "terms and conditions" that must be met before a Certificate of Environmental Audit can be issued. The terms and conditions that need to be complied with before a Certificate of Environmental Audit may be issued are set out as follows:

- identified polluted land is remediated such that all beneficial uses of land and water are restored, or it is demonstrated that all elements of land at the site do not pose an unacceptable human health and/or environmental risk through appropriate risk-based assessment.

11.2.4 Other related information

Other related information detailed in the Statement of Environmental Audit for the site includes the following:

- The auditor is satisfied that the groundwater has been cleaned up to the extent practicable and recommends the Authority identify the site as a groundwater quality restricted use zone (also known as a GQRUZ).

- Groundwater at the site is polluted with nitrate and PCE and is not suitable for the beneficial uses of water dependant ecosystems and species, agriculture and irrigation (irrigation and stock watering), water-based recreation (primary contact recreation) and industrial and commercial. The groundwater is suitable for the beneficial uses of buildings and structures.

- In accordance with clause 58(4) of the SEPP (Waters), the Authority may require periodic reassessment of the practicability of groundwater clean up.

- Groundwater monitoring bores present at the site/ installed off-site (BH01, BH02, BH03 and BH05) should be decommissioned within 12 months of cessation of use in accordance with the requirements of "Minimum Construction Requirements for Water Bores in Australia", published by the Land and Water Biodiversity Committee 2012.

- Groundwater at the site contains natural elevated concentrations of sodium, chloride, bicarbonate and metals (Cu, Fe, Mn and Zn). The levels are considered typical of the natural groundwater quality surrounding the site and do not constitute pollution in accordance with clause 17(3)(b) of State Environment Protection Policy Waters 2018.
- Groundwater at the site contains elevated concentrations of nitrate and PCE. The concentrations are considered to be associated with off-site regional sources of pollution. The pollution is not sourced from the site.
- Any groundwater extracted at the site for the purpose of dewatering, construction or control of infiltration into basements, is likely to be contaminated and will require disposal to sewer (potentially requiring pre-treatment) or a licensed treatment plant, subject to the requirements of the relevant water authority.
- Groundwater may impact on the building footings due to its natural salinity and corrosiveness potential.
- This statement of Environmental Audit (SoEA) supersedes the SoEA issued by Michael Seignior of Lloyd Consulting Pty Ltd which was provided in the Audit report titled Environmental Audit 15 Horne Street Elsternwick, Victoria and dated 16 June 2011.
- Any soil that is proposed to be removed from the site after the completion of the Environmental Audit must be tested and disposed of in accordance with EPA (June 2009) *Industrial Waste Resource Guideline 621 – Soil Hazard Categorisation and Management* (IWRG621) and to statutory requirements (or replacement publication). Also, any soil that is proposed to be imported onto the site must be IWRG621 classified “Fill Material” prior to use onsite (or replacement publication).

12 ENVIRONMENTAL EARTH SCIENCES ENVIRONMENTAL AUDIT LIMITATIONS

The site has been investigated as part of the Environmental Audit by the placement of sampling points on a systematic basis. Though the Environmental Auditor has inspected the site and viewed the data collected, the Environmental Auditor is not responsible for opinions based on work that is later found to be false or misleading. The Environmental Audit in no way implies that the site will be free from contamination after development but only that exposure of contamination to the environment or from activities on the site as a whole will not cause adverse impact.

This Environmental Audit does not conclude that all material remaining onsite, if excavated, will be classified as “Fill Material” for offsite disposal (in accordance with IWRG621 or replacement publication). As the site has been investigated on a systematic basis and validated statistically the Environmental Auditor cannot guarantee that the locations between the sampling points are not contaminated, but the site statistically, as a whole, is fit for the proposed use.

The Environmental Auditor does not conclude that commercially viable yields of food, flora and fibre can be achieved on this site. Prospective buyers who envisage this use should undertake their own investigations.

The Environmental Auditor does not make any comment regarding the geotechnical suitability of the site.

The Environmental Auditor is not responsible for any change in state of the site from the date of the Environmental Audit report, and for the compliance by site owners of any laws or regulations relating to demolition and waste disposal.

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14 ABBREVIATIONS

As	Arsenic
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure
BaP	Benzo(a)pyrene
BTEXN	Benzene, toluene, ethyl-benzene, xylenes and naphthalene
Cd	Cadmium
CoEA	Certificate of Environmental Audit
Cr	Chromium
Cu	Copper
CUTEP	Clean Up To the Extent Practicable
DCE	Dichloroethene
DSI	Detailed Site Investigation
EAR	Environmental Audit Report
EIL	Ecological Investigation Level
ESL	Ecological Screening Level
GQRUZ	Groundwater Quality Restricted Use Zone
HIL	Health Investigation Level
HSL	Health Screening Level

Hg	Mercury
LOR	Limit of Reporting
MAH	Mono-cyclic Aromatic Hydrocarbon
Mn	Manganese
NAPL	Non Aqueous Phase Liquid
NEPC	National Environment Protection Council
Ni	Nickel
OCP	Organochlorine pesticides
OPP	Organophosphorous pesticides
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCB	Polychlorinated biphenyls
PCE	Tetrachloroethene
PSI	Preliminary Site Investigation
SAQP	Sampling Analysis and Quality Plan
SoEA	Statement of Environmental Audit
SVOC	Semi Volatile Organic Compound
SO_4	Sulfate
TEQ	Toxicity Equivalent Quotient
TCE	Trichloroethylene
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
VOC	Volatile organic compounds
Zn	Zinc

15 GLOSSARY OF TERMS

The following descriptions are of terms used in the text of this report.

Acid Sulfate Soil (ASS). A soil containing iron sulfides deposited during either the Pleistocene or Holocene geological epochs (Quaternary aged) as sea levels rose and fell.

Aquifer. A rock or sediment in a formation, group of formations, or part of a formation which is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs..0.

Background. The natural level of a property.

Biodegradation. A biochemical process of microbial oxidation of complex organic compounds, to simpler chemical products. Micro-organisms derive the energy and cell carbon for growth from oxidation of organic compounds.

Bore. A hydraulic structure that facilitates the monitoring of groundwater level, collection of groundwater samples, or the extraction (or injection) of groundwater. Also known as a well, monitoring well or piezometer, although piezometers are typically of small diameter and only used for measuring the groundwater elevation or potentiometric surface.

Borehole. An uncased well drill hole.

Cation Exchange Capacity (CEC). The maximum positive charge required to balance the negative charge on colloids (clays and other charged particles). The units are milli-equivalents per 100 grams of material or centimoles of charge per kilogram of exchanger.

Clay. A soil material composed of particles finer than 0.002 mm. When used as a soil texture group such soils contain at least 35% clay.

Confined Aquifer. An aquifer that is confined between two low-permeability aquitards. The groundwater in these aquifers is usually under hydraulic pressure, i.e. its hydraulic head is above the top of the aquifer.

Confining layer. A layer with low vertical hydraulic conductivity that is stratigraphically adjacent to one or more aquifers. A confining layer is an aquitard. It may lie above or below the aquifer.

Contaminant. Generally, any chemical species introduced into the soil or water. More particularly relates to those species that render soil or water unfit for beneficial use.

Contamination. Is considered to have occurred when the concentration of a specific element or compound is established as being greater than the normally expected (or actually quantified) background concentration.

Discrete sample. Samples collected from different locations and depths that will not be composited but analysed individually.

Dissolved Oxygen (DO). Oxygen in the gaseous phase dissolved in water. Measured either as a concentration in mg/L or as a percentage of the theoretical saturation point, which

is inversely related to temperature. At 19, 20 and 21 degrees Celsius, the oxygen concentrations in mg/L corresponding to 100% saturation are 9.4, 9.2 and 9.0 respectively.

Electrical Conductivity (EC). The EC of water is a measure of its ability to conduct an electric current. This property is related to the ionic content of the sample, which is in turn a function of the total dissolved (ionisable) solids (TDS) concentration. An estimate of TDS in fresh water can be obtained by multiplying EC by 0.65.

Flow path. The direction in which groundwater is moving.

Groundwater. The water held in the pores in the ground below the water table.

Groundwater Elevation. The elevation of the groundwater surface measured relative to a specified datum such as the Australian Height Datum (mAHD) or an arbitrary survey datum onsite, or "reduced level" (mRL).

Heavy Metals. All metallic elements whose atomic mass exceeds that of calcium (20) and includes lead (Pb), copper (Cu), Zinc (Zn), cadmium (Cd), and tin (Sn).

Heterogeneous. A condition of having different characteristics in proximate locations. Non-uniform. (Opposite of homogeneous).

Horizon. An individual soil layer, based on texture and colour, which differs from those above and below.

Hydraulic Conductivity (K). A coefficient describing the rate at which water can move through a permeable medium. It has units of length per time. The units for hydraulic conductivity are typically m3/day/m2 or m/day.

Hydrocarbon. A molecule consisting of carbon and hydrogen atoms only, such as found in petroleum.

Hydrocarbon, volatile. A hydrocarbon with a low boiling point (high vapour pressure). Normally taken to mean those with ten (or less) carbon atoms per molecule.

Ions. An ion is a charged element or compound as a result of an excess or deficit of electrons. Positively charged ions are called cations, whilst negatively charged ions are called anions. Cations are written with superscript +, whilst anions use - as the superscript. The major aqueous ions are those that dominate total dissolved solids (TDS). These ions include: Cl-, SO42-, HCO3-, Na+, Ca2+, Mg2+, K+, NH4+, NO3-, NO2-, F-, PO43- and the heavy metals.

Mottled. Masses, blobs or blotches of sub-dominant, varying colours in the soil matrix.

Nodule. A small, concretionary (hard) deposit, usually of iron and/or manganese.

Organics. Chemical compounds comprising atoms of carbon, hydrogen and others (commonly oxygen, nitrogen, phosphorous, sulfur). Opposite is inorganic, referring to chemical species not containing carbon.

Oxidation. Was originally referred only to the addition of oxygen to elements. However oxidation now encompasses the broader concept of the loss of electrons by electron transfer to other ions.

Perched Groundwater. Unconfined groundwater separated from an underlying main body of groundwater by an unsaturated zone. Perched groundwater typically occurs in discontinuous, often ephemeral, lenses, with unsaturated conditions both above and below.

Piezometric or Potentiometric Surface. A surface that represents the level to which water will rise in cased bores. The water table is the potentiometric surface in an unconfined aquifer.

pH. A logarithmic index for the concentration of hydrogen ions in an aqueous solution, which is used as a measure of acidity.

Polycyclic aromatic Hydrocarbons (PAHs). Complex organic molecules which originate typically in the combustion of organic compounds.

Potential Acid Sulfate Soil (PASS). A soil that has the potential to become acidic if it is exposed to the atmosphere.

Profile. The solum. This includes the soil A and B horizons and is basically the depth of soil to weathered rock.

Purge (wells). The pumping out of well water to remove drilling debris or impurities; also conducted to bring fresh groundwater into the casing for sample collection. The later ensures that a more representative sample of an aquifer is taken.

QA/QC. Quality Assurance / Quality Control.

Recharge Area. Location of the replenishment of an aquifer by a natural process such as addition of water at the ground surface, or by an artificial system such as addition through a well

Redox. REDuction-OXidation state of a chemical or solution.

Redox potential (Eh). The oxidation/reduction potential of the soil or water measured as milli-volt.

Reducing Conditions. Can be simply expressed as the absence of oxygen, though chemically the meaning is more complex. For more details refer to OXIDATION.

Remediation. The restoration of land or groundwater contaminated by pollutants, to a state suitable for other, beneficial uses.

Representative Sample. Assumed not to be significantly different than the population of samples available. In many investigations samples are often collected to represent the worst case situation.

Saturated Zone. A zone in which the rock or soil pores are filled (saturated) with water.

Standing Water Level (SWL). The depth to the groundwater surface in a well or bore measured below a specific reference point – usually recorded as metres below the top of the well casing or below the ground surface.

Stratigraphy. A vertical sequence of geological units.

Subsoil. Subsurface material comprising the B and C horizons of soils with distinct profiles. They often have brighter colours and higher clay content than topsoils.

Texture. The size of particles in the soil. Texture is divided into six groups, depending on the amount of coarse sand, fine sand, silt and clay in the soil.

Topsoil. Part of the soil profile, typically the A1 horizon, containing material which is usually darker, more fertile and better structured than the underlying layers.

Total Dissolved Salts (TDS). The total dissolved salts comprise dissociated compounds and undissociated compounds, but not suspended material, colloids or dissolved gases.

Toxicity. The inherent potential or capacity of a material to cause adverse effects in a living organism.

Unsaturated Zone. The zone between the land surface and the water table, in which the rock or soil pores contain both air and water (water in the unsaturated zone is present at less than atmospheric pressure). It includes the root zone, intermediate zone and capillary fringe. Saturated bodies such as perched groundwater may exist in the unsaturated zone. Also referred to as the Vadose Zone.

Volatile. Having a low boiling or subliming pressure (a high vapour pressure).

Water table. Interface between the saturated zone and unsaturated zones. The surface in an aquifer at which pore water pressure is equal to atmospheric pressure.

Well. A hydraulic structure that facilitates the monitoring of groundwater level, collection of groundwater samples, or the extraction (or injection) of groundwater. Also known as a Bore.

FIGURES

N

1:500 Scale at A3

Meters

0 5 10 20

Site Locality

DETAILED SITE INVESTIGATION
7-15 HORNE STREET, ELSTERNWICK, VICTORIA
AUYIN PROPERTY DEVELOPMENT PTY LTD
FIGURE 1

Cardno

Map Produced by Cardno
Date: 2019-08-22
Coordinate System: GDA 1994 MGA Zone 55
Project: V170147
Map: V170147-GS-001-SiteLoc.mxd 02
Aerial Imagery supplied by Nearmap (April, 2019)

Environmental Assessment Areas

N

1:1,000 Scale at A3

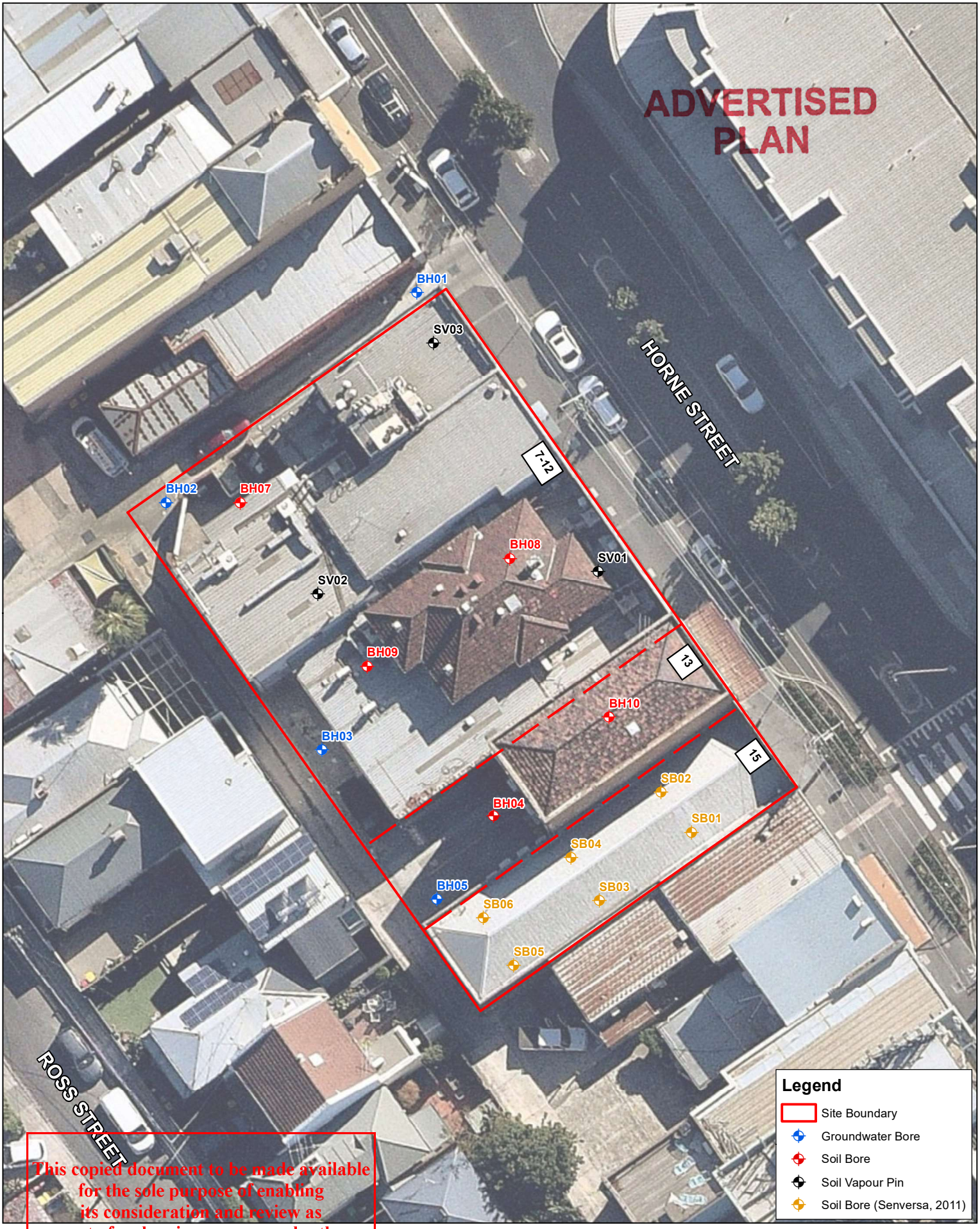
Meters

0 10 20 40

DETAILED SITE INVESTIGATION
7-15 HORNE STREET, ELSTERNWICK, VICTORIA
AUYIN PROPERTY DEVELOPMENT PTY LTD
FIGURE 2

Cardno

Map Produced by Cardno
Date: 2019-08-22
Coordinate System: GDA 1994 MGA Zone 55
Project: V170147
Map: V170147-GS-002-SiteLayoutandEAA.mxd 02
Aerial Imagery supplied by Nearmap (April, 2019)



N

1:250 Scale at A3

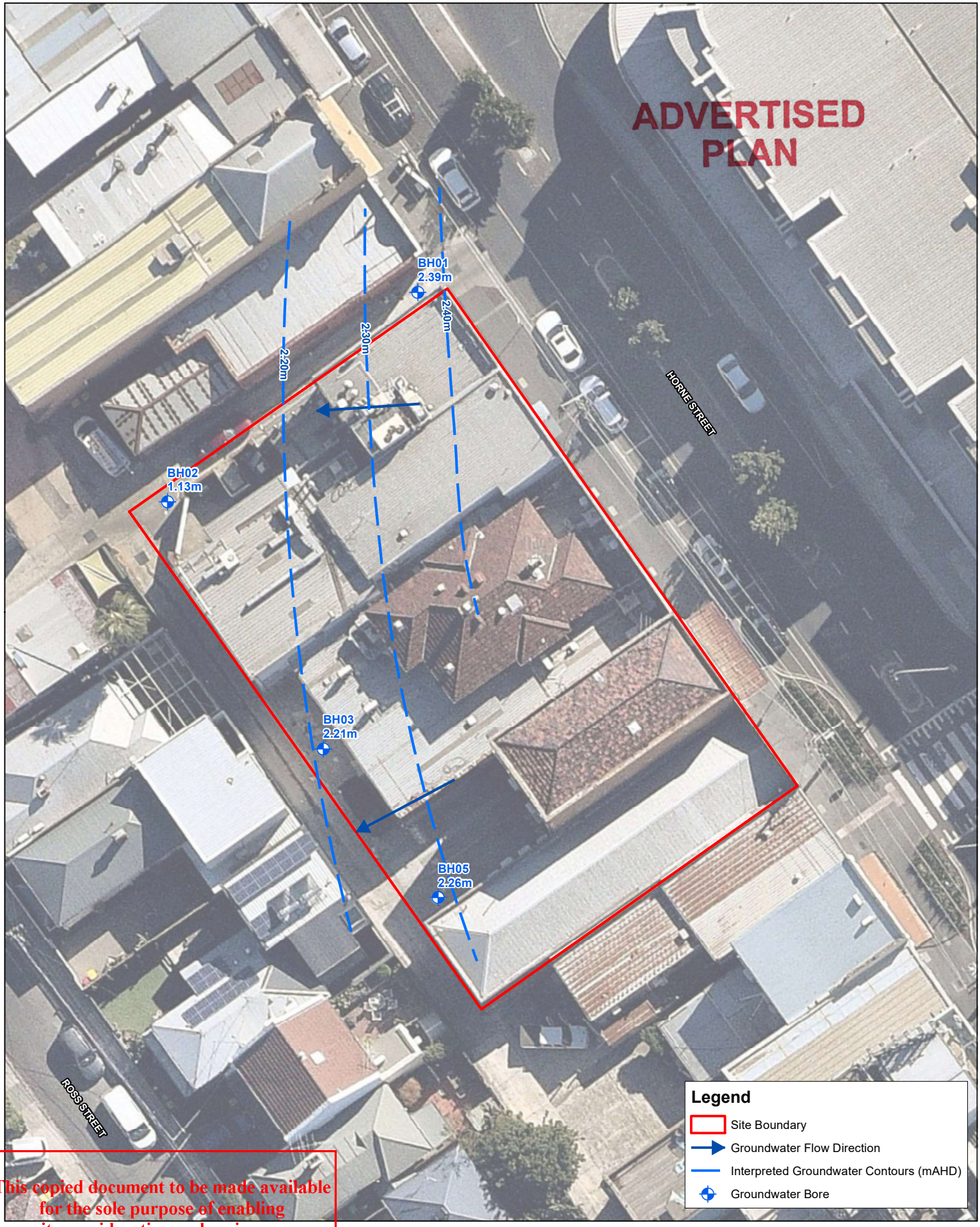
Meters 0 2.5 5 10

Bore Locations

DETAILED SITE INVESTIGATION
7-15 HORNE STREET, ELSTERNWICK, VICTORIA
AUYIN PROPERTY DEVELOPMENT PTY LTD
FIGURE 3

Cardno

Map Produced by Cardno
Date: 2019-08-22
Coordinate System: GDA 1994 MGA Zone 55
Project: V170147
Map: V170147-GS-007-BoreLocPlan.mxd 02
Aerial Imagery supplied by Nearmap (April, 2019)



N

1:250 Scale at A3

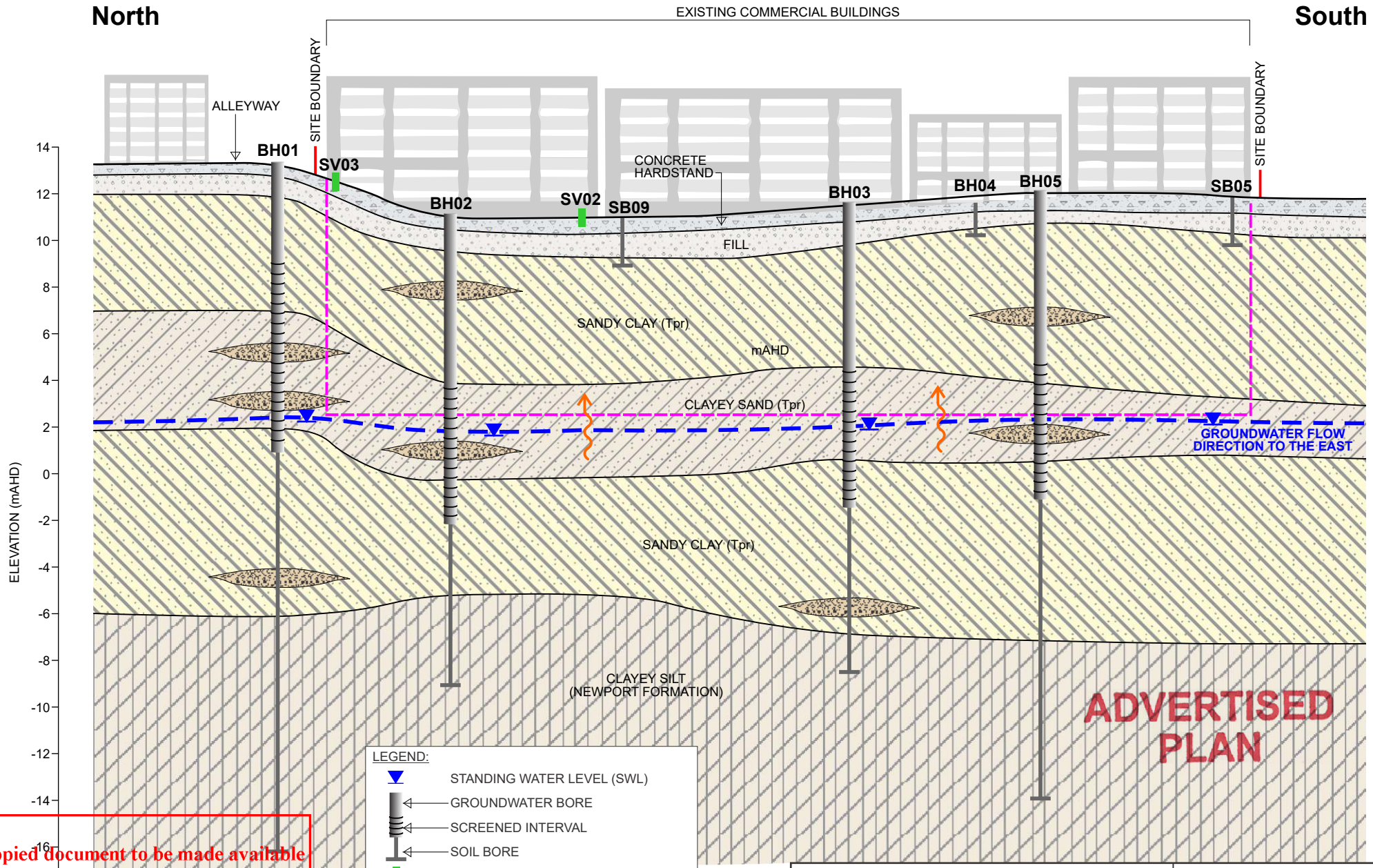
Meters
0 2.5 5 10

Groundwater Elevation Plan (4 July 2019)

DETAILED SITE INVESTIGATION
7-15 HORNE STREET, ELSTERNWICK, VICTORIA
AUYIN PROPERTY DEVELOPMENT PTY LTD
FIGURE 4

Cardno

Map Produced by Cardno
Date: 2019-09-03
Coordinate System: GDA 1994 MGA Zone 55
Project: V170147
Map: V170147-GS-008-GWContours.mxd 01
Aerial Imagery supplied by Nearmap (April, 2019)



ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title:	**Conceptual Cross Section**
Location:	**7 - 15 Horne Street Elsternwick, Vic.**
Client: **Auyin Property**	Job No: **217057**
Project Man: **SS**	Scale: **As Shown**
Drawn By: **LB**	Date: **March 2020**
	Figure 5

Source: © Nearmap

LEGEND:

- Site boundary
- Recommended GQRUZ extent
- Groundwater bore

0 3 6 9 12 15
Scale in Metres

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title:	Recommended GQRUZ		
Location:	7 - 15 Horne Street Elsternwick, Vic.		
Client:	Auyin Property Development Pty Ltd		Job No: 217057
Project Man:	SS	Scale: As Shown	Figure 6
Drawn By:	LB	Date: April 2021	

TABLES

Table 24: Groundwater bore search results (2 km radius)

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
WRK992328	126	NE		20.5	
WRK069674	146	E		18	Observation
WRK069675	146	E		18	Observation
WRK072266	163	N		10	Observation
WRK072267	163	N		12	Observation
WRK072268	163	N		10	Observation
WRK992250	209	NW		8	Groundwater investigation
WRK989501	265	E		150	
WRK091607	396	SE		50	Domestic and stock
WRK984707	434	N		150	
WRK979043	521	N		50	
WRK980513	538	N		100	
WRK076203	540	E		11.4	Observation
WRK090692	543	E		14.5	Observation
WRK090694	629	E		11	Observation
WRK966436	658	W		6.2	Groundwater investigation
WRK966440	658	W		6.2	Groundwater investigation
WRK966441	658	W		6.2	Groundwater investigation
88682	732	NW	16/01/1973	15.24	Stock, domestic
WRK977985	758	SE		25	
WRK092445	773	E		12	Investigation
WRK092443	776	E		12	Investigation
WRK092446	794	E		12	Investigation
WRK092444	799	E		12	Investigation
WRK077034	848	N		10	Observation
WRK061155	848	N		11	Observation
WRK077027	848	N		10	Observation
WRK077028	848	N		10	Observation
WRK077029	848	N		10	Observation

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
WRK077030	848	N		10	Observation
WRK077031	848	N		10	Observation
WRK077032	848	N		10	Observation
WRK077033	848	N		10	Observation
WRK061157	850	N		11	Observation
WRK051937	864	SE		54	Industrial
WRK982750	864	SE		75	
WRK983264	872	N		25	
WRK991356	889	N		10	Groundwater investigation
WRK988366	909	N		65	
WRK100653	932	NE		51.5	Domestic and stock
88696	937	NW	8/12/1982	24.5	Domestic
WRK070197	959	N		9	Observation
WRK062030	976	N		9	Observation
88693	996	SE	11/02/1983	54	Domestic
WRK070199	998	N		9	Observation
138466	1001	SW	15/01/1998	6	Groundwater investigation
138467	1001	SW	14/01/1998	7	Groundwater investigation
138468	1001	SW	15/01/1998	6	Groundwater investigation
138469	1001	SW	14/01/1998	7	Groundwater investigation
138470	1001	SW	3/04/1998	6	Groundwater investigation
138825	1001	SW	15/01/1998	6	Groundwater investigation
WRK070198	1002	N		9	Observation
WRK976045	1026	S		39	Domestic and stock
144115	1068	SW	11/11/1999	5.6	Groundwater investigation
WRK990916	1070	SW		7	Groundwater investigation
WRK990917	1076	SW		25	
WRK987047	1078	SW		7	Groundwater investigation
WRK042499	1089	N	10/07/2007	63	Irrigation, groundwater investigation
WRK978199	1099	NW		50	

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
144116	1099	SW	11/11/1999	5	Groundwater investigation
WRK990918	1105	SW		25	
142701	1112	SW	10/08/1998	6	Groundwater investigation
88706	1127	N	1/03/1983	36	Stock, domestic
WRK102832	1130	W		12	Investigation
WRK102831	1141	W		12	Investigation
WRK978645	1144	NW		40	
88732	1161	E	11/04/1987	45.7	Domestic
WRK983180	1175	SW		150	
WRK988333	1175	SW		150	
88731	1204	S	24/09/1983	60.1	Stock, domestic
WRK055927	1235	SE		49	Domestic and stock
88701	1253	SW	4/02/1982	47.24	Domestic
WRK058092	1260	S		10	Observation
WRK988397	1264	NE		25	
WRK981074	1272	NE		75	
WRK986671	1272	NE		150	
WRK988396	1272	NE		25	
WRK978177	1283	E		100	
WRK978551	1287	E		100	
WRK061384	1289	S		8	Observation
WRK977042	1291	SW		30	
WRK988398	1296	NE		25	
88720	1323	NE	21/01/1983	36.58	Domestic
WRK979680	1327	N		60	
326124	1339	N	31/12/1957	14.5	Non groundwater
326125	1339	N	31/12/1957	14.02	Non groundwater
326126	1339	N	31/12/1957	9.14	Non groundwater
326127	1339	N	31/12/1957	3.04	Non groundwater
326128	1339	N	31/12/1957	14.32	Non groundwater
326129	1339	N	31/12/1957	12.8	Non groundwater

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
326130	1339	N	31/12/1957	10.66	Non groundwater
326131	1339	N	31/12/1957	5.79	Non groundwater
326132	1339	N	31/12/1957	3.35	Non groundwater
326133	1339	N	31/12/1957	2.13	Non groundwater
326134	1339	N	31/12/1957	2.13	Non groundwater
326135	1339	N	12/08/1960	1.22	Sec bores (use unidentified)
326136	1339	N	9/08/1965	4.27	Sec bores (use unidentified)
326137	1339	N	10/08/1965	2.44	Sec bores (use unidentified)
326138	1339	N	14/12/1964	3.05	Sec bores (use unidentified)
326139	1339	N	15/12/1964	3.05	Sec bores (use unidentified)
326140	1339	N	15/12/1964	1.83	Sec bores (use unidentified)
326141	1339	N	15/12/1964	3.05	Sec bores (use unidentified)
326142	1339	N	16/12/1964	3.05	Sec bores (use unidentified)
326143	1339	N	16/12/1964	2.9	Sec bores (use unidentified)
326144	1339	N	23727	3.35	Sec bores (use unidentified)
326145	1339	N	16/12/1964	2.9	Sec bores (use unidentified)
326146	1339	N	16/12/1964	2.9	Sec bores (use unidentified)
326147	1339	N	10/10/1966	3.05	Sec bores (use unidentified)
326148	1339	N	10/10/1966	2.44	Sec bores (use unidentified)
326150	1339	N	11/10/1966	2.44	Sec bores (use unidentified)
326151	1339	N	11/10/1966	2.44	Sec bores (use unidentified)
326152	1339	N	9/11/1972	3.66	Sec bores (use unidentified)
326153	1339	N	9/11/1972	3.35	Sec bores (use unidentified)
326154	1339	N	9/11/1972	2.67	Sec bores (use unidentified)
326155	1339	N	26617	3.66	Sec bores (use unidentified)
326156	1339	N	26617	1.45	Sec bores (use unidentified)
326157	1339	N	26617	1.22	Sec bores (use unidentified)
326158	1339	N	16/11/1972	1.98	Sec bores (use unidentified)
326159	1339	N	16/11/1972	1.98	Sec bores (use unidentified)
326160	1339	N	30/11/1967	4.57	Sec bores (use unidentified)
326161	1339	N	1/12/1967	4.65	Sec bores (use unidentified)

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
88716	1341	NE	30/08/1983	18.59	Domestic
88738	1358	NE	25/08/1989	46	Domestic
WRK067644	1376	NW		7.5	Observation
WRK991846	1384	NE		60	Domestic and stock
WRK067643	1397	N		7.5	Observation
WRK067645	1401	NW		7.9	Observation
WRK986469	1405	NE		150	
WRK052821	1406	NE		48.5	Domestic and stock
WRK977520	1422	NE		80	
WRK986071	1423	NE		60	Domestic and stock
WRK047017	1429	S		60	
WRK987561	1430	NE		150	
88694	1431	SW	15/03/1983	15.24	Domestic
WRK981112	1432	NE		26	Domestic
WRK979085	1434	N		30	
88684	1441	NE	26700	45.72	Stock, domestic
WRK978344	1443	NE		30	
WRK978553	1447	S		40	
WRK985455	1453	N		150	
WRK987560	1454	S		150	
88687	1463	NE	30337	33.53	Domestic
88705	1477	SW	20/12/1982	21.5	Domestic
WRK073418	1504	N		62	Domestic and stock
WRK054969	1514	SW		40	Domestic and stock
88679	1514	N	15/01/1973	19.81	Stock, domestic
WRK052893	1516	S		26	Domestic and stock
WRK992498	1519	SW		150	
WRK964564	1524	N		50	Domestic and stock
WRK979733	1530	NE		60	
WRK988781	1534	W		150	
WRK991923	1537	SW		150	

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
WRK984582	1537	NE		150	
WRK987218	1544	N		51	Domestic
88718	1556	N	25/10/1983	17.07	Domestic
WRK101527	1567	E		10	Investigation
WRK982857	1574	NE		150	
WRK101529	1576	E		10	Investigation
WRK101530	1576	E		10	Investigation
WRK101528	1576	E		10	Investigation
WRK985605	1577	N		55	Domestic
WRK978321	1579	N		80	
WRK983900	1585	NE		150	
WRK988759	1593	NE		55	Domestic
WRK973287	1593	SW		15.7	Domestic and stock
WRK989568	1616	S		84	Domestic and stock
88728	1623	NE	26/03/1985	50	Domestic
WRK989500	1627	NE		150	
WRK989221	1631	NE		50	Domestic
WRK990238	1634	NE		45	Domestic
88698	1640	SW	7/10/1982	30.7	Not known
WRK978315	1656	S		34.5	Domestic and stock
WRK981411	1659	NE		40	
WRK987330	1664	SW		33	Domestic and stock
88723	1668	SW	20/01/1973	9.14	Domestic
WRK980712	1669	NE		100	
WRK987902	1687	N		122	
WRK983189	1689	NE		55	Domestic
WRK979669	1690	NE		26.7	Domestic and stock
WRK053298	1691	W		24	Domestic and stock
88722	1701	NE	14/02/1983	36.58	Domestic
WRK984247	1701	NE		52.5	Domestic
WRK054430	1715	NE		48	Domestic and stock

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
WRK990584	1717	S		150	
WRK967098	1719	NE		50	Domestic and stock
WRK968507	1721	NE		70	
WRK053524	1726	S		6.5	Observation
WRK979612	1727	NE		75	
WRK978824	1727	NE		35	
WRK982856	1727	NE		150	
WRK989076	1732	NE		150	
WRK983865	1746	NE		150	
WRK979541	1749	SE		70	
WRK990332	1754	NE		150	
WRK047161	1757	NE		80	Irrigation
WRK988236	1777	N		51	Domestic
WRK984015	1779	NE		33	Domestic
WRK979084	1781	N		30	
WRK055241	1806	S		22	Domestic and stock
WRK989207	1824	N		150	
WRK056095	1830	NE		42	Domestic and stock
WRK981011	1831	NE		30	
WRK979300	1835	NE		80	
WRK977390	1835	SW		50	
WRK984178	1846	NE		150	
WRK988277	1848	N		150	
WRK983053	1850	S		25	
WRK980278	1851	NE		40	
WRK056094	1852	NE		72	Domestic and stock
WRK052314	1853	NE		56	Domestic and stock
WRK978554	1857	NE		30	
88739	1865	N	7/09/1989	56	Domestic
WRK979895	1874	NE		47	Domestic
WRK978288	1875	E		100	

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
WRK985693	1879	E		150	
WRK991987	1880	N		150	
WRK982713	1901	NW		150	
WRK985598	1907	NE		45	Domestic
WRK965126	1913	NE		20	
WRK985345	1920	N		150	
80646	1922	SW	1/01/1988	12.8	Domestic
WRK988681	1928	NE		54	Domestic
WRK985566	1940	N		10	Groundwater investigation
WRK961602	1940	NE		60	
142878	1943	N	6/10/1999	5	Groundwater investigation
142880	1943	N	6/10/1999	5	Groundwater investigation
142881	1943	N	5/10/1999	8	Groundwater investigation
WRK054760	1947	NW		6	Observation
WRK054762	1947	NW		6	Observation
WRK054448	1948	N		45	Domestic and stock
WRK976319	1950	NE		70	
88735	1953	NE	14/01/1987	62.5	Domestic
WRK054761	1955	NW		6	Observation
WRK978215	1956	NE		30	Domestic and stock
WRK985567	1957	N		10	Groundwater investigation
142901	1958	E	15/11/1999	7	Groundwater investigation
142902	1958	E	15/11/1999	7	Groundwater investigation
142903	1959	E	15/11/1999	7	Groundwater investigation
142899	1959	E	15/11/1999	7	Groundwater investigation
142900	1963	E	15/11/1999	7	Groundwater investigation
88729	1972	NE	31/12/1983	27	Domestic
142897	1974	E	5/11/1999	13	Groundwater investigation
WRK985568	1978	N		10	Groundwater investigation
88733	1979	NE	23/10/1986	47	Domestic
142898	1981	E	5/11/1999	6.5	Groundwater investigation

Site no	Distance (m)	Direction	Date completed	Total depth (m)	Uses
WRK991843	1982	E		60	Domestic and stock
WRK992079	1982	E		7	Groundwater investigation
WRK985569	1983	N		10	Groundwater investigation
WRK985993	1983	E		25	
WRK988917	1991	NE		150	
WRK052355	1993	NE		46	Domestic and stock
WRK985994	1995	E		25	
WRK978822	1999	NE		70	

								BTEX						TPH					CRC Care TPH Fractions								MAH					
								Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C6-C10	C10-C16	C16-C34	C34-C40	C10 - C40 (Sum of total)	F1: C6-C10 less BTEX	F2: >C10-C16 less Naphthalene	Monocyclic aromatic hydrocarbons IWRG621	Total MAH	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	Styrene
								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
LOR								0.1	0.1	0.1	0.2	0.1	0.3	0.2	20	20	50	50	50	20	50	100	100	100	20	50		0.5	0.5	0.5	0.5	0.5
Need for ASLP (20x ASLP1)								2																								
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - aged (0-2m)																																
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - aged (0-2m)																																
NEPM 2013 ESL Comm./Ind., Fine Soil (0-2m)								95	135	185			95			170						2500	6600		215	170						
NEPM 2013 ESL UR/POS, Fine Soil (0-2m)								65	105	125			45			120					120	1300	5600		180						
NEPM 2013 HIL, Commercial/Industrial D																																
NEPM 2013 HIL, Residential B																																
NEPM 2013 Soil HSL Commercial/Industrial D, for Vapour Intrusion, Clay																																
0-1m								4	NL	NL			NL												310	NL						
1-2m								6	NL	NL			NL												480	NL						
2-4m								9	NL	NL			NL												NL	NL						
>4m								20	NL	NL			NL												NL	NL						
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Clay																																
0-1m								0.7	480	NL			110												50	280						
1-2m								1	NL	NL			310												90	NL						
2-4m								2	NL	NL			NL												150	NL						
>4m								3	NL	NL			NL												290	NL						
Location Code	Sample Depth	Field ID	Sample Type	Sampled Date	Lab Report No.																											
BH02	0.3	BH02_0.3	Normal	4/10/2018	621283	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	0	-	-	-	-	-
	1	BH02_1.0	Normal	4/10/2018	621283	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	0	-	-	-	-	-
BH03	0.2	BH03_0.2	Normal	5/10/2018	621283	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	0	<0.5	<0.5	<0.5	<0.5	<0.5
	1	BH03_1.0	Normal	5/10/2018	621283	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	0	-	-	-	-	-
BH04	0.2	BH04_0.2	Normal	5/10/2018	621283	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	270	160	430	<20	<50	410	<100	410	<20	<50	0	-	-	-	-	-
	0.9	BH04_0.9	Normal	5/10/2018	621283	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	0	-	-	-	-	-
		QC02_20181005	Split	5/10/2018	EM1816100	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<50	<100	<100	<50	<10	<50	<100	<100	<50	<10	<50	0	-	-	-	-	-
BH05	0.2	BH05_0.2	Normal	5/10/2018	621283	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	520	230	750	<20	<50	720	<100	720	<20	<50	0	-	-	-	-	-
	0.9	BH05_0.9	Normal	5/10/2018	621283	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	0	-	-	-	-	-
BH07	0.5	BH07/0.5	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5
	1	BH07/1.0	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5
BH08	0.5	BH08/0.5	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5
	0.8	BH08/0.8	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5
	1.2	BH08/1.2	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	-	-	-	-	-
BH09	0.2	BH09/0.2	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5
		QC01_20190704	Duplicate	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC02_20190704	Split	4/07/2019	EM1910817	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH09/0.9	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	-	-	-	-	-
	1.2	BH09/1.2	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5
BH10	0.2	BH10/0.2	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5
	0.9	BH10/0.9	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5
	1.4	BH10/1.4	Normal	4/07/2019	664455	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	<20	<20	<50	<50	<50	<20	<50	<100	<100	<100	<20	<50	-	<0.5	<0.5	<0.5	<0.5	<0.5

Env Stds Comments

#1: Site specific EILs calculated using pH 6.6, CEC 7.8 meq/100g and Olszowy et al. VIC Old Suburb, High Traffic

PAH

Location Code	Sample Depth	Field ID	Sample Type	Sampled Date	Lab Report No.	Benzo(b+j)fluoranthene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ (zero)	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
						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
LOR						0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Need for ASLP (20x ASLP1)											0.02														
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - aged (0-2m)																						370			
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - aged (0-2m)																						170			
NEPM 2013 ESL Comm./Ind., Fine Soil (0-2m)											1.4														
NEPM 2013 ESL UR/POS, Fine Soil (0-2m)											0.7														
NEPM 2013 HIL, Commercial/Industrial D												40											4000		
NEPM 2013 HIL, Residential B												4											400		
NEPM 2013 Soil HSL Commercial/Industrial D, for Vapour Intrusion, Clay																									
0-1m																						NL			
1-2m																						NL			
2-4m																						NL			
>4m																						NL			
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Clay																									
0-1m																						5			
1-2m																						NL			
2-4m																						NL			
>4m																						NL			
BH02	0.3	BH02 0.3	Normal	4/10/2018	621283	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1	BH02 1.0	Normal	4/10/2018	621283	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH03	0.2	BH03 0.2	Normal	5/10/2018	621283	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1	BH03 1.0	Normal	5/10/2018	621283	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH04	0.2	BH04 0.2	Normal	5/10/2018	621283	5	<0.5	0.9	1.8	6	7.2	12	12	12	4.4	4.4	5.6	2.2	9.2	<0.5	4.8	<0.5	64.1	3.9	8.7
	0.9	BH04 0.9	Normal	5/10/2018	621283	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		QC02 20181005	Split	5/10/2018	EM1816100	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH05	0.2	BH05 0.2	Normal	5/10/2018	621283	12	<0.5	1.9	9	19	18	28	28	28	8.9	9.7	16	5.1	34	1.5	10	<0.5	201.1	25	31
	0.9	BH05 0.9	Normal	5/10/2018	621283	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH07	0.5	BH07/0.5	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1	BH07/1.0	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH08	0.5	BH08/0.5	Normal	4/07/2019	664455	0.5	<0.5	<0.5	<0.5	0.6	0.9	1.4	1.7	1.1	0.7	0.8	0.9	<0.5	1.1	<0.5	<0.5	<0.5	6.8	<0.5	1.3
	0.8	BH08/0.8	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1.2	BH08/1.2	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH09	0.2	BH09/0.2	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		QC01 20190704	Duplicate	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		QC02 20190704	Split	4/07/2019	EM1910817	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	0.9	BH09/0.9	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1.2	BH09/1.2	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH10	0.2	BH10/0.2	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	0.9	BH10/0.9	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1.4	BH10/1.4	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Metals

Location Code	Sample Depth	Field ID	Aluminium	Arsenic	Beryllium	Boron	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Tin	Zinc
			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
LOR			10	2	2	10	0.4	1	5	5	5	20	5	5	0.1	5	5	2	0.2	10	5
Need for ASLP (20x ASLP1)				14			4	100			4000		20		2	100	40	20	200		6000
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - aged (0-2m)				160					310		230[#1]		1800				170[#1]				570[#1]
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - aged (0-2m)				100					190		160[#1]		1100				100[#1]				380[#1]
NEPM 2013 ESL Comm./Ind., Fine Soil (0-2m)																					
NEPM 2013 ESL UR/POS, Fine Soil (0-2m)																					
NEPM 2013 HIL, Commercial/Industrial D				3000	500	300000	900	3600		4000	240000		1500	60000	730		6000	10000			400000
NEPM 2013 HIL, Residential B				500	90	40000	150	500		600	30000		1200	14000	120		1200	1400			60000
BH02	0.3	BH02 0.3	-	<2	-	-	<0.4	-	31	-	34	-	52	-	<0.1	-	110	-	-	-	71
	1	BH02 1.0	-	51	-	-	<0.4	-	54	-	<5	-	19	-	0.1	-	17	-	-	-	11
BH03	0.2	BH03 0.2	-	<2	-	-	<0.4	<1	<5	-	<5	-	32	-	<0.1	<5	<5	<2	<0.2	<10	25
	1	BH03 1.0	-	50	-	-	<0.4	-	81	-	<5	-	24	-	0.1	-	30	-	-	-	13
BH04	0.2	BH04 0.2	-	11	-	-	<0.4	-	8.6	-	55	-	590	-	0.3	-	9.2	-	-	-	190
	0.9	BH04 0.9	-	66	-	-	<0.4	-	92	-	<5	-	30	-	0.1	-	30	-	-	-	13
		QC02 20181005	-	37	-	-	<1	-	56	-	<5	-	13	-	0.1	-	14	-	-	-	<5
BH05	0.2	BH05 0.2	-	23	-	-	<0.4	-	8.1	-	12	-	250	-	0.1	-	11	-	-	-	710
	0.9	BH05 0.9	-	76	-	-	<0.4	-	73	-	<5	-	23	-	0.2	-	24	-	-	-	9
BH07	0.5	BH07/0.5	-	<2	-	-	<0.4	<1	26	-	30	-	<5	-	<0.1	<5	100	<2	<0.2	<10	58
	1	BH07/1.0	29000	60	-	-	<0.4	-	50	-	<5	35000	12	21	<0.1	-	14	-	-	-	9.8
BH08	0.5	BH08/0.5	880	2.3	-	-	<0.4	-	<5	-	6.3	4100	97	35	<0.1	-	<5	-	-	-	190
	0.8	BH08/0.8	-	5.6	-	-	<0.4	<1	<5	-	<5	-	8.9	-	<0.1	<5	<5	<2	<0.2	<10	10
	1.2	BH08/1.2	-	37	<2	<10	<0.4	<1	78	9.7	<5	44000	16	25	<0.1	-	27	<2	-	-	13
BH09	0.2	BH09/0.2	11000	<2	-	-	<0.4	-	25	-	43	50000	<5	760	<0.1	-	130	-	-	-	73
		QC01 20190704	-	<2	-	-	<0.4	-	18	-	34	-	<5	-	<0.1	-	100	-	-	-	58
		QC02 20190704	-	<5	-	-	<1	-	18	-	33	-	<5	-	<0.1	-	108	-	-	-	49
	0.9	BH09/0.9	-	4.4	<2	<10	<0.4	<1	7	<5	16	-	250	88	0.2	-	5.4	<2	-	-	750
	1.2	BH09/1.2	66000	34	-	-	<0.4	-	90	-	<5	51000	31	35	0.2	-	30	-	-	-	37
BH10	0.2	BH10/0.2	2600	3.1	-	-	<0.4	-	5	-	5.4	4500	140	26	<0.1	-	<5	-	-	-	150
	0.9	BH10/0.9	-	26	-	-	<0.4	<1	24	-	<5	-	100	-	<0.1	<5	<5	<2	<0.2	<10	63
	1.4	BH10/1.4	65000	57	-	-	<0.4	-	90	-	<5	65000	23	26	0.1	-	31	-	-	-	14

Env Stds Comments

#1: Site specific EILs calculated using pH 6.6, CEC 7.8 meq/100g and Olszowy et al. VIC Old Suburb, High Traffic

Location Code	Sample Depth	Field ID	Sample Type	Sampled Date	Lab Report No.	Inorganics: Moisture Content	% Clay*	Conductivity (1:5 aqueous extract)	CEC	Cyanide (Free)	Cyanide Total	Fluoride	Moisture Content (dried @ 103°C)	pH (aqueous extract)	pH (Lab)	Organic: TOC	Chlorinated Hydrocarbons: Vic EPA IWRG 621 CHC (Total)*	Vic EPA IWRG 621 Other CHC (Total)*
						%	%	US/CM	meq/100g	mg/kg	mg/kg	mg/kg	%	pH_Units	pH_Units	%	MG/KG	MG/KG
LOR						1	1	10	0.05	5	5	100	1	0.1	0.1	0.1	0.5	0.5
Need for ASLP (20x ASLP1)											160	3000						
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - aged (0-2m)																		
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - aged (0-2m)																		
NEPM 2013 ESL Comm./Ind., Fine Soil (0-2m)																		
NEPM 2013 ESL UR/POS, Fine Soil (0-2m)																		
NEPM 2013 HIL, Commercial/Industrial D										1500								
NEPM 2013 HIL, Residential B										300								
NEPM 2013 Soil HSL Commercial/Industrial D, for Vapour Intrusion, Clay																		
0-1m																		
1-2m																		
2-4m																		
>4m																		
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Clay																		
0-1m																		
1-2m																		
2-4m																		
>4m																		
BH02	0.3	BH02_0.3	Normal	4/10/2018	621283	-	-	-	-	-	-	-	9.1	-	-	-	-	-
	1	BH02_1.0	Normal	4/10/2018	621283	-	-	-	-	-	-	-	20	-	-	-	-	-
BH03	0.2	BH03_0.2	Normal	5/10/2018	621283	-	-	45	7.8	-	<5	<100	12	8.5	-	-	<0.5	<0.5
	1	BH03_1.0	Normal	5/10/2018	621283	-	-	-	-	-	-	-	23	-	-	-	-	-
BH04	0.2	BH04_0.2	Normal	5/10/2018	621283	-	-	-	-	-	-	-	12	-	-	-	-	-
	0.9	BH04_0.9	Normal	5/10/2018	621283	-	-	-	-	-	-	-	25	-	-	-	-	-
		QC02_20181005	Split	5/10/2018	EM1816100	25.4	-	-	-	-	-	-	-	-	-	-	-	-
BH05	0.2	BH05_0.2	Normal	5/10/2018	621283	-	-	-	-	-	-	-	9.7	-	-	-	-	-
	0.9	BH05_0.9	Normal	5/10/2018	621283	-	-	-	-	-	-	-	22	-	-	-	-	-
BH07	0.5	BH07/0.5	Normal	4/07/2019	664455	-	-	-	-	-	<5	<100	8.6	9.7	-	-	<0.5	<0.5
	1	BH07/1.0	Normal	4/07/2019	664455	-	-	-	-	-	-	-	15	-	-	-	<0.5	<0.5
BH08	0.5	BH08/0.5	Normal	4/07/2019	664455	-	-	-	-	-	-	-	7.7	-	-	-	<0.5	<0.5
	0.8	BH08/0.8	Normal	4/07/2019	664455	-	-	-	-	-	<5	<100	11	9	-	-	<0.5	<0.5
	1.2	BH08/1.2	Normal	4/07/2019	664455	-	48	140	20	<5	-	-	21	-	6.6	0.7	-	-
BH09	0.2	BH09/0.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	7.7	-	-	-	<0.5	<0.5
		QC01_20190704	Duplicate	4/07/2019	664455	-	-	-	-	-	-	-	6	-	-	-	-	-
		QC02_20190704	Split	4/07/2019	EM1910817	8.4	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH09/0.9	Normal	4/07/2019	664455	-	-	-	-	<5	-	-	11	-	-	-	-	-
	1.2	BH09/1.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	25	-	-	-	<0.5	<0.5
BH10	0.2	BH10/0.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	7.4	-	-	-	<0.5	<0.5
	0.9	BH10/0.9	Normal	4/07/2019	664455	-	-	-	-	-	<5	<100	7.6	8.4	-	-	<0.5	<0.5
	1.4	BH10/1.4	Normal	4/07/2019	664455	-	-	-	-	-	-	-	24	-	-	-	<0.5	<0.5

Field ID	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,2,3-trichloropropane	1,2-dichloroethane	1,2-dichloropropane	1,3-dichloropropane	Bromochloromethane	Bromodichloromethane	Bromoform	Carbon tetrachloride	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	cis-1,2-dichloroethene	cis-1,3-dichloropropene	Dibromomethane	Dichloromethane	Hexachlorobutadiene	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene	trans-1,3-dichloropropene	Vinyl chloride
	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
LOR	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Need for ASLP (20x ASLP1)																							1.4					0.6
BH02_0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH02_1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH03_0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH03_1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH04_0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH04_0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QC02_20181005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05_0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05_0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH07/0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH07/1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5
BH08/0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5
BH08/0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH08/1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH09/0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5
QC01_20190704	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QC02_20190704	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH09/0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH09/1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5
BH10/0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5
BH10/0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH10/1.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5

Env Stds Comments

#1: Site specific EILs calculated using pH 6.6, CEC 7.8 meq/100g and Olszowy et al. VIC Old Suburb, High Traffic

														Halogenated Hydrocarbons												Phenols										Halogenated Phenols						
														1,2,4-trichlorobenzene	1,2-dibromoethane	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	4-chlorotoluene	Bromobenzene	Bromomethane	Chlorobenzene	Dichlorodifluoromethane	Iodomethane	Trichlorofluoromethane	2,4-dimethylphenol	2,4-dinitrophenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4,6-Dinitro-2-methylphenol	4,6-Dinitro-o-cyclohexyl phenol	4-chloro-3-methylphenol	4-nitrophenol	Phenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol	tetrachlorophenols
														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
LOR														0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5	0.2	1	0.4	5	20	1	5	0.5	1	1	0.5	0.5	0.5	1	1
Need for ASLP (20x ASLP1)																																									
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - aged (0-2m)																																									
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - aged (0-2m)																																									
NEPM 2013 ESL Comm./Ind., Fine Soil (0-2m)																																									
NEPM 2013 ESL UR/POS, Fine Soil (0-2m)																																									
NEPM 2013 HIL, Commercial/Industrial D																																		240000						660	
NEPM 2013 HIL, Residential B																																		45000						130	
NEPM 2013 Soil HSL Commercial/Industrial D, for Vapour Intrusion, Clay																																									
0-1m																																									
1-2m																																									
2-4m																																									
>4m																																									
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Clay																																									
0-1m																																									
1-2m																																									
2-4m																																									
>4m																																									
Location Code	Sample Depth	Field ID	Sample Type	Sampled Date	Lab Report No.																																					
BH02	0.3	BH02_0.3	Normal	4/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	BH02_1.0	Normal	4/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH03	0.2	BH03_0.2	Normal	5/10/2018	621283	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<0.4	<5	<20	<1	<5	<0.5	<1	<1	<0.5	<0.5	<0.5	<1	<1	<1	<1
	1	BH03_1.0	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH04	0.2	BH04_0.2	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH04_0.9	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC02_20181005	Split	5/10/2018	EM1816100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05	0.2	BH05_0.2	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH05_0.9	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH07	0.5	BH07/0.5	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.2	<1	<0.4	<5	<20	<1	<5	<0.5	<1	<1	<0.5	<0.5	<0.5	<1	<10	<1	<10
	1	BH07/1.0	Normal	4/07/2019	664455	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH08	0.5	BH08/0.5	Normal	4/07/2019	664455	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.8	BH08/0.8	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.2	<1	<0.4	<5	<20	<1	<5	<0.5	<1	<1	<0.5	<0.5	<0.5	<1	<10	<1	<10
	1.2	BH08/1.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-	<0.4	-	-	-	-	<0.5	-	-	-	-	-	-	<1	-	-	-
BH09	0.2	BH09/0.2	Normal	4/07/2019	664455	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC01_20190704	Duplicate	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC02_20190704	Split	4/07/2019	EM1910817	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH09/0.9	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	-	<0.4	-	-	-	-	<0.5	-	-	-	-	-	-	<1	-	-	-
	1.2	BH09/1.2	Normal	4/07/2019	664455	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH10	0.2	BH10/0.2	Normal	4/07/2019	664455	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH10/0.9	Normal	4/07/2019	664455	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.2	<1	<0.4	<5	<20	<1	<5	<0.5	<1	<1	<0.5	<0.5	<0.5	<1	<10	<1	<10
	1.4	BH10/1.4	Normal	4/07/2019	664455	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Env Stds Comments
#1: Site specific EILs calculated using pH 6.6, CEC 7.8 meq/100g and Olszowy et al. VIC Old Suburb, High Traffic

			Organochlorine Pesticides																										Organophosphorous Pesticides	Solvents				
			Organochlorine pesticides IWRG621	Other organochlorine pesticides IWRG621	Vic EPA IWRG 621 OCP (Total)*	Vic EPA IWRG 621 Other OCP (Total)*	4,4'-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor	Toxaphene	Chlorpyrifos	Methyl Ethyl Ketone	4-Methyl-2-pentanone	Acetone	Allyl chloride	Carbon disulfide
			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
LOR					0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	1	0.2	0.5	0.5	0.5	0.5	0.5
Need for ASLP (20x ASLP1)										0.6		2				40									0.6										
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - aged (0-2m)															640																				
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - aged (0-2m)															180																				
NEPM 2013 ESL Comm./Ind., Fine Soil (0-2m)																																			
NEPM 2013 ESL UR/POS, Fine Soil (0-2m)																																			
NEPM 2013 HIL, Commercial/Industrial D										45		530				3600					100				50		80	2500	160	2000					
NEPM 2013 HIL, Residential B										10		90				600					20				10		15	500	30	340					
NEPM 2013 Soil HSL Commercial/Industrial D, for Vapour Intrusion, Clay																																			
0-1m																																			
1-2m																																			
2-4m																																			
>4m																																			
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Clay																																			
0-1m																																			
1-2m																																			
2-4m																																			
>4m																																			

Location Code	Sample Depth	Field ID	Sample Type	Sampled Date	Lab Report No.																															
BH02	0.3	BH02_0.3	Normal	4/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	BH02_1.0	Normal	4/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH03	0.2	BH03_0.2	Normal	5/10/2018	621283	0	0	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5
	1	BH03_1.0	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH04	0.2	BH04_0.2	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH04_0.9	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC02_20181005	Split	5/10/2018	EM1816100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05	0.2	BH05_0.2	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH05_0.9	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH07	0.5	BH07/0.5	Normal	4/07/2019	664455	-	-	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5
	1	BH07/1.0	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
BH08	0.5	BH08/0.5	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
	0.8	BH08/0.8	Normal	4/07/2019	664455	-	-	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5
	1.2	BH08/1.2	Normal	4/07/2019	664455	-	-	-	-	<0.05	-	<0.05	-	-	<0.1	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	<0.05	-	<0.05	<0.05	<1	<0.2	-	-	-	-
BH09	0.2	BH09/0.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
		QC01_20190704	Duplicate	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC02_20190704	Split	4/07/2019	EM1910817	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH09/0.9	Normal	4/07/2019	664455	-	-	-	-	<0.05	-	<0.05	-	-	<0.1	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	<0.05	-	<0.05	<0.05	<1	<0.2	-	-	-	-
	1.2	BH09/1.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
BH10	0.2	BH10/0.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
	0.9	BH10/0.9	Normal	4/07/2019	664455	-	-	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	-	<0.5	<0.5	<0.5	<0.5	<0.5
	1.4	BH10/1.4	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5

Env Stds Comments

#1: Site specific EILs calculated using pH 6.6, CEC 7.8 meq/100g and Olszowy et al. VIC Old Suburb, High Traffic

						Herbicides							Pesticides	Polychlorinated Biphenyls							
						2,4,5-Trichlorophenoxy Acetic Acid	Hedonal	Atrazine	Dinoseb	2-Methyl-4-chlorophenoxyacetic acid	2-Methyl-4-Chlorophenoxy Butanoic Acid	Mecoprop	Picloram	Mirex	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Sum of total)
						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
LOR						0.5	0.5	0.2	20	0.5	0.5	0.5	0.5	0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Need for ASLP (20x ASLP1)																						
NEPM 2013 EIL Comm./Ind., low pH, CEC, clay content - aged (0-2m)																						
NEPM 2013 EIL UR/POS, low pH, CEC, clay content - aged (0-2m)																						
NEPM 2013 ESL Comm./Ind., Fine Soil (0-2m)																						
NEPM 2013 ESL UR/POS, Fine Soil (0-2m)																						
NEPM 2013 HIL, Commercial/Industrial D						5000	9000	2500		5000	5000	5000	35000	100								7
NEPM 2013 HIL, Residential B						900	1600	470		900	900	900	6600	20								1
NEPM 2013 Soil HSL Commercial/Industrial D, for Vapour Intrusion, Clay																						
0-1m																						
1-2m																						
2-4m																						
>4m																						
NEPM 2013 Soil HSL Residential A&B, for Vapour Intrusion, Clay																						
0-1m																						
1-2m																						
2-4m																						
>4m																						
Location Code	Sample Depth	Field ID	Sample Type	Sampled Date	Lab Report No.																	
BH02	0.3	BH02_0.3	Normal	4/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	BH02_1.0	Normal	4/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH03	0.2	BH03_0.2	Normal	5/10/2018	621283	-	-	-	<20	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	1	BH03_1.0	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH04	0.2	BH04_0.2	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH04_0.9	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC02_20181005	Split	5/10/2018	EM1816100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05	0.2	BH05_0.2	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH05_0.9	Normal	5/10/2018	621283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH07	0.5	BH07/0.5	Normal	4/07/2019	664455	-	-	-	<20	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	1	BH07/1.0	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH08	0.5	BH08/0.5	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.8	BH08/0.8	Normal	4/07/2019	664455	-	-	-	<20	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	1.2	BH08/1.2	Normal	4/07/2019	664455	<0.5	<0.5	<0.2	-	<0.5	<0.5	<0.5	<0.5	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH09	0.2	BH09/0.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC01_20190704	Duplicate	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		QC02_20190704	Split	4/07/2019	EM1910817	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH09/0.9	Normal	4/07/2019	664455	<0.5	<0.5	<0.2	-	<0.5	<0.5	<0.5	<0.5	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	1.2	BH09/1.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH10	0.2	BH10/0.2	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	BH10/0.9	Normal	4/07/2019	664455	-	-	-	<20	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	1.4	BH10/1.4	Normal	4/07/2019	664455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Env Stds Comments
#1: Site specific EILs calculated using pH 6.6, CEC 7.8 meq/100g and Olszowy et al. VIC Old Suburb, High Traffic

senversa

Preliminary Environmental Site Assesssment
15 Horne Street Elsternwick

Table 1 - Soils Analytical Results vs. Investigation Levels

Chem_Group	Chemical Name	Units	EQL	Maintenance of Ecosystems	Human Health - Commercial/ Industrial	Human Health - Recreation Open Space	Human Health - Sensitive Use - High Density Residential	Human Health - Sensitive Use - Other	Sample ID	SB01 0.55-0.65	SB01 1.4-2.0	SB02 0.5-0.6	SB02 1.4-2.0	SB03 0.15-0.25	SB03 0.9-1.0	SB04 0.7-0.8	SB04 1.2-1.3	SB05 0.8-0.9	SB05 1.3-1.4	SB06 0.8-0.9	QS04	QS05	SB06 1.35-1.45
									Location	SB01	SB01	SB02	SB02	SB03	SB03	SB04	SB04	SB05	SB05	SB06	SB06 0.8-0.9	SB06 0.8-0.9	SB06
									Sample Date	17/01/2011	17/01/2011	17/01/2011	17/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011
									Matrix	Fill	Clay	Fill	Clay	Fill	Clay	Fill	Clay	Fill	Clay	Fill	Fill	Fill	Clay
Inorganics	Cyanide Total	mg/kg	1		2500[#3]	1000[#4]	2000[#7]	500[#5]		3	-	-	-	-	-	-	-	1	-	2	-	-	-
	Fluoride	mg/kg	40		41000[#1]		3100[#7]	3100[#2]		190	-	-	-	-	-	-	-	<40	-	70	-	-	-
	Moisture	%	1							11.9	20.2	10.5	9.2	13	24.8	13.9	28.2	8.2	21.8	10.7	9.6	-	18.8
	Moisture Content (dried @ 103°C)	%	0.1							-	-	-	-	-	-	-	-	-	-	-	-	11	-
	pH (Lab)	pH Units	0.1							9.2	8.1	9.4	8.4	8.1	7.9	8.7	8.2	8.4	6.4	7.3	-	-	7.8
	Sulphate	mg/kg	50	2000[#5]						150	100	80	80	300	90	<50	130	<50	170	<50	-	-	<50
Metals	Arsenic	mg/kg	5	20[#6]	500[#3]	200[#4]	400[#7]	100[#5]		<5	36	<5	16	<5	24	5	28	<5	18	5	12	-	42
	Cadmium	mg/kg	1	3[#6]	100[#3]	40[#4]	80[#7]	20[#5]		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1
	Chromium (hexavalent)	mg/kg	0.5	1[#6]	500[#3]	200[#4]	400[#7]	100[#5]		<0.5	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-
	Chromium (III+VI)	mg/kg	2							-	56	2	18	6	66	8	62	-	65	-	13	-	51
	Copper	mg/kg	5	100[#6]	5000[#3]	2000[#4]	4000[#7]	1000[#5]		6	<5	<5	<5	17	<5	<5	<5	<5	<5	26	101	-	<5
	Lead	mg/kg	5	600[#6]	1500[#3]	600[#4]	1200[#7]	300[#5]		961	18	48	6	501	14	24	19	<5	17	330	1290	-	18
	Mercury	mg/kg	0.1	1[#6]	75[#3]	30[#4]	60[#7]	15[#5]		0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	-	<0.1
	Molybdenum	mg/kg	2		5100[#1]		390[#7]	390[#2]		<2	-	-	-	-	-	-	-	<2	-	<2	-	-	-
	Nickel	mg/kg	2	60[#6]	3000[#3]	600[#4]	2400[#7]	600[#5]		3	9	<2	3	3	15	3	15	<2	16	4	7	-	12
	Selenium	mg/kg	5		5100[#1]		390[#7]	390[#2]		<5	-	-	-	-	-	-	-	<5	-	<5	-	-	-
	Silver	mg/kg	2		5100[#1]		390[#7]	390[#2]		<2	-	-	-	-	-	-	-	<2	-	<2	-	-	-
	Tin	mg/kg	5		610000[#1]		47000[#7]	47000[#2]		<5	-	-	-	-	-	-	-	<5	-	7	-	-	-
	Zinc	mg/kg	5	200[#6]	35000[#3]	14000[#4]	28000[#7]	7000[#5]		146	<5	101	<5	182	8	18	37	6	7	285	1060	-	7
TRH	TPH C6 - C9	mg/kg	10	210[#8]	320[#8]	30[#8]	30[#7]	30[#8]		<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<20	<10
	TPH C10 - C14	mg/kg	50	150[#8]	1000[#8]	150[#8]	150[#7]	150[#8]		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH C15 - C28	mg/kg	100							<100	<100	<100	<100	250	<100	<100	<100	<100	<100	<100	<100	<100	<100
	TPH C29 - C36	mg/kg	100							<100	<100	<100	<100	240	<100	<100	<100	<100	<100	<100	<100	<100	<100
	Sum TPH C10 - C36	mg/kg	50							<50	<50	<50	<50	490 - 515	<50	<50	<50	<50	<50	<50	<50	<100	<50
PAH	Acenaphthylene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	1	1	<0.5
	Anthracene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	1.8	2.6	<0.5
	Benz(a)anthracene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	6	<0.5	<0.5	<0.5	<0.5	<0.5	2.1	3.4	4.6	<0.5
	Benzo(a) pyrene	mg/kg	0.1		5[#3]	2[#4]	4[#7]	1[#5]		<0.5	<0.5	<0.5	<0.5	6.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.7	3.1	4.7	<0.5
	Benzo(b)&(k)fluoranthene	mg/kg	0.5							0.6	-	-	-	-	-	-	-	<0.5	-	3	-	-	-
	Benzo(b)fluoranthene	mg/kg	0.1							-	<0.5	<0.5	<0.5	7	<0.5	<0.5	<0.5	-	<0.5	-	3.5	4.5	<0.5
	Benzo(g,h,i)perylene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	4	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	1.6	3	<0.5
	Benzo(k)fluoranthene	mg/kg	0.1							-	<0.5	<0.5	<0.5	2.7	<0.5	<0.5	<0.5	-	<0.5	-	1.5	2.8	<0.5
	Chrysene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	5.1	<0.5	<0.5	<0.5	<0.5	<0.5	1.8	2.7	3.8	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5
	Fluoranthene	mg/kg	0.1							<0.5	<0.5	0.6	<0.5	10.6	<0.5	<0.5	0.6	<0.5	<0.5	5	7.7	10	<0.5
	Fluorene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	0.9	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	3.1	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	1.4	3.1	<0.5
	Naphthalene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.3	<0.5
	Phenanthrene	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	4.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.1	5.6	9	<0.5
	Pyrene	mg/kg	0.1							<0.5	<0.5	0.5	<0.5	11.1	<0.5	<0.5	<0.5	<0.5	<0.5	4.2	6.6	8.3	<0.5
	Total PAHs	mg/kg	0.1		100[#3]	40[#4]	80[#7]	20[#5]		0.6	<8	1.1	<8	63.9	<8	<8	<8	<7.5	<8	23.7	40.6	60	<8
BTEX	Benzene	mg/kg	0.05		5.4[#1]		1.1[#7]	1.1[#2]		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.05	<0.2
	Ethylbenzene	mg/kg	0.05		27[#1]		5.4[#7]	5.4[#2]		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	<0.5	<0.5	<0.05	<0.5
	Toluene	mg/kg	0.05		45000[#1]		5000[#7]	5000[#2]		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.05	<0.5
	Xylene (m & p)	mg/kg	0.1							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.5
	Xylene (o)	mg/kg	0.05		19000[#1]		3800[#7]	3800[#2]		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.05	<0.5
	Xylene Total	mg/kg	0.15		2700[#1]		630[#7]	630[#2]		<0.5	<1	<1	<1	<1	<1	<1	<1	<0.5	<1	<0.5	<1	<0.15	<1
	IWRG Monocyclic aromatic hydrocarbons *	mg/kg	0.2							<0.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<2.2	<0.2	<2.2	<0.2	<2.2	<0.3	<2.2
OCP	IWRG Organochlorine pesticides *	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	IWRG Other organochlorine pesticides *	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	4,4-DDE	mg/kg	0.05		5.1[#1]		1.4[#7]	1.4[#2]		<0.06	-	-	-	-	-	-	-	<0.05	-	<0.06	-	-	-
	a-BHC	mg/kg	0.03		0.27[#1]		0.077[#7]	0.077[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Aldrin	mg/kg	0.03		0.1[#1]		0.029[#7]	0.029[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Aldrin + Dieldrin	mg/kg	0.03		50[#3]	20[#4]	40[#7]	10[#5]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	b-BHC	mg/kg	0.03		0.96[#1]		0.27[#7]	0.27[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	chlordane	mg/kg	0.03		250[#3]	100[#4]	200[#7]	50[#5]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Chlordane (cis)	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Chlordane (trans)	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	d-BHC	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	DDD	mg/kg	0.05		7.2[#1]		2[#7]	2[#2]		<0.06	-	-	-	-	-	-	-	<0.05	-	<0.06	-	-	-
	DDT	mg/kg	0.05		7[#1]		1.7[#7]	1.7[#2]		<0.06	-	-	-	-	-	-	-	<0.05	-	<0.06	-	-	-
	DDT+DDE+DDD	mg/kg	0.05		1000[#3]	400[#4]	800[#7]	200[#5]		<0.06	-	-	-	-	-	-	-	<0.05	-	<0.06	-	-	-
	Dieldrin	mg/kg	0.03		0.11[#1]		0.03[#7]	0.03[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Endosulfan I	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Endosulfan II	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Endosulfan sulphate	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Endrin	mg/kg	0.03		180[#1]		18[#7]	18[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Endrin aldehyde	mg/kg	0.03							<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	g-BHC (Lindane)	mg/kg	0.03		2.1[#1]		0.52[#7]	0.52[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Heptachlor	mg/kg	0.03		50[#3]	20[#4]	40[#7]	10[#5]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Heptachlor epoxide	mg/kg	0.03		0.19[#1]		0.053[#7]	0.053[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Hexachlorobenzene	mg/kg	0.03		1.1[#1]		0.3[#7]	0.3[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	Methoxychlor	mg/kg	0.03		3100[#1]		310[#7]	310[#2]		<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
Other VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.01		9.3[#1]		1.9[#7]	1.9[#2]		<0.01	-	-	-	-	-	-	-	<0.01	-	<0.01	-	-	-
	1,1,1-trichloroethane	mg/kg	0.01		38000[#1]		8700[#7]	8700[#2]		<0.01	-	-	-	-	-	-	-	<0.01	-	<0.01	-	-	-
	1,1,2,2-tetrachloroethane	mg/kg	0.02		2.8[#1]		0.56[#7]	0.56[#2]		<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	1,1,2-trichloroethane	mg/kg	0.04		5.3[#1]		1.1[#7]	1.1[#2]		<0.04	-	-	-	-	-	-	-	<0.04	-	<0.04	-	-	-
	1,1-dichloroethene	mg/kg	0.01		1100[#1]		240[#7]	240[#2]		<0.01	-	-	-	-	-	-	-	<0.01	-	<0.01	-	-	-
	1,2,4-trichlorobenzene	mg/kg	0.01		99[#1]		22[#7]	22[#2]		<0.01	-	-	-	-	-	-	-	<0.01	-	<0.01	-	-	-
	1,2-dichlorobenzene	mg/kg	0.02		9800[#1]		1900[#7]	1900[#2]		<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	1,2-dichloroethane	mg/kg	0.02		2.2[#1]		0.43[#7]	0.43[#2]		<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-

Preliminary Environmental Site Assesssment
15 Horne Street Elsternwick

Table 1 - Soils Analytical Results vs. Investigation Levels

Sample ID	SB01_0.55-0.65	SB01_1.4-2.0	SB02_0.5-0.6	SB02_1.4-2.0	SB03_0.15-0.25	SB03_0.9-1.0	SB04_0.7-0.8	SB04_1.2-1.3	SB05_0.8-0.9	SB05_1.3-1.4	SB06_0.8-0.9	QS04	QS05	SB06_1.35-1.45
Location	SB01	SB01	SB02	SB02	SB03	SB03	SB04	SB04	SB05	SB05	SB06	SB06_0.8-0.9	SB06_0.8-0.9	SB06
Sample Date	17/01/2011	17/01/2011	17/01/2011	17/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011	18/01/2011
Matrix	Fill	Clay	Fill	Clay	Fill	Clay	Fill	Clay	Fill	Clay	Fill	Fill	Fill	Clay

Chem_Group	Chemical Name	Units	EQL	Maintenance of Ecosystems	Human Health - Commercial/ Industrial	*Human Health - Recreation Open Space*	Human Health - Sensitive Use - High Density Residential	Human Health - Sensitive Use - Other													
	1,4-dichlorobenzene	mg/kg	0.02		12[#1]		2.4[#7]	**2.4**[#2]	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	Carbon tetrachloride	mg/kg	0.01		3[#1]		0.61[#7]	**0.61**[#2]	<0.01	-	-	-	-	-	-	-	<0.01	-	<0.01	-	-	-
	Chlorobenzene	mg/kg	0.02		1400[#1]		290[#7]	**290**[#2]	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	Chloroform	mg/kg	0.02		1.5[#1]		0.29[#7]	**0.29**[#2]	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	cis-1,2-dichloroethene	mg/kg	0.01		2000[#1]		160[#7]	**160**[#2]	<0.01	-	-	-	-	-	-	-	<0.01	-	<0.01	-	-	-
	Dichloromethane	mg/kg	0.4		53[#1]		11[#7]	**11**[#2]	<0.4	-	-	-	-	-	-	-	<0.4	-	<0.4	-	-	-
	Hexachlorobutadiene	mg/kg	0.02		22[#1]		6.2[#7]	**6.2**[#2]	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	Styrene	mg/kg	0.5		36000[#1]		6300[#7]	**6300**[#2]	<0.5	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-
	Trichloroethene	mg/kg	0.02		14[#1]		2.8[#7]	**2.8**[#2]	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	Tetrachloroethene	mg/kg	0.02		2.6[#1]		0.55[#7]	**0.55**[#2]	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	trans-1,2-dichloroethene	mg/kg	0.02		690[#1]		150[#7]	**150**[#2]	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
	Vinyl chloride	mg/kg	0.02		1.7[#1]		0.06[#7]	**0.06**[#2]	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	-
Phenols	2,3,5,6-Tetrachlorophenol	mg/kg	0.03						<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	2,4,5-trichlorophenol	mg/kg	0.05		62000[#1]		6100[#7]	**6100**[#2]	<0.06	-	-	-	-	-	-	-	<0.05	-	<0.06	-	-	-
	2,4,6-trichlorophenol	mg/kg	0.05		160[#1]		44[#7]	**44**[#2]	<0.06	-	-	-	-	-	-	-	<0.05	-	<0.06	-	-	-
	2,4-dichlorophenol	mg/kg	0.03		180[#1]		180[#7]	**180**[#2]	<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	2,4-dimethylphenol	mg/kg	1		12000[#1]		1200[#7]	**1200**[#2]	<1	-	-	-	-	-	-	-	<1	-	<1	-	-	-
	2,4-dinitrophenol	mg/kg	5		1200[#1]		120[#7]	**120**[#2]	<5	-	-	-	-	-	-	-	<5	-	<5	-	-	-
	2,6-dichlorophenol	mg/kg	0.03						<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	2,3,4,5 & 2,3,4,6-Tetrachlorophenol	mg/kg	0.05						<0.12	-	-	-	-	-	-	-	<0.05	-	<0.12	-	-	-
	2-chlorophenol	mg/kg	0.03		510[#1]		390[#7]	**390**[#2]	<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	2-methylphenol	mg/kg	1		31000[#1]		3100[#7]	**3100**[#2]	<1	-	-	-	-	-	-	-	<1	-	<1	-	-	-
	2-nitrophenol	mg/kg	1						<1	-	-	-	-	-	-	-	<1	-	<1	-	-	-
	3-&4-methylphenol	mg/kg	1						<1	-	-	-	-	-	-	-	<1	-	<1	-	-	-
	4,6-Dinitro-2-methylphenol	mg/kg	5		49[#1]		4.9[#7]	**4.9**[#2]	<5	-	-	-	-	-	-	-	<5	-	<5	-	-	-
	4,6-Dinitro-o-cyclohexyl phenol	mg/kg	5		1200[#1]		120[#7]	**120**[#2]	<5	-	-	-	-	-	-	-	<5	-	<5	-	-	-
	4-chloro-3-methylphenol	mg/kg	0.03		62000[#1]		6100[#7]	**6100**[#2]	<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
	4-nitrophenol	mg/kg	5						<5	-	-	-	-	-	-	-	<5	-	<5	-	-	-
	Pentachlorophenol	mg/kg	0.2		2.7[#1]		0.89[#7]	**0.89**[#2]	<0.2	-	-	-	-	-	-	-	<0.2	-	<0.2	-	-	-
	Phenol	mg/kg	1		42500[#3]	*17000*[#4]	3400[#7]	**8500**[#6]	<1	-	-	-	-	-	-	-	<1	-	<1	-	-	-
	IWRG Phenols (non-halogenated)	mg/kg	1						<1	-	-	-	-	-	-	-	<1	-	<1	-	-	-
	IWRG Phenols(halogenated)	mg/kg	0.03						<0.06	-	-	-	-	-	-	-	<0.03	-	<0.06	-	-	-
Other	PCBs (Sum of total)	mg/kg	0.1		50[#3]	*20*[#4]	40[#7]	**10**[#5]	<0.1	-	-	-	-	-	-	-	<0.1	-	<0.1	-	-	-
	Dinoseb	mg/kg	5		620[#1]		61[#7]	**61**[#2]	<5	-	-	-	-	-	-	-	<5	-	<5	-	-	-
	IWRG Chlorinated hydrocarbons*	mg/kg	0.01						<0.01	-	-	-	-	-	-	-	<0.01	-	<0.01	-	-	-
	IWRG Other chlorinated hydrocarbons*	mg/kg	0.01						<0.01	-	-	-	-	-	-	-	<0.01	-	<0.01	-	-	-

Comments

#1 US EPA RSL November 2010 - industrial
#2 US EPA RSL 2010 November - residential
#3 NEPM Health Investigation Levels - Setting F (1999)
#4 NEPM Health Investigation Levels - Setting E (1999)
#5 NEPM Health Investigation Levels - Setting A (1999)
#6 NEPM EILs 1999
#7 Human Health - Sensitive Use - High Density Residential
#8 CCME 2008 (TPH only)

Location Code	Sampled Date	Field ID	Sample Type	Lab Report No.	BTEX							TRH					CRC Care TRH Fractions						
					Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C6-C10	C10-C16	C16-C34	C34-C40	C10 - C40 (Sum of total)	F1: C6-C10 less BTEX	F2: >C10-C16 less Naphthalene
					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
LOR					1	1	1	2	1	3	1	20	50	100	100	100	20	50	100	100	100	20	50
ANZECC 2000 Fresh Water (95%)					950				350														
ANZECC 2000 Irrigation - Short-term trigger value																							
ANZECC 2000 Irrigation - Long-term trigger value																							
ANZECC 2000 Livestock drinking water					1#8	800#8	300#8			600#8													
ANZECC 1992 Industrial Use - Brackish																							
Managing Risks in Recreational Water 2008 (Health)					1	800	300			600													
Managing Risks in Recreational Water 2008 (Aesthetic)						25	3			20													
Buildings & Structures (AS2159-2009)																							
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																							
2-4m					5000	NL#18	NL#18			NL#18												NL#18	NL#18
4-8m					5000	NL#18	NL#18			NL#18												NL#18	NL#18
>8m					5000	NL#18	NL#18			NL#18												NL#18	NL#18
BH01	13/11/2018	BH01	Normal	627947	<1	<1	<1	<2	<1	<3	-	50	<50	<100	<100	<100	50	<50	<100	<100	<100	50	<50
BH01	12/12/2018	BH01_20181212	Normal	633193	<1	<1	<1	<2	<1	<3	-	60	<50	<100	<100	<100	60	<50	<100	<100	<100	60	<50
BH01	4/07/2019	BH01_20190704	Normal	664456	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50
BH02	13/11/2018	BH02	Normal	627947	<1	<1	<1	2	<1	<3	-	30	<50	<100	<100	<100	40	<50	<100	<100	<100	40	<50
BH02	13/11/2018	QC01_20181113	Duplicate	627947	<1	<1	<1	2	<1	<3	-	30	<50	<100	<100	<100	40	<50	<100	<100	<100	40	<50
BH02	13/11/2018	QC02_20181113	Split	EM1818487	<1	<2	<2	2	<2	2	2	40	<50	210	<50	210	40	<100	160	<100	160	40	<100
BH02	12/12/2018	BH02_20181212	Normal	633193	<1	<1	<1	<2	<1	<3	-	60	<50	<100	<100	<100	60	<50	<100	<100	<100	60	<50
BH02	12/12/2018	QC01_20181212	Duplicate	633193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH02	12/12/2018	QC02_20181212	Split	EM1820215	<1	<2	<2	<2	<2	<2	<1	50	<50	<100	<50	<50	50	<100	<100	<100	<100	50	<100
BH02	4/07/2019	BH02_20190704	Normal	664456	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50
BH03	13/11/2018	BH03	Normal	627947	<1	<1	<1	<2	<1	<3	-	30	<50	<100	<100	<100	30	<50	<100	<100	<100	30	<50
BH03	12/12/2018	BH03_20181212	Normal	633193	<1	<1	<1	<2	<1	<3	-	60	<50	<100	<100	<100	60	<50	<100	<100	<100	60	<50
BH03	4/07/2019	BH03_20190704	Normal	664456	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50
BH03	4/07/2019	QC01_20190704	Duplicate	664456	<1	<1	<1	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-
BH03	4/07/2019	QC02_20190704	Split	EM1910736	<1	<2	<2	<2	<2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05	14/11/2018	BH05	Normal	627947	<1	<1	<1	<2	<1	<3	-	20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50
BH05	12/12/2018	BH05_20181212	Normal	633193	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50
BH05	4/07/2019	BH05_20190704	Normal	664456	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100	<20	<50	<100	<100	<100	<20	<50

Field ID	MAH										PAH																
	Total MAH	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	Styrene	tert-butylbenzene	Benzo(b+j)fluoranthene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
	mg/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
LOR	0.003	1	1	1	5	5	5	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ANZECC 2000 Fresh Water (95%)														0.4 #1										16			
ANZECC 2000 Irrigation - Short-term trigger value																											
ANZECC 2000 Irrigation - Long-term trigger value																											
ANZECC 2000 Livestock drinking water									30#8							0.01#8											
ANZECC 1992 Industrial Use - Brackish																											
Managing Risks in Recreational Water 2008 (Health)									30							0.01											
Managing Risks in Recreational Water 2008 (Aesthetic)									4																		
Buildings & Structures (AS2159-2009)																											
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																											
2-4m																								NL#18			
4-8m																								NL#18			
>8m																								NL#18			
BH01	<0.003	<1	<1	<1	-	-	-	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH01_20181212	-	<1	<1	<1	-	-	-	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH01_20190704	<0.003	<1	<1	<1	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
BH02	<0.003	1	<1	<1	-	-	-	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
QC01_20181113	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
QC02_20181113	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
BH02_20181212	-	<1	<1	<1	-	-	-	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
QC01_20181212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QC02_20181212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
BH02_20190704	<0.003	<1	<1	<1	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
BH03	<0.003	<1	<1	<1	-	-	-	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH03_20181212	-	<1	<1	<1	-	-	-	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH03_20190704	<0.003	<1	<1	<1	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
QC01_20190704	<0.003	<1	<1	<1	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QC02_20190704	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
BH05	<0.003	<1	<1	<1	-	-	-	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH05_20181212	-	<1	<1	<1	-	-	-	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH05_20190704	<0.003	<1	<1	<1	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-

Env Stds Comments

#1:Low reliability - derived using either assessment factors or from modelled data using the statistical method. Low degree of confidence, should only be used as interim indicative working levels.
#2:pH>6.5
#3:See Notes for Table 3.4.1
#4:Errata Slip June 2005; See Notes for Table 3.4.1
#5:Criterion from Hickey (2013) Updating nitrate toxicity effects on freshwater aquatic species
#6:Short-term use - up to 20 yrs
#7:Long-term use - up to 100 yrs
#8:In the absence of livestock specific criteria for pesticides and other organic contaminants NHMRC 2011 drinking water criteria used.
#9:Depending on presence of other constituents such as phosphorus, magnesium, or sodium
#10:Sheep. Higher for other livestock.
#11:Sheep. Higher for other livestock. Errata Slip, June 2005.
#12:Loss of production and a decline in animal condition and health would be expected (poultry). Higher for other livestock.
#13:Criteria for inorganic compounds have been multiplied by 10, to account for the assumed ingestion of 200 mL during recreational activities (NHMRC 2008, Section 9.3.2)
#14:pH range of 5.0-9.0 acceptable if water has very poor buffering capacity
#15:Sulfate and pH need to be included in assessment, refer to Table 6.4.2-C
#16:Sulfate and chloride need to be included in assessment, refer to Table 6.4.2-C
#17:Chloride and pH need to be included in assessment, refer to Table 6.4.2-C
#18:The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour that is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.
#19: ANZG (2018) Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants

					BTEX							TRH				
					Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR					1	1	1	2	1	3	1	20	50	100	100	100
ANZECC 2000 Fresh Water (95%)					950				350							
ANZECC 2000 Irrigation - Short-term trigger value																
ANZECC 2000 Irrigation - Long-term trigger value																
ANZECC 2000 Livestock drinking water					1#8	800#8	300#8			600#8						
ANZECC 1992 Industrial Use - Brackish																
Managing Risks in Recreational Water 2008 (Health)					1	800	300			600						
Managing Risks in Recreational Water 2008 (Aesthetic)						25	3			20						
Buildings & Structures (AS2159-2009)																
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																
2-4m					5000	NL#18	NL#18			NL#18						
4-8m					5000	NL#18	NL#18			NL#18						
>8m					5000	NL#18	NL#18			NL#18						
Location Code	**Sampled Date**	**Field ID**	**Sample Type**	**Lab Report No.**												
BH01	13/11/2018	BH01	Normal	627947	<1	<1	<1	<2	<1	<3	-	50	<50	<100	<100	<100
	12/12/2018	BH01_20181212	Normal	633193	<1	<1	<1	<2	<1	<3	-	60	<50	<100	<100	<100
	4/07/2019	BH01_20190704	Normal	664456	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100
BH02	13/11/2018	BH02	Normal	627947	<1	<1	<1	2	<1	<3	-	30	<50	<100	<100	<100
	13/11/2018	QC01_20181113	Duplicate	627947	<1	<1	<1	2	<1	<3	-	30	<50	<100	<100	<100
	13/11/2018	QC02_20181113	Split	EM1818487	<1	<2	<2	2	<2	2	2	40	<50	210	<50	210
	12/12/2018	BH02_20181212	Normal	633193	<1	<1	<1	<2	<1	<3	-	60	<50	<100	<100	<100
	12/12/2018	QC01_20181212	Duplicate	633193	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	QC02_20181212	Split	EM1820215	<1	<2	<2	<2	<2	<2	<1	50	<50	<100	<50	<50
	4/07/2019	BH02_20190704	Normal	664456	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100
BH03	13/11/2018	BH03	Normal	627947	<1	<1	<1	<2	<1	<3	-	30	<50	<100	<100	<100
	12/12/2018	BH03_20181212	Normal	633193	<1	<1	<1	<2	<1	<3	-	60	<50	<100	<100	<100
	4/07/2019	BH03_20190704	Normal	664456	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100
	4/07/2019	QC01_20190704	Duplicate	664456	<1	<1	<1	<2	<1	<3	-	-	-	-	-	-
	4/07/2019	QC02_20190704	Split	EM1910736	<1	<2	<2	<2	<2	-	-	-	-	-	-	-
BH05	14/11/2018	BH05	Normal	627947	<1	<1	<1	<2	<1	<3	-	20	<50	<100	<100	<100
	12/12/2018	BH05_20181212	Normal	633193	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100
	4/07/2019	BH05_20190704	Normal	664456	<1	<1	<1	<2	<1	<3	-	<20	<50	<100	<100	<100

					CRC Care TRH Fractions							MAH									
					C6-C10	C10-C16	C16-C34	C34-C40	C10 - C40 (Sum of total)	F1: C6-C10 less BTEX	F2: >C10-C16 less Naphthalene	Total MAH	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	Styrene	tert-butylbenzene
					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	µg/L	µg/L	µg/L	µg/L
LOR					20	50	100	100	100	20	50	0.003	1	1	1	5	5	5	5	1	5
ANZECC 2000 Fresh Water (95%)																					
ANZECC 2000 Irrigation - Short-term trigger value																					
ANZECC 2000 Irrigation - Long-term trigger value																					
ANZECC 2000 Livestock drinking water																				30#8	
ANZECC 1992 Industrial Use - Brackish																					
Managing Risks in Recreational Water 2008 (Health)																				30	
Managing Risks in Recreational Water 2008 (Aesthetic)																				4	
Buildings & Structures (AS2159-2009)																					
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																					
2-4m										NL#18	NL#18										
4-8m										NL#18	NL#18										
>8m										NL#18	NL#18										
Location Code	**Sampled Date**	**Field ID**	**Sample Type**	**Lab Report No.**																	
BH01	13/11/2018	BH01	Normal	627947	50	<50	<100	<100	<100	50	<50	<0.003	<1	<1	<1	-	-	-	-	<1	-
	12/12/2018	BH01_20181212	Normal	633193	60	<50	<100	<100	<100	60	<50	-	<1	<1	<1	-	-	-	-	<1	-
	4/07/2019	BH01_20190704	Normal	664456	<20	<50	<100	<100	<100	<20	<50	<0.003	<1	<1	<1	-	-	-	-	<1	-
BH02	13/11/2018	BH02	Normal	627947	40	<50	<100	<100	<100	40	<50	<0.003	1	<1	<1	-	-	-	-	<1	-
	13/11/2018	QC01_20181113	Duplicate	627947	40	<50	<100	<100	<100	40	<50	-	-	-	-	-	-	-	-	-	-
	13/11/2018	QC02_20181113	Split	EM1818487	40	<100	160	<100	160	40	<100	-	-	-	-	-	-	-	-	-	-
	12/12/2018	BH02_20181212	Normal	633193	60	<50	<100	<100	<100	60	<50	-	<1	<1	<1	-	-	-	-	<1	-
	12/12/2018	QC01_20181212	Duplicate	633193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	QC02_20181212	Split	EM1820215	50	<100	<100	<100	<100	50	<100	-	-	-	-	-	-	-	-	-	-
	4/07/2019	BH02_20190704	Normal	664456	<20	<50	<100	<100	<100	<20	<50	<0.003	<1	<1	<1	-	-	-	-	<1	-
BH03	13/11/2018	BH03	Normal	627947	30	<50	<100	<100	<100	30	<50	<0.003	<1	<1	<1	-	-	-	-	<1	-
	12/12/2018	BH03_20181212	Normal	633193	60	<50	<100	<100	<100	60	<50	-	<1	<1	<1	-	-	-	-	<1	-
	4/07/2019	BH03_20190704	Normal	664456	<20	<50	<100	<100	<100	<20	<50	<0.003	<1	<1	<1	-	-	-	-	<1	-
	4/07/2019	QC01_20190704	Duplicate	664456	-	-	-	-	-	-	-	<0.003	<1	<1	<1	-	-	-	-	<1	-
	4/07/2019	QC02_20190704	Split	EM1910736	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
BH05	14/11/2018	BH05	Normal	627947	<20	<50	<100	<100	<100	<20	<50	<0.003	<1	<1	<1	-	-	-	-	<1	-
	12/12/2018	BH05_20181212	Normal	633193	<20	<50	<100	<100	<100	<20	<50	-	<1	<1	<1	-	-	-	-	<1	-
	4/07/2019	BH05_20190704	Normal	664456	<20	<50	<100	<100	<100	<20	<50	<0.003	<1	<1	<1	-	-	-	-	<1	-

					PAH																
					Benzo(b+j)fluoranthene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
					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
LOR					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ANZECC 2000 Fresh Water (95%)								0.4#1										16			
ANZECC 2000 Irrigation - Short-term trigger value																					
ANZECC 2000 Irrigation - Long-term trigger value																					
ANZECC 2000 Livestock drinking water										0.01#8											
ANZECC 1992 Industrial Use - Brackish																					
Managing Risks in Recreational Water 2008 (Health)										0.01											
Managing Risks in Recreational Water 2008 (Aesthetic)																					
Buildings & Structures (AS2159-2009)																					
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																					
2-4m																		NL#18			
4-8m																		NL#18			
>8m																		NL#18			
Location Code	**Sampled Date**	**Field ID**	**Sample Type**	**Lab Report No.**																	
BH01	13/11/2018	BH01	Normal	627947	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	12/12/2018	BH01_20181212	Normal	633193	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	4/07/2019	BH01_20190704	Normal	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
BH02	13/11/2018	BH02	Normal	627947	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	13/11/2018	QC01_20181113	Duplicate	627947	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
	13/11/2018	QC02_20181113	Split	EM1818487	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
	12/12/2018	BH02_20181212	Normal	633193	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	12/12/2018	QC01_20181212	Duplicate	633193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	QC02_20181212	Split	EM1820215	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
	4/07/2019	BH02_20190704	Normal	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
BH03	13/11/2018	BH03	Normal	627947	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	12/12/2018	BH03_20181212	Normal	633193	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	4/07/2019	BH03_20190704	Normal	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
	4/07/2019	QC01_20190704	Duplicate	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/07/2019	QC02_20190704	Split	EM1910736	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
BH05	14/11/2018	BH05	Normal	627947	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	12/12/2018	BH05_20181212	Normal	633193	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	4/07/2019	BH05_20190704	Normal	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-

Env Stds Comments

#1:Low reliability - derived using either assessment factors or from modelled data using the statistical method. Low degree of confidence, should only be used as interim indicative working levels.
#2:pH>6.5
#3:See Notes for Table 3.4.1
#4:Errata Slip June 2005; See Notes for Table 3.4.1
#5:Criterion from Hickey (2013) Updating nitrate toxicity effects on freshwater aquatic species
#6:Short-term use - up to 20 yrs
#7:Long-term use - up to 100 yrs
#8:In the absence of livestock specific criteria for pesticides and other organic contaminants NHMRC 2011 drinking water criteria used.
#9:Depending on presence of other constituents such as phosphorus, magnesium, or sodium
#10:Sheep. Higher for other livestock.
#11:Sheep. Higher for other livestock. Errata Slip, June 2005.
#12:Loss of production and a decline in animal condition and health would be expected (poultry). Higher for other livestock.
#13:Criteria for inorganic compounds have been multiplied by 10, to account for the assumed ingestion of 200 mL during recreational activities (NHMRC 2008, Section 9.3.2)
#14:pH range of 5.0-9.0 acceptable if water has very poor buffering capacity
#15:Sulfate and pH need to be included in assessment, refer to Table 6.4.2-C
#16:Sulfate and chloride need to be included in assessment, refer to Table 6.4.2-C
#17:Chloride and pH need to be included in assessment, refer to Table 6.4.2-C
#18:The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour that is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.
#19: ANZG (2018) Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants

	Metals																				Inorganics																	
	Aluminium (Filtered)	Arsenic (Filtered)	Cadmium (Filtered)	Calcium	Chromium (hexavalent)	Chromium (III+VI) (Filtered)	Copper (Filtered)	Iron (Filtered)	Lead (Filtered)	Magnesium	Manganese (Filtered)	Mercury (Filtered)	Molybdenum (Filtered)	Nickel (Filtered)	Potassium	Selenium (Filtered)	Silver (Filtered)	Sodium	Tin (Filtered)	Zinc (Filtered)	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Ammonia as N	Chloride	Cyanide Total	Electrical conductivity *(lab)	Fluoride	Nitrate (as N)	Nitrite (as N)	Nitrate & Nitrite (as N)	pH (Lab)	Reactive Phosphorus as P	Sulfate	Hardness	TDS
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm	mg/L	mg/L	mg/L	mg/L	pH Units	mg/L	mg/L	µg/L	mg/L
LOR	0.05	0.001	0.0002	0.5	0.001	0.001	0.001	0.05	0.001	0.5	0.005	0.0001	0.005	0.001	0.5	0.001	0.005	0.5	0.005	0.005	20	10	20	20	0.01	1	0.005	1	0.5	0.02	0.02	0.05	0.1	0.01	5		10
ANZECC 2000 Fresh Water (95%)	0.055[#2]		0.0017[#19]		0.007[#19]		0.0014		0.070[#19]		1.9[#3]	0.0006		0.084[#19]		0.011	0.00005			0.061[#19]					0.9[#4]		0.007			2.4[#5]								
ANZECC 2000 Irrigation - Short-term trigger value	20[#6]	2[#6]	0.05[#6]			1[#6]	5[#6]	10[#6]	5[#6]		10[#6]	0.002[#6]	0.05[#6]	2[#6]		0.05[#6]				5[#6]										2[#6]								
ANZECC 2000 Irrigation - Long-term trigger value	5[#7]	0.1[#7]	0.01[#7]			0.1[#7]	0.2[#7]	0.2[#7]	2[#7]		0.2[#7]	0.002[#7]	0.01[#7]	0.2[#7]		0.02[#7]				2[#7]										1[#7]								
ANZECC 2000 Livestock drinking water	5	0.5	0.01	1000[#9]		1	0.4[#10][0.5#11]		0.1			0.002	0.15	1		0.02				20										2	338.7	9.13				2000		3000[#12]
ANZECC 1992 Industrial Use - Brackish				420				0.08													140					19000											
Managing Risks in Recreational Water 2008 (Health)		0.07[#13]	0.02[#13]		0.5[#13]		20[#13]		0.1[#13]		5[#13]	0.01[#13]	0.5[#13]	0.2[#13]		0.1[#13]											0.8[#13]			15[#13]	113[#13]	9[#13]		6.5-8.5[#14]		5000[#13]		
Managing Risks in Recreational Water 2008 (Aesthetic)							1	0.3			0.1								180						0.4	250									250		
Buildings & Structures (AS2159-2009)																										6000[#15]							5.5-12[#16]		1000[#17]		
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																																					
2-4m																																					
4-8m																																					
>8m																																					

Location Code	Sampled Date	Field ID	Sample Type	Lab Report No.																																				
BH01	13/11/2018	BH01	Normal	627947	-	0.017	<0.0002	46	<0.001	<0.001	0.002	-	<0.001	33	-	<0.0001	<0.005	0.019	<5	0.002	<0.005	570	<0.005	0.028	600	<10	<20	600	<0.01	490	<0.005	3500	0.6	3.3	0.05	3.3	7.4	0.02	90	250	1500
	12/12/2018	BH01_20181212	Normal	633193	<0.05	0.007	<0.0002	39	-	0.002	0.002	2.7	<0.001	32	3.6	<0.0001	<0.005	0.01	5	0.003	<0.005	660	<0.005	0.110	420	<10	<20	420	0.24	660	<0.005	3000	0.5	4	-	-	6.4	-	140	229	1800
	4/07/2019	BH01_20190704	Normal	664456	<0.05	<0.001	<0.0002	-	-	<0.001	<0.001	<0.05	<0.001	-	<0.005	<0.0001	-	<0.001	-	-	-	-	-	<0.005	-	-	-	-	0.06	-	-	-	-	19	-	-	-	-	-	-	-
BH02	13/11/2018	BH02	Normal	627947	-	0.027	<0.0002	62	<0.001	<0.001	<0.001	-	<0.001	47	-	<0.0001	<0.005	0.019	<5	0.002	<0.005	590	<0.005	0.058	800	<10	<20	800	<0.01	670	<0.005	4200	0.8	0.1	0.38	0.48	7	<0.01	77	348	2000
	13/11/2018	QC01_20181113	Duplicate	627947	-	0.035	<0.0002	-	-	<0.001	<0.001	-	<0.001	-	-	<0.0001	-	0.018	-	-	-	-	-	0.057	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13/11/2018	QC02_20181113	Split	EM1818487	-	0.033	<0.0001	-	-	<0.001	<0.001	-	<0.001	-	-	<0.0001	-	0.017	-	-	-	-	-	0.053	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	BH02_20181212	Normal	633193	<0.05	0.019	<0.0002	67	-	<0.001	<0.001	5.8	<0.001	48	6.7	<0.0001	<0.005	0.006	<5	0.001	<0.005	660	<0.005	0.027	550	<10	<20	550	0.54	810	<0.005	3900	0.6	0.93	-	-	7	-	120	365	2000
	12/12/2018	QC01_20181212	Duplicate	633193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	QC02_20181212	Split	EM1820215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/07/2019	BH02_20190704	Normal	664456	<0.05	0.002	<0.0002	-	-	<0.001	0.003	<0.05	<0.001	-	1.9	<0.0001	-	0.026	-	-	-	-	-	0.035	-	-	-	-	0.02	-	-	-	-	4.6	-	-	-	-	-	-	-
BH03	13/11/2018	BH03	Normal	627947	-	0.018	<0.0002	63	<0.001	<0.001	0.001	-	<0.001	49	-	<0.0001	<0.005	0.01	<5	0.003	<0.005	670	<0.005	0.010	550	<10	<20	550	0.11	790	<0.005	4400	0.6	4.6	0.03	4.6	8	0.02	110	359	2000
	12/12/2018	BH03_20181212	Normal	633193	0.06	0.003	<0.0002	56	-	<0.001	<0.001	0.61	<0.001	41	3.4	<0.0001	<0.005	0.005	<5	0.004	<0.005	670	<0.005	0.010	390	<10	<20	390	0.42	840	<0.005	3900	0.5	9.1	-	-	7.7	-	140	308	2100
	4/07/2019	BH03_20190704	Normal	664456	<0.05	0.002	<0.0002	-	-	<0.001	0.002	<0.05	<0.001	-	0.57	<0.0001	-	0.024	-	-	-	-	-	0.066	-	-	-	-	0.04	-	-	-	-	12	-	-	-	-	-	-	-
	4/07/2019	QC01_20190704	Duplicate	664456	<0.05	0.002	<0.0002	-	-	<0.001	0.002	<0.05	<0.001	-	0.58	<0.0001	-	0.024	-	-	-	-	-	0.067	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/07/2019	QC02_20190704	Split	EM1910736	0.03	0.002	<0.0001	-	-	<0.001	0.002	<0.05	<0.001	-	0.622	<0.0001	-	0.027	-	-	-	-	-	0.071	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05	14/11/2018	BH05	Normal	627947	-	0.014	<0.0002	68	<0.001	<0.001	<0.001	-	<0.001	43	-	<0.0001	<0.005	0.011	<5	0.003	<0.005	610	<0.005	0.032	450	<10	<20	450	<0.01	770	<0.005	3500	0.8	7.2	0.04	7.2	8.2	0.02	110	346	1800
	12/12/2018	BH05_20181212	Normal	633193	<0.05	0.02	<0.0002	77	-	0.001	0.003	2.0	<0.001	50	2.8	<0.0001	<0.005	0.009	5.8	0.004	<0.005	700	<0.005	0.110	490	<10	<20	490	0.16	900	<0.005	4000	<0.5	9.1	-	-	6.3	-	120	398	2100
	4/07/2019	BH05_20190704	Normal	664456	<0.05	0.005	<0.0002	-	-	<0.001	<0.001	0.38	<0.001	-	0.37	<0.0001	-	0.030	-	-	-	-	-	0.067	-	-	-	-	0.18	-	-	-	-	13	-	-	-	-	-	-	-

Env Stds Comments

#1:Low reliability - derived using either assessment factors or from modelled data using the statistical method. Low degree of confidence, should only be used as interim indicative working levels.
#2:pH>6.5
#3:See Notes for Table 3.4.1
#4:Errata Slip June 2005; See Notes for Table 3.4.1
#5:Criterion from Hickey (2013) Updating nitrate toxicity effects on freshwater aquatic species
#6:Short-term use - up to 20 yrs
#7:Long-term use - up to 100 yrs
#8:In the absence of livestock specific criteria for pesticides and other organic contaminants NHMRC 2011 drinking water criteria used.
#9:Depending on presence of other constituents such as phosphorus, magnesium, or sodium
#10:Sheep. Higher for other livestock.
#11:Sheep. Higher for other livestock. Errata Slip, June 2005.
#12:Loss of production and a decline in animal condition and health would be expected (poultry). Higher for other livestock.
#13:Criteria for inorganic compounds have been multiplied by 10, to account for the assumed ingestion of 200 mL during recreational activities (NHMRC 2008, Section 9.3.2)
#14:pH range of 5.0-9.0 acceptable if water has very poor buffering capacity
#15:Sulfate and pH need to be included in assessment, refer to Table 6.4.2-C
#16:Sulfate and chloride need to be included in assessment, refer to Table 6.4.2-C
#17:Chloride and pH need to be included in assessment, refer to Table 6.4.2-C
#18:The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour that is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.
#19: ANZG (2018) Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants

	VOCs			Chlorinated Hydrocarbons																																		
	cis-1,4-Dichloro-2-butene	Pentachloroethane	trans-1,4-Dichloro-2-butene	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,1-dichloropropene	1,2,3-trichloropropane	1,2-dibromo-3-chloropropane	1,2-dichloroethane	1,2-dichloropropane	1,3-dichloropropane	2,2-dichloropropane	Bromochloromethane	Bromodichloromethane	Bromoform	Carbon tetrachloride	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	cis-1,2-dichloroethene	cis-1,3-dichloropropene	Dibromomethane	Dichloromethane	Hexachlorobutadiene	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene	trans-1,3-dichloropropene	Vinyl chloride
	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
LOR	5	5	5	1	1	1	1	0.01	1	5	1	5	0.01	1	1	5	1	1	1	1	1	1	5	1	0.01	1	1	0.02	1	0.01	0.02	1	1	0.05
ANZECC 2000 Fresh Water (95%)							6500																														
ANZECC 2000 Irrigation - Short-term trigger value																																					
ANZECC 2000 Irrigation - Long-term trigger value																																					
ANZECC 2000 Livestock drinking water									30[#8]				3[#8]							3[#8]								4[#8]	0.7[#8]		50[#8]			0.3[#8]		
ANZECC 1992 Industrial Use - Brackish																																					
Managing Risks in Recreational Water 2008 (Health)									30				3							3								4	0.7		50			0.3		
Managing Risks in Recreational Water 2008 (Aesthetic)																																					
Buildings & Structures (AS2159-2009)																																					
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																																					
2-4m																																					
4-8m																																					
>8m																																					

Location Code	Sampled Date	Field ID	Sample Type	Lab Report No.																																			
BH01	13/11/2018	BH01	Normal	627947	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	<1	1	57	<1	<1	<1
	12/12/2018	BH01_20181212	Normal	633193	-	-	-	<1	<1	<1	<1	<0.01	<1	-	<1	-	<0.01	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	0.3	<1	<1	<0.02	-	1.6	56	<1	<1	<0.05
	4/07/2019	BH01_20190704	Normal	664456	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	-	1	53	<1	<1	<1
BH02	13/11/2018	BH02	Normal	627947	-	-	-	<1	<1	<1	<1	<2	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	3	<1	<1	30	<1	<1	<1
	13/11/2018	QC01_20181113	Duplicate	627947	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13/11/2018	QC02_20181113	Split	EM1818487	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	BH02_20181212	Normal	633193	-	-	-	<1	<1	<1	<1	0.06	<1	-	<1	-	<0.01	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	0.75	<1	<1	0.18	-	2.3	52	<1	<1	<0.05
	12/12/2018	QC01_20181212	Duplicate	633193	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	-	<1	<1	<1	<1	-	<5	<1	<1	<1	<1	<1	-	2	41	<1	<1	<1
	12/12/2018	QC02_20181212	Split	EM1820215	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	-	<5	<5	36	<5	<5	<50
	4/07/2019	BH02_20190704	Normal	664456	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	-	2	41	<1	<1	<1
BH03	13/11/2018	BH03	Normal	627947	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	<1	<1	35	<1	<1	<1
	12/12/2018	BH03_20181212	Normal	633193	-	-	-	<1	<1	<1	<1	<0.01	<1	-	<1	-	<0.01	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	1.3	<1	<1	<0.02	-	2.3	48	<1	<1	<0.05
	4/07/2019	BH03_20190704	Normal	664456	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	-	2	32	<1	<1	<1
	4/07/2019	QC01_20190704	Duplicate	664456	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	-	2	28	<1	<1	<1
	4/07/2019	QC02_20190704	Split	EM1910736	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	-	<5	<5	24	<5	<5	<50
BH05	14/11/2018	BH05	Normal	627947	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	<1	<1	22	<1	<1	<1
	12/12/2018	BH05_20181212	Normal	633193	-	-	-	<1	<1	<1	<1	<0.01	<1	-	<1	-	<0.01	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	0.22	<1	<1	<0.02	-	0.46	11	<1	<1	<0.05
	4/07/2019	BH05_20190704	Normal	664456	-	-	-	<1	<1	<1	<1	<1	<1	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	-	1	26	<1	<1	<1

Env Stds Comments

#1:Low reliability - derived using either assessment factors or from modelled data using the statistical method. Low degree of confidence, should only be used as interim indicative working levels.
#2:pH>6.5
#3:See Notes for Table 3.4.1
#4:Errata Slip June 2005; See Notes for Table 3.4.1
#5:Criterion from Hickey (2013) Updating nitrate toxicity effects on freshwater aquatic species
#6:Short-term use - up to 20 yrs
#7:Long-term use - up to 100 yrs
#8:In the absence of livestock specific criteria for pesticides and other organic contaminants NHMRC 2011 drinking water criteria used.
#9:Depending on presence of other constituents such as phosphorus, magnesium, or sodium
#10:Sheep. Higher for other livestock.
#11:Sheep. Higher for other livestock. Errata Slip, June 2005.
#12:Loss of production and a decline in animal condition and health would be expected (poultry). Higher for other livestock.
#13:Criteria for inorganic compounds have been multiplied by 10, to account for the assumed ingestion of 200 mL during recreational activities (NHMRC 2008, Section 9.3.2)
#14:pH range of 5.0-9.0 acceptable if water has very poor buffering capacity
#15:Sulfate and pH need to be included in assessment, refer to Table 6.4.2-C
#16:Sulfate and chloride need to be included in assessment, refer to Table 6.4.2-C
#17:Chloride and pH need to be included in assessment, refer to Table 6.4.2-C
#18:The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour that is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.
#19: ANZG (2018) Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants

	Halogenated Hydrocarbons																Phenols										Halogenated Phenols							
	Chlorinated hydrocarbons IWRG621	Other chlorinated HCs IWRG621	1,2,3-trichlorobenzene	1,2,4-trichlorobenzene	1,2-dibromoethane	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	2-chlorotoluene	4-chlorotoluene	Bromobenzene	Bromomethane	Chlorobenzene	Dichlorodifluoromethane	Iodomethane	Trichlorofluoromethane	Total Non-Halogenated Phenol*	2,4-dimethylphenol	2,4-dinitrophenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4,6-Dinitro-2-methylphenol	4,6-Dinitro-o-cyclohexyl phenol	4-chloro-3-methylphenol	4-nitrophenol	Phenol	Total Halogenated Phenol*	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol	tetrachlorophenols
	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	mg/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	µg/L	µg/L
LOR	5	5	5	1	1	1	1	0.01	5	1	1	1	0.01	1	1	1	0.1	3	0.03	3	10	6	30	100	10	30	3	0.01	10	10	3	3	3	10	30
ANZECC 2000 Fresh Water (95%)			10	170[#3]		160	260	60										2[#1]	0.045		2[#1]						320		0.5[#1]	20	160[#3]	34[#1]	490[#3]	10	
ANZECC 2000 Irrigation - Short-term trigger value																																			
ANZECC 2000 Irrigation - Long-term trigger value																																			
ANZECC 2000 Livestock drinking water					1[#8]	1500[#8]		40[#8]				1[#8]	300[#8]																	20[#8]	200[#8]		300[#8]	10[#8]	
ANZECC 1992 Industrial Use - Brackish																																			
Managing Risks in Recreational Water 2008 (Health)					1	1500		40					300																	20	200		300	10	
Managing Risks in Recreational Water 2008 (Aesthetic)						1	20	0.3					10																	2	0.3		0.1		
Buildings & Structures (AS2159-2009)																																			
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																																			
2-4m																																			
4-8m																																			
>8m																																			

Location Code	Sampled Date	Field ID	Sample Type	Lab Report No.																																
BH01	13/11/2018	BH01	Normal	627947	58	58	-	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	12/12/2018	BH01_20181212	Normal	633193	-	-	-	<1	<1	<1	<0.01	-	<1	<1	<1	<0.01	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	4/07/2019	BH01_20190704	Normal	664456	54	54	-	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
BH02	13/11/2018	BH02	Normal	627947	33	33	-	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	13/11/2018	QC01_20181113	Duplicate	627947	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13/11/2018	QC02_20181113	Split	EM1818487	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	BH02_20181212	Normal	633193	-	-	-	-	<1	<1	<1	<0.01	-	<1	<1	<1	<0.01	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	12/12/2018	QC01_20181212	Duplicate	633193	43	43	-	-	<1	<1	<1	<1	-	-	-	<1	<1	-	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	QC02_20181212	Split	EM1820215	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<5	<50	<5	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/07/2019	BH02_20190704	Normal	664456	43	43	-	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
BH03	13/11/2018	BH03	Normal	627947	35	35	-	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	12/12/2018	BH03_20181212	Normal	633193	-	-	-	-	<1	<1	<1	<0.01	-	<1	<1	<1	<0.01	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	4/07/2019	BH03_20190704	Normal	664456	34	34	-	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	4/07/2019	QC01_20190704	Duplicate	664456	30	30	-	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/07/2019	QC02_20190704	Split	EM1910736	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<5	<50	<5	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05	14/11/2018	BH05	Normal	627947	22	22	-	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	12/12/2018	BH05_20181212	Normal	633193	-	-	-	-	<1	<1	<1	<0.01	-	<1	<1	<1	<0.01	<1	<1	<1	<0.1	<3	<0.03	<3	<10	12	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30
	4/07/2019	BH05_20190704	Normal	664456	27	27	-	-	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<0.1	<3	<0.03	<3	<10	<6	<30	<100	<10	<30	<3	<0.01	<10	<10	<3	<3	<3	<10	<30

Env Stds Comments

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#13:Criteria for inorganic compounds have been multiplied by 10, to account for the assumed ingestion of 200 mL during recreational activities (NHMRC 2008, Section 9.3.2)
#14:pH range of 5.0-9.0 acceptable if water has very poor buffering capacity
#15:Sulfate and pH need to be included in assessment, refer to Table 6.4.2-C
#16:Sulfate and chloride need to be included in assessment, refer to Table 6.4.2-C
#17:Chloride and pH need to be included in assessment, refer to Table 6.4.2-C
#18:The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour that is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.
#19: ANZG (2018) Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants

	Organochlorine Pesticides																									Solvents							Herbicides	Polychlorinated Biphenyls							
	Organochlorine pesticides IWRG621	Other organochlorine pesticides IWRG621	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor	Toxaphene	Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Acetone	Allyl chloride	Carbon disulfide	Vinyl acetate	Dinoseb	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Sum of total)
	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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR	1	1	0.1	0.1	0.1	0.1	0.1	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.01	1	50	1	1	1	1	50	100	1	1	1	1	1	1	1	1
ANZECC 2000 Fresh Water (95%)								0.08			0.01						0.02			0.2	0.09				0.0002												0.6		0.03		
ANZECC 2000 Irrigation - Short-term trigger value																																									
ANZECC 2000 Irrigation - Long-term trigger value																																									
ANZECC 2000 Livestock drinking water						0.3[#8]		2[#8]			9[#8]									10[#8]	0.3[#8]			300[#8]																		
ANZECC 1992 Industrial Use - Brackish																																									
Managing Risks in Recreational Water 2008 (Health)						0.3		1			20									20				300																	
Managing Risks in Recreational Water 2008 (Aesthetic)																																									
Buildings & Structures (AS2159-2009)																																									
NEPM 2013 GW HSL Residential A&B, for Vapour Intrusion, Clay																																									
2-4m																																									
4-8m																																									
>8m																																									

Location Code	Sampled Date	Field ID	Sample Type	Lab Report No.																																							
BH01	13/11/2018	BH01	Normal	627947	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1	-	<1	<1	<1	<1	-	<100	<1	<1	<1	<1	<1	<1	<1	<1
	12/12/2018	BH01_20181212	Normal	633193	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1	-	<1	8	<1	<1	-	<100	<1	<1	<1	<1	<1	<1	<1	<1
	4/07/2019	BH01_20190704	Normal	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	<1	<1	<1	<1	-	<100	-	-	-	-	-	-	-	-
BH02	13/11/2018	BH02	Normal	627947	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1	-	<1	9	<1	<1	-	<100	<1	<1	<1	<1	<1	<1	<1	<1
	13/11/2018	QC01_20181113	Duplicate	627947	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13/11/2018	QC02_20181113	Split	EM1818487	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	BH02_20181212	Normal	633193	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1	-	<1	9	<1	<1	-	<100	<1	<1	<1	<1	<1	<1	<1	<1
	12/12/2018	QC01_20181212	Duplicate	633193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/12/2018	QC02_20181212	Split	EM1820215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/07/2019	BH02_20190704	Normal	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	<1	<1	<1	<1	-	<100	-	-	-	-	-	-	-	-
BH03	13/11/2018	BH03	Normal	627947	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1	-	<1	<1	<1	<1	-	<100	<1	<1	<1	<1	<1	<1	<1	<1
	12/12/2018	BH03_20181212	Normal	633193	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1	-	<1	11	<1	<1	-	<100	<1	<1	<1	<1	<1	<1	<1	<1
	4/07/2019	BH03_20190704	Normal	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	<1	<1	<1	<1	-	<100	-	-	-	-	-	-	-	-
	4/07/2019	QC01_20190704	Duplicate	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4/07/2019	QC02_20190704	Split	EM1910736	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	-	-	<5	<50	-	-	-	-	-	-	-	-	-	-
BH05	14/11/2018	BH05	Normal	627947	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1	-	<1	<1	<1	<1	-	<100	<1	<1	<1	<1	<1	<1	<1	<1
	12/12/2018	BH05_20181212	Normal	633193	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<1	-	<1	8	<1	<1	-	<100	<1	<1	<1	<1	<1	<1	<1	<1
	4/07/2019	BH05_20190704	Normal	664456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	<1	<1	<1	<1	-	<100	-	-	-	-	-	-	-	-

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#19: ANZG (2018) Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants

						Location Code	SV01	SV02		SV03
						Field ID	SV01	SV02	QC01_20181114	SV03
						Date Sampled	14/11/2018	14/11/2018	14/11/2018	14/11/2018
						Sample Type	Normal	Normal	Field_D	Normal
						Lab Report No.	627860	627860	627860	627860
			NEPM 2013 Soil Vapour HIL, Comm./Ind. D	NEPM 2013 Soil Vapour HIL, Residential B	NEPM 2013 Soil Vapour HSL Comm./Ind. D, for Vapour Intrusion, Clay	NEPM 2013 Soil Vapour HSL Res. A&B, for Vapour Intrusion, Clay				
ChemName	**Unit**	**LOR**			0-1m	0-1m				
BTEX										
Benzene	mg/m³	0.0016			5	1	<0.004	<0.004	<0.004	<0.004
Toluene	mg/m³	0.0075			6500	1600	0.01	1.6	1.7	0.19
Ethylbenzene	mg/m3	0.0022			1800	420	<0.005	<0.005	0.007	<0.006
Xylene (m & p)	mg/m³	0.0044					0.0072	0.027	0.028	<0.006
Xylene (o)	mg/m³	0.0022					<0.005	0.01	0.011	<0.006
Xylene Total	mg/m3	0.0066			1200	280	0.0072	0.037	0.038	<0.0066
TPH										
>C10-C12	mg/m³	0.1					<0.1	<0.1	<0.1	<0.15
CRC Care TPH Fractions										
C6-C10	mg/m³	0.1					0.22	2.2	2	0.21
F1: C6-C10 less BTEX	mg/m³	0.1			1000	230	0.2	0.56	0.23	<0.15
F2: >C10-C16 less Naphthalene	mg/m³	0.1			800	180	<0.1	<0.1	<0.1	<0.15
MAH										
1,2,4-trimethylbenzene	mg/m³	0.0025					<0.006	0.021	0.025	<0.006
1,3,5-trimethylbenzene	mg/m³	0.0025					<0.006	0.011	0.013	<0.006
1-methyl-4 ethyl benzene	mg/m³	0.0025					<0.006	<0.006	<0.006	<0.006
Isopropylbenzene	mg/m³	0.0025					<0.006	<0.006	<0.006	<0.006
n-propylbenzene	mg/m³	0.0025					<0.006	<0.006	<0.006	<0.006
Styrene	mg/m³	0.0021					<0.005	<0.005	<0.005	<0.006
PAH										
Naphthalene	mg/m³	0.0105			4	1	<0.025	<0.027	<0.027	<0.028
VOCs										
1,3-Butadiene	mg/m³	0.0011					<0.003	<0.003	<0.003	<0.003
2,2,4-Trimethylpentane	ug/m3	9.3					<22	<23	<23	<24
Organic										
Propene	mg/m³	0.0034					<0.008	0.02	0.031	<0.009
Chlorinated Hydrocarbons										
Freon 114	mg/m3	0.0035					<0.008	<0.009	<0.009	<0.009
1,1,1-trichloroethane	mg/m³	0.0027	230	60			<0.006	<0.007	<0.007	<0.007
1,1,2,2-tetrachloroethane	mg/m³	0.0034					<0.008	<0.009	<0.009	<0.009
1,1,2-trichloroethane	mg/m³	0.0027					<0.006	<0.007	<0.007	<0.007
1,1-dichloroethane	mg/m³	0.002					<0.005	<0.005	<0.005	<0.005
1,1-dichloroethene	mg/m³	0.002					<0.005	<0.005	<0.005	<0.005
1,2-dichloroethane	mg/m³	0.002					<0.005	<0.005	<0.005	<0.005
1,2-dichloropropane	mg/m³	0.0023					<0.005	<0.006	<0.006	<0.006
Benzyl chloride	µg/m3	2.6					<6	<6	<6	<7
Bromodichloromethane	mg/m³	0.0034					<0.008	<0.008	<0.008	<0.009
Bromoform	mg/m³	0.0052					<0.012	<0.013	<0.013	<0.014
Carbon tetrachloride	mg/m³	0.0031					<0.007	<0.008	<0.008	<0.008
Chlorodibromomethane	mg/m³	0.0043					<0.01	<0.011	<0.011	<0.011
Chloroethane	mg/m³	0.0053					<0.012	<0.013	<0.013	<0.014
Chloroform	mg/m³	0.0024					<0.006	<0.006	<0.006	0.047
Chloromethane	mg/m³	0.0103					<0.024	<0.026	<0.026	<0.027
cis-1,2-dichloroethene	mg/m³	0.002	0.3	0.08			<0.005	<0.005	<0.005	<0.005
cis-1,3-dichloropropene	mg/m³	0.0023					<0.005	<0.006	<0.006	<0.006
Dichloromethane	mg/m³	0.0174					<0.04	<0.043	<0.043	<0.046
Freon 113	mg/m³	0.0038					<0.009	<0.01	<0.01	<0.01
Hexachlorobutadiene	mg/m³	0.0213					<0.049	<0.053	<0.053	<0.056
Trichloroethene	mg/m³	0.0027	0.08	0.02			<0.006	<0.007	<0.007	<0.007
Tetrachloroethene	mg/m³	0.0034	8	2			0.04	0.019	0.019	<0.009
trans-1,2-dichloroethene	mg/m³	0.002					<0.005	<0.005	<0.005	<0.005
trans-1,3-dichloropropene	mg/m³	0.0023					<0.005	<0.006	<0.006	<0.006
Vinyl chloride	mg/m³	0.0013	0.1	0.03			<0.003	<0.003	<0.003	<0.003
Halogenated Hydrocarbons										
1,2,4-trichlorobenzene	mg/m³	0.015					<0.034	<0.037	<0.037	<0.039
1,2-dibromoethane	mg/m³	0.0036					<0.008	<0.009	<0.009	<0.009
1,2-dichlorobenzene	mg/m³	0.003					<0.007	<0.008	<0.008	<0.008
1,3-dichlorobenzene	mg/m³	0.003					<0.007	<0.008	<0.008	<0.008
1,4-dichlorobenzene	mg/m³	0.003					<0.007	<0.008	<0.008	<0.008
Bromomethane	mg/m³	0.0194					<0.045	<0.049	<0.049	<0.051
Chlorobenzene	mg/m³	0.0023					<0.005	<0.006	<0.006	<0.006
Dichlorodifluoromethane	mg/m³	0.0025					<0.006	<0.006	<0.006	<0.007
Trichlorofluoromethane	mg/m³	0.0028					<0.007	<0.007	<0.007	<0.007
Solvents										
1,4-Dioxane	mg/m³	0.0072					<0.017	<0.018	<0.018	<0.019
Methyl Ethyl Ketone	mg/m³	0.0059					<0.014	0.22	0.24	<0.016
2-hexanone (MBK)	mg/m³	0.0082					<0.019	0.068	0.054	<0.022
4-Methyl-2-pentanone	mg/m³	0.0021					<0.005	<0.005	<0.005	<0.005
Acetone	mg/m³	0.0119					0.035	2.1	4.3	0.11
Allyl chloride	mg/m³	0.0063					<0.015	<0.016	<0.016	<0.016
Carbon disulfide	mg/m³	0.0062					<0.014	<0.016	<0.016	<0.016
Cyclohexane	mg/m³	0.0017					<0.004	<0.004	<0.004	<0.005
Ethanol	mg/m³	0.0038					0.21	1.1	1.6	1.1
Heptane	mg/m³	0.0021					<0.005	<0.005	<0.005	<0.005
Hexane	mg/m³	0.0035					<0.004	<0.004	<0.004	<0.005
Isopropanol	mg/m³	0.049					<0.114	90	720	0.3
MTBE	mg/m³	0.0072					<0.017	<0.018	<0.018	<0.019
Tetrahydrofuran	mg/m³	0.0015					<0.003	<0.004	<0.004	<0.004
Vinyl acetate	mg/m³	0.007					<0.016	<0.018	<0.018	<0.019